

**The Great Grid Upgrade**

Grimsby to Walpole

# Grimsby to Walpole

Corridor Preliminary Routeing and Siting Study

January 2024



**nationalgrid**

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Table 1-1 – Abbreviations

<b>Abbreviations</b>	<b>Definition</b>
AC	Alternating Current
AIL	Abnormal Indivisible Load
AIS	Air Insulated Switchgear
ALC	Agricultural Land Classification
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
BESS	Battery Energy Storage System
BMV	Best Most Versatile
BNG	Biodiversity Net Gain
CCGT	Combined Cycle Gas Turbine
CNP	Critical National Priority
CPRSS	Corridor Preliminary Routeing and Siting Study
DC	Direct Current
DCSS	Direct Current Switching Station
Defra	Department for Environment, Food & Rural Affairs
DNO	Distribution Network Operator
EIA	Environmental Impact Assessment
EISD	Earliest in-service Date
ESO	Electricity System Operator
FEED	Front-End Engineering Design
FES	Future Energy Scenarios
FRA	Flood Risk Assessment
GIS	Geographical Information Systems (or Gas Insulated Switchgear dependent upon context)
GSP	Grid Supply Point
GWDTE	Ground Water Dependent Terrestrial Ecosystem
GWUE	Grimsby West Urban Extension
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle

<b>Abbreviations</b>	<b>Definition</b>
HND	Holistic Network Design
IDB	Internal Drainage Board
LCA	Landscape Character Area
LCS	Lincolnshire Connection Substations
LNR	Local Nature Reserve
MoD	Ministry of Defence
NCA	National Character Area
NCN	National Cycle Network
NETS	National Grid Electricity Transmission System
NGED	National Grid Electricity Distribution Plc
NGET	National Grid Electricity Transmission Plc
NPS	National Policy Statement
NSN	National Site Networks
OfGEM	Office of Gas and Electricity Markets
OS	Ordnance Survey
OWF	Offshore Wind Farm
PDL	Previously Developed Land
PRoW	Public Right of Way
RAG	Red, Amber, Green
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEC	Sealing End Compound
SF <sub>6</sub>	Sulphur Hexafluoride
SGT	Super Grid Transformer
SINC	Site of Importance for Nature Conservation
SOR	Strategic Options Report
SPA	Special Protection Area
SPZ	Source Protection Zone
SQSS	Security and Quality of Supply Standard
SSSI	Special Site of Scientific Interest

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<b>Abbreviations</b>	<b>Definition</b>
WFD	Water Framework Directive

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Table 1-2 – Glossary of Terms

<b>Term</b>	<b>Definition</b>
2WS	A 400 kV double circuit transmission route from Spalding substation, in Spalding, to a Tee-Point (the Spalding Tee-Point) along the 4ZM 400 kV double circuit transmission route.
4KG	A 400 kV double circuit transmission route from Keadby substation in North Lincolnshire to Grimsby West substation in North East Lincolnshire.
4ZM	A 400 kV double circuit transmission route from West Burton substation in Bassetlaw to the Burwell substation in East Cambridgeshire via the Walpole substation in King’s Lynn and West Norfolk.
4VV	A 400 kV double circuit transmission route from Necton substation in Breckland to the Walpole substation in King’s Lynn and West Norfolk.
Alternating Current (AC)	A type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. Current flowing in transmission lines and normal household electricity that comes from a wall outlet is alternating current.
Air Insulated Switchgear (AIS)	An air insulated switchgear composing electrical disconnect switches or circuit breakers used to control, protect and isolate electrical equipment.
Boundaries	A boundary splits the system into two parts, crossing critical circuit paths that carry power between areas and where power flow limitations may be encountered. Boundaries help identify regions where reinforcement is most needed by enabling analysis of power transfers between separated areas. They can be local boundaries, which are small areas of the Transmission System with a high concentration of generation, or wider boundaries, which are large areas containing significant amounts of both generation and demand
Corridor	A broad preliminary area, which National Grid seeks to identify within the study area where new transmission infrastructure for the Project (overhead lines and underground cables) could be routed.
Corridor Preliminary Routeing and Siting Study	The Corridor Preliminary Routeing and Siting Study (CPRSS) reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) to identify an emerging preferred corridor, siting zones and siting areas within which the required infrastructure for the Project may be located.
Direct Current (DC)	Direct current (DC) is electrical current which flows consistently in one direction. The current that flows in a torch or another appliance running on batteries is direct current.

<b>Term</b>	<b>Definition</b>
Distribution Network Operator (DNO)	A Distribution Network Operator is the company that owns and operates the overhead power lines and infrastructure that connects the National Grid electricity transmission system to properties and businesses. The DNOs in proximity to the Project are Northern Power Grid (NPG), National Grid Electricity Distribution (NGED) and UK Power Networks (UKPN).
Electricity System Operator (ESO)	The Electricity System Operator plans and operates the transmission system in Great Britain but does not own the transmission assets such as the overhead lines and substations. These are developed, owned and maintained by National Grid Electricity Transmission and other 'Transmission Owner' companies. Generation and interconnector customers apply to National Grid ESO when they wish to connect to the network. The ESO is a wholly independent company within the wider National Grid Group.
Electricity Transmission System	In England and Wales the electricity transmission system is made up largely of 400 kV and 275 kV assets connecting separately owned generators, interconnectors, large demands fed directly from the transmission system, and distribution systems. The electricity transmission system is designed to make sure there is sufficient transmission capacity to ensure that the system can be operated in an economic and efficient way by the ESO, ensuring power can be moved from where it is generated to demand centres across Britain. The planning and development of the electricity transmission system is governed by the Security and Quality of Supply Standard (SQSS) which ensures that the network is developed and operated securely and is resilient to any foreseeable network faults and disruption.
Emerging Preferred Corridor	An area within which the transmission infrastructure for the Project may be located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Emerging Preferred Siting Area	An area within which the substation or SEC infrastructure for the Project may be located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Emerging Preferred Siting Zone	An area within which the Emerging Preferred Siting Area may be located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Future Energy Scenarios (FES)	Published annually by the ESO to indicate possible future power requirements and where future connections may occur across the network.
Gas Insulated Switchgear (GIS)	Gas insulated switchgear (usually Sulphur hexafluoride (SF <sub>6</sub> ) – see below) composing electrical disconnect switches or circuit breakers used to control, protect and isolate electrical equipment.

Term	Definition
Graduated Swathe	Shaded areas within the emerging preferred corridor, siting zone and siting areas within which Project infrastructure is considered more or less likely to be located, shown by the varying levels of shading. Darker shaded areas represent where infrastructure is likely to be better located, in NGET's emerging view at this stage, within the corridor, siting zone and siting areas.
Grimsby to Walpole (the Project)	Located in the Humber, East Midlands, East of England and East Anglia regions of England, the Project comprises major reinforcement of the electricity transmission system. This will allow increased north-south power flows and facilitate the connection of new sources of clean offshore power that will land on the Lincolnshire coast. The Project is expected to comprise a new overhead electricity transmission line and may include the use of underground cables. There will be associated works to connect the new route into substations along the electricity transmission line and at either end, and to alter existing infrastructure crossed by the route, including crossings of existing 400 kV transmission lines and lower voltage lines.
Holford Rules	A series of guidelines/rules for the routeing and design of new overhead lines or overhead line extensions. The guidelines were initially developed in 1959 and have been reviewed on a number of occasions by National Grid and by the other UK transmission licence holders. The guidelines provide a set of design criteria that have stood the test of time and became accepted industry best practice in overhead line routeing. The guidelines now form an important part of national planning policy relating to the development of electricity networks, as set out in National Policy Statement EN-5 <sup>1</sup> .
Horlock Rules	A series of guidelines/rules for the siting and design of new substations, or substation extensions, including consideration of line entries and SECs. The guidelines were initially developed in 2003 and have been reviewed on a number of occasions by National Grid, with a revised version issued in 2009. The Horlock Rules provide a set of principles which avoid, or reduce the environmental impacts associated with the development of new substation infrastructure.
National Grid	Throughout this Report the term National Grid is used to refer to National Grid Electricity Transmission Plc (see below). The wider National Grid Group comprises several businesses, including National Grid Ventures and National Grid Electricity Distribution. These businesses are not licenced Transmission Owners and do not develop the national transmission system.

<sup>1</sup> National Policy Statement for Electricity Networks Infrastructure (EN-5).



<b>Term</b>	<b>Definition</b>
National Grid Electricity Distribution Plc (NGED)	In June 2021 Western Power Distribution was acquired by National Grid Group. It remains a separate company from NGET, operating within the wider National Grid Group and was recently rebranded as National Grid Electricity Distribution. NGED is a DNO operating in proximity to the Project.
National Grid Electricity Transmission Plc (NGET)	National Grid operate the national electricity transmission network across Great Britain and own and maintain the network in England and Wales, providing electricity supplies from generating stations to local distribution companies. National Grid does not distribute electricity to individual premises, but its role in the wholesale market is vital to ensuring a reliable, secure, and quality supply to all.
National Policy Statement (NPS)	Government planning policy relating to the development of Nationally Significant Infrastructure Projects (NSIPs) is set out in the relevant National Policy Statement (NPS). NSIPs should be developed in accordance with the relevant NPS. In the case of new transmission routes the relevant energy-related NPS are EN-1; Overarching NPS for Energy <sup>2</sup> and EN-5; Electricity Networks Infrastructure <sup>1</sup> .
National site network (NSN)	<p>Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK no longer form part of the European Union’s Natura 2000 ecological network. The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes:</p> <ul style="list-style-type: none"> <li>• Existing SACs and SPAs; and</li> <li>• New SACs and SPAs designated under these Regulations.</li> </ul> <p>Designated Wetlands of International Importance (known as Ramsar sites) do not form part of the national site network. Many Ramsar sites overlap with SACs and SPAs, and may be designated for the same or different species and habitats.</p> <p>All Ramsar sites remain protected in the same way as SACs and SPAs.</p>
Non-statutory Consultation	An engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the emerging preferred corridor, siting zone and siting areas, and the graduated swathe. The feedback received will inform the onward development of the Project.
North Humber to High Marnham	Located in the Humber and East Midlands region of England, North Humber to High Marnham comprises a major reinforcement of the electricity transmission system. This will allow increased north-south power flows and facilitate the connection of new sources of clean offshore power that will land on the Yorkshire coast. North Humber to High Marnham is expected to comprise a new overhead electricity transmission line and may include the use of underground cables.

<sup>2</sup> Overarching National Policy Statement for Energy (EN-1).

<b>Term</b>	<b>Definition</b>
	There will be associated works to connect the new route into substations at either end, and to alter existing infrastructure crossed by the route, including crossings of existing 400 kV transmission lines.
Northern Power Grid (NPG)	A power distribution company operating in north-east England and Yorkshire. NPG is a DNO operating in proximity to the Project.
Offline build	An offline build means that the infrastructure can be built without impacting on the operation of the existing network and without the need for any system outages until the infrastructure is ready to be commissioned.
Options Appraisal	A robust and transparent process used to compare options and to assess the potential impacts they may have across a wide range of criteria including environmental, socio-economic, technical and cost factors.
Options Identification and Selection	Work undertaken to determine the emerging preferred corridor and preliminary routing options for the Project. It is intended to demonstrate how National Grid's statutory duties, licence obligations, policy considerations, environmental, socio-economic, technical, cost, and programme issues have been considered and to provide information on the approach to the identification and appraisal of corridors.
Overhead Line	An above ground electricity line that safely and securely transmits electricity through a series of conductors (wires). An overhead line comprises a series of components including: supporting structures, such as pylons; line fittings, such as electrical insulators and conductor spacers; an earthwire (to protect the line from electrical faults and carry control data) and; the conductors themselves.
Project Need Case	Sets out the reasons why the Project is required.
Pylon	Overhead line structure used to carry overhead electrical conductors, insulators and fittings.
Ramsar Site	An area of land designated under the Ramsar Convention to conserve wetlands, especially those providing waterfowl habitat.
Sealing End Compound (SEC)	A secure compound within which the transition between underground cables and overhead lines is made. Buried cables are brought to the surface and directed vertically through insulated post structures before connecting onto overhead line conductors (wires) secured (via insulators) to anchor blocks or gantry structures.
Security and Quality of Supply Standard (SQSS)	The SQSS sets out a coordinated set of criteria and methodologies for planning, constructing and operating the National Grid Electricity Transmission System (NETS).
Site of Special Scientific Interest (SSSI)	An area of land designated by Natural England as of special interest by reason of its flora, fauna or geological or physiographical features.

<b>Term</b>	<b>Definition</b>
Siting Area	An area of land within a study area, within which a substation or cable sealing end compound (SEC) could be sited.
Siting Zone	An area of land within a study area, within which multiple Siting Areas could be located.
Special Area of Conservation (SAC)	An area of land designated under the under Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora to protect one or more special habitats and/or species.
Special Protection Area (SPA)	An area of land designated under the Directive 79/409 on the Conservation of Wild Birds to protect the habitats of migratory birds and certain particularly threatened birds.
Strategic Proposal	The outcome of the strategic options appraisal process; the Strategic Proposal is taken forward to the Options Identification and Selection Stage (Stage 2).
Substation	A secure node on the electricity system where: switching may be undertaken to direct power flows; operating voltages may be altered through the use of electricity transformers and; sources of electricity import, generation and/or demand can be connected, substations may be located either outdoors or within a building but will always be enclosed by a secure perimeter fence.
Sulphur hexafluoride (SF <sub>6</sub> )	Sulphur hexafluoride is a highly effective electrical insulator used in high-voltage electrical applications. It's a greenhouse gas that has a global warming impact of 22,800 times that of carbon dioxide.
Tee-Point	The point at which two electrical routes connect.
Underground Cable	An insulated conductor carrying electric current designed for underground installation.
UK Power Networks (UKPN)	A power distribution company operating in east England. UKPN is a DNO operating in proximity to the Project.
Wirescape	Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.

# Grimsby to Walpole

## Document control

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### Document Properties

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<b>Organisation</b>	National Grid
<b>Author</b>	National Grid, WSP, LUC and LSTC
<b>Approved by</b>	Carl Simms, Senior Project Manager-Consents
<b>Title</b>	Corridor and Preliminary Routeing and Siting Study (CPRSS)
<b>Document Register ID</b>	GWNC-WSP-CNS-REP-0002
<b>Published Document Ref</b>	GWNC-WSP-CNS-REP-0002-Corridor and Preliminary Routeing and Siting Study
<b>Data Classification</b>	Public

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### Version History

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<b>Document</b>	<b>Version</b>	<b>Status</b>	<b>Description / Changes</b>
January 2024	1.0	Final	For non-statutory consultation

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# Executive Summary

# Executive summary

National Grid Electricity Transmission plc (NGET) own, build and maintain the high-voltage electricity transmission network in England and Wales. NGET is responsible for making sure electricity is transported safely and efficiently from where it is produced to where it is needed.

The Grimsby to Walpole Project (the 'Project') is a proposed network reinforcement that is currently being developed by NGET. The Project, located in the Humber, East Midlands, East of England and East Anglia regions of England, is required to help deliver the UK Government's Net Zero targets. It forms part of a major programme of reinforcement of the electricity transmission system to provide additional north-south power flows, helping take power generated from low-carbon sources, especially from offshore wind to areas of consumer demand.

The indicative location for the proposed reinforcement was identified through a Strategic Options Appraisal undertaken at the Strategic Proposal Stage (Stage 1)<sup>3</sup>. This considered a range of options for providing the necessary north-south power flows and addressing the requirement for a Lincolnshire Connection substation(s) for offshore generation customers to connect to the transmission system.

This report is the **Corridor Preliminary Routeing and Siting Study (CPRSS)** for the Project, which details the work undertaken at the Options Identification and Selection Stage (Stage 2). This includes development and refinement of preliminary corridor options, preliminary siting zones and preliminary siting areas and the comparative assessment of these to identify NGET's proposed corridor, proposed siting zones and proposed siting areas: the broad location of the new infrastructure required to meet the Project need.

This CPRSS will be used to inform the non-statutory consultation and engagement with key stakeholders, including landowners. The non-statutory consultation will take place in January 2024.

This report considers the routeing of new electricity transmission infrastructure and the siting of new substations. In summary, the component parts of the Project are as follows:

- A new overhead line between a new 'Grimsby West substation' located west of Grimsby in the vicinity of the existing 400 kV Grimsby West substation and new 'Lincolnshire Connection substations', comprising two substations, located south-west of Mablethorpe in East Lindsey; and
- A new overhead line between the Lincolnshire Connection substations, a new Weston Marsh substation located in the vicinity of the Spalding Tee-point; and
- A new overhead line between Weston Marsh and a new 'Walpole substation' located to the south of the existing 400 kV Walpole substation in the vicinity of Wisbech.

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<sup>3</sup> NGET's Approach to Consenting outlines the project development process, divided into six stages, for major infrastructure projects; Strategic Proposal, Options Identification & Selection, Defined Proposal & Statutory Consultation, Assessment & Land Rights, Application, Examination & Decision and Construction, with Strategic Proposal being Stage 1 and Construction being Stage 6. NGET's Approach to Consenting is detailed in Chapter 3 of this report.

In summary, the reasons for selecting each of these as an emerging preference, from north to south, are as follows:

### **Grimsby West**

The emerging preference at Grimsby West is to locate the new substation adjacent to the existing Grimsby West 400 kV substation. Siting in proximity to the existing Grimsby West substations (NGET and Northern Power Grid) offers greatest opportunities to limit the spread of environmental effects, effects upon adjacent land uses, use (where possible) land within existing NGET land ownership, and limit the lengths of deviations and replacement of existing circuits (132 kV and 400 kV).

### **Overhead Line between Grimsby West and Burgh Le Marsh**

The emerging preference for the overhead line connection from Grimsby West routes between the Lincolnshire Wolds Area of Outstanding Natural Beauty and existing settlements (Grimsby, Holton le Clay, Waltham, Fulstow, Yarburgh, North Cockerington, Withern and Maltby le Marsh) until reaching the emerging preference for the two new Lincolnshire Connection substations. This represents the best opportunity to limit environmental and socio-economic impacts and technical complexity, whilst also representing the most direct, and a lower cost, route (except where the route avoids Alford, proximity to the Lincolnshire Wolds Areas of Outstanding Natural Beauty and to connect to the Lincolnshire Connection Substations (LCS) siting zones emerging as preferred).

### **LCS-A and LCS-B**

The emerging preference is for the two new Lincolnshire Connection Substations to be split between two siting zones. This provides suitable locations, accounting for the construction of connection infrastructure by offshore connections. One is located south-west of Woodthorpe, and one is located north-east of Bilsby. An overhead line between the two Lincolnshire Connection substations siting zones would route east to west, north of Alford. The siting of the two new Lincolnshire Connection Substations, split between two areas, represents the best opportunity to limit potential landscape and visual effects in-combination and help to reduce the potential for other environmental and socio-economic effects whilst minimising technical complexity during construction and operation.

### **Overhead Line between Burgh Le Marsh and Weston Marsh**

The emerging preference for the overhead line connection from the two new Lincolnshire Connection substations continues east of Bilsby routing directly south-east towards the A158 at Burgh le Marsh. From Burgh le Marsh the emerging preference for the overhead line connection broadly routes west towards Stickney and south-west, to the north and west of Boston, where it crosses the South Forty Foot Drain. From here it routes broadly south-west towards Weston Marsh. This represents the best opportunity to limit environmental and socio-economic impacts (in part by limiting the length and therefore amount of infrastructure required) and technical complexity whilst also representing the most direct and least cost route.

### **Weston Marsh**

The emerging preference for the new Weston Marsh substation is located south-west of the Spalding Tee-Point where the existing 400 kV 4ZM and 2WS overhead lines intersect. The siting of the new Weston Marsh substation represents the greatest opportunity to limit the spread of environmental effects, overhead line deviations of two existing overhead lines, and

reduce technical complexity during construction and operation by siting closest to the Spalding Tee-Point.

## **Overhead Line between Weston Marsh and Walpole**

The emerging preference for the overhead line connection from the Weston Marsh substation routes south-west in proximity to the existing 400 kV 2WS overhead line before routing broadly south-east to the north of Whaplode St Catherine and south of Tydd St Giles before crossing the River Nene to connect with the new Walpole substation. This represents the best opportunity to limit environmental and socio-economic impacts (in part by limiting the length and therefore amount of infrastructure required) and technical complexity, whilst also representing the most direct and least cost route that is unlikely to require the compulsory acquisition of residences.

## **Walpole**

The emerging preference for the new Walpole substation is located adjacent to the existing 4ZM 400 kV overhead line to the north of Walton Highway and West Walton. The siting of the new Walpole substation represents the greatest opportunity to limit the spread of environmental effects, overhead line deviations of the existing 4ZM 400 kV overhead line and reduces technical complexity during construction and operation. It also represents one of the greatest opportunities to limit the length of the overhead line connection for the Project and for the Eastern Green Link 3 and Eastern Green Link 4 Projects that require connection into this substation.

## **Graduated Swathe and Next Steps**

A 'graduated swathe' has been identified within the emerging preferred corridor, emerging preferred siting zones and emerging preferred siting areas. The graduated swathe is a way of showing the areas within the emerging preferred corridors, siting zones and siting areas where the required Project infrastructure is considered more or less likely to be located. The graduated swathes are shown with a colour shading, with the depth of shading indicating NGET's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, while lighter shading indicates less likely locations.

The use of the graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor, siting zones and siting areas. The graduated swathe represents the current thinking on where the Project infrastructure may be located. This will be informed by feedback received during non-statutory consultation and therefore there is the potential for the final design of the Project to extend beyond the graduated swathe. This will be fully considered through the development of the Project, whilst maintaining the principles used to develop the current graduated swathe, for instance, the avoidance of areas of highest constraint such as settlements.

During non-statutory consultation, NGET will be inviting feedback from local communities and stakeholders about our work to date, the proposed corridor and graduated swathe and matters that they would like us to consider as we further develop our detailed proposals. The feedback from non-statutory consultation, along with information from surveys undertaken to obtain baseline data and ongoing design studies will inform the further development of the Project. The developed design will be subject to Environmental Impact Assessment, statutory public consultation and design development, prior to submission of the application for a Development Consent Order.



# 1. Introduction

# 1. Introduction

## 1.1 Overview

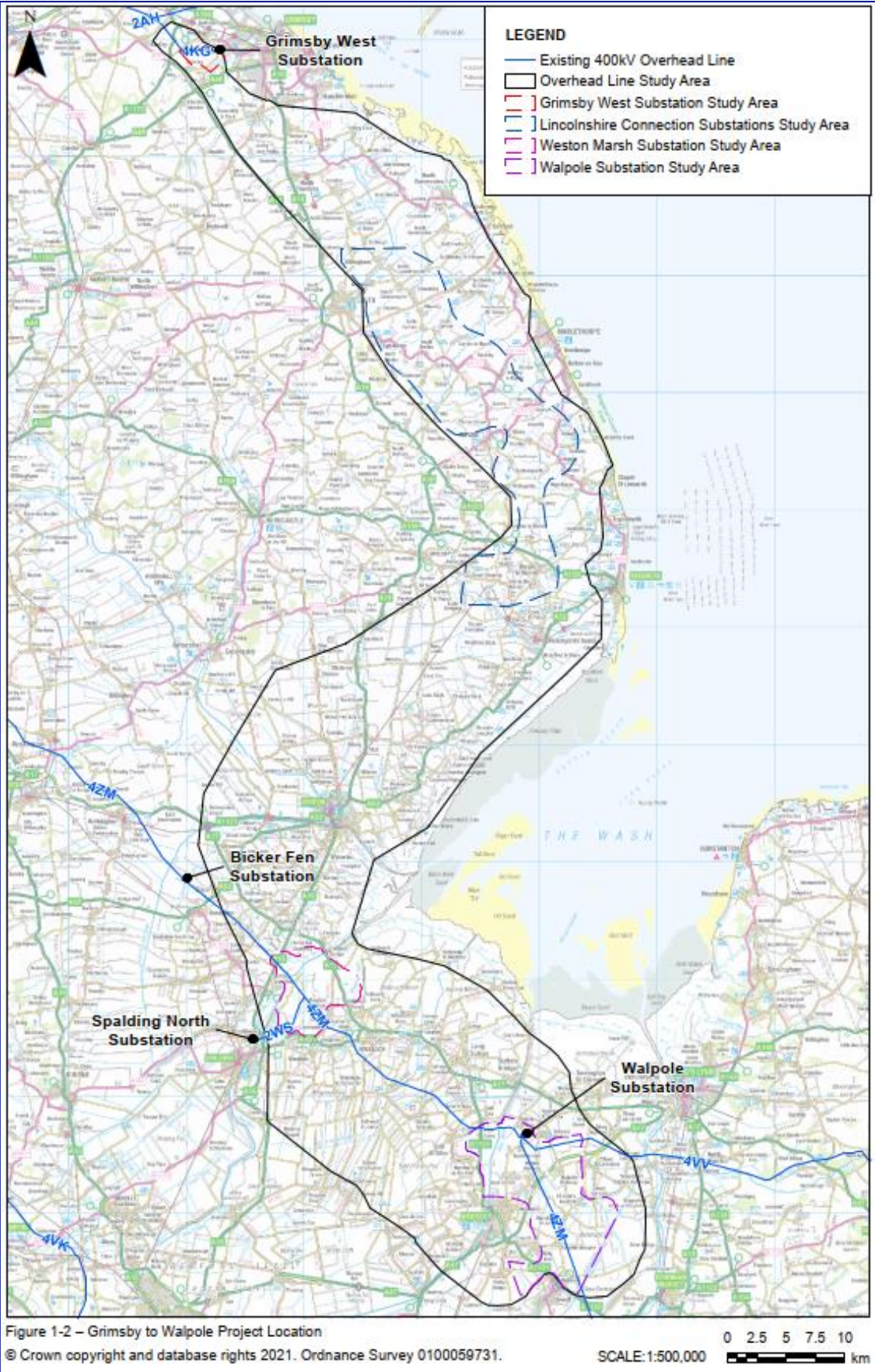
- 1.1.1 National Grid Electricity Transmission Plc (NGET) owns, builds and maintains the high-voltage electricity transmission system in England and Wales. NGET is responsible for making sure electricity is transported safely and efficiently from where it's produced to where it's needed and for developing upgrades to the network as agreed with the industry regulator, Office of Gas and Electricity Markets (OfGEM).
- 1.1.2 The National Grid Electricity System Operator (ESO) controls and operates the high-voltage electricity transmission system in England and Wales. National Grid ESO is a legally separate business, balancing supply and demand to ensure homes and businesses in Great Britain have the electricity they need 24/7. It is currently proposed that the ESO will become a wholly separate entity in 2024 and will no longer form part of the National Grid group of companies. The ESO facilitates several roles on behalf of the electricity industry, including making formal offers to connection applicants to the National Electricity Transmission System (NETS).
- 1.1.3 National Grid's transmission system in England and Wales consists of approximately 7,250 km of overhead lines and a further 1,450 km of underground cabling, operating at 400 kV and 275 kV. The 275 kV grid was developed in the 1950's to provide a national transmission system and then further developed from the mid 1960's, at 400 kV to increase the power carrying capacity. The overhead lines and cables connect around 350 substations to form a highly interconnected network. The substations provide points of connection to the local distribution networks, which operate at voltages from 132 kV down to 240 V (the voltage at which the power is distributed to domestic consumers). The distribution networks are owned by Distribution Network Operators (DNOs), including Northern Power Grid (NPG), National Grid Electricity Distribution (NGED) and UK Power Networks (UKPN) in the Humber, East Midlands, East of England and East Anglia regions of England.
- 1.1.4 Example images of NGET's transmission system are shown in **Figure 1-1**.

Figure 1-1 – Example Images of NGET’s Transmission System



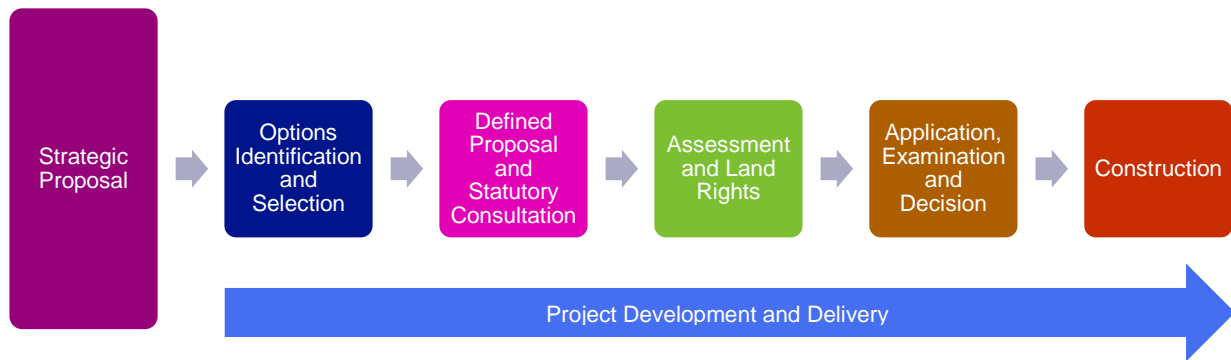
1.1.5 The Grimsby to Walpole Project (the ‘Project’) is being developed by NGET. The Project, located in the Humber, East Midlands, East of England and East Anglia regions of England, is required to reinforce the electricity transmission system to help deliver the UK Government's Net Zero targets. It forms part of a major programme of reinforcement of the electricity transmission system to accommodate substantial increases in north-south power flows, helping take power generated from low-carbon sources (especially from offshore wind) to areas of consumer demand. The Project location is shown in **Figure 1-2**.

Figure 1-2 - Grimsby to Walpole Project Location



1.1.6 National Grid’s Approach to Consenting<sup>4</sup> outlines the project development process, divided into six stages, for major infrastructure projects. **Figure 1-3** presents an overview of National Grid’s Approach these consenting stages, which is explained in more detail in **Chapter 3** of this Corridor Preliminary Routeing and Siting Study.

Figure 1-3 – National Grid’s Approach to Project Development and Delivery



## Background

1.1.7 The UK Government has set targets of 50 GW of offshore wind generation by 2030<sup>5</sup> and up to 140 GW by 2050<sup>6</sup>. There is particular growth forecast in offshore wind capacity in Scotland and the north-east of England, as well as interconnectors to and from European power grids. This will put pressure on the existing network such that reinforcement of the network in the Yorkshire and Humber and Lincolnshire areas has been identified as necessary to ensure optimal operation of the transmission system and reliable economic long-term supply.

1.1.8 The need for the Project was first identified by the ESO. NGET then undertook a Strategic Options Appraisal at the Strategic Proposal Stage (Stage 1) which identified the preferred strategic option to bring forward to address the identified need. The Strategic Options Appraisal is reported in the North Humber to High Marnham and Grimsby to Walpole Strategic Options Report<sup>7</sup> (the SOR). As detailed in the SOR the Project is needed to:

- Enable future customer connections and offshore transmission connections along the East Coast (between the Humber and The Wash);
- Ensure Security and Quality of Supply Standards (SQSS) compliance; and

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<sup>4</sup> National Grid develops projects through a six-stage process set out in the Approach to Consenting (April 2022) guidance available at <https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/planning-and-development>. Accessed 26 July 2022. The process is detailed further in Chapter 3 of this report.

<sup>5</sup> UK Government, (2022), British Energy Security Strategy. Available at <https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy>. Accessed 26 July 2022.

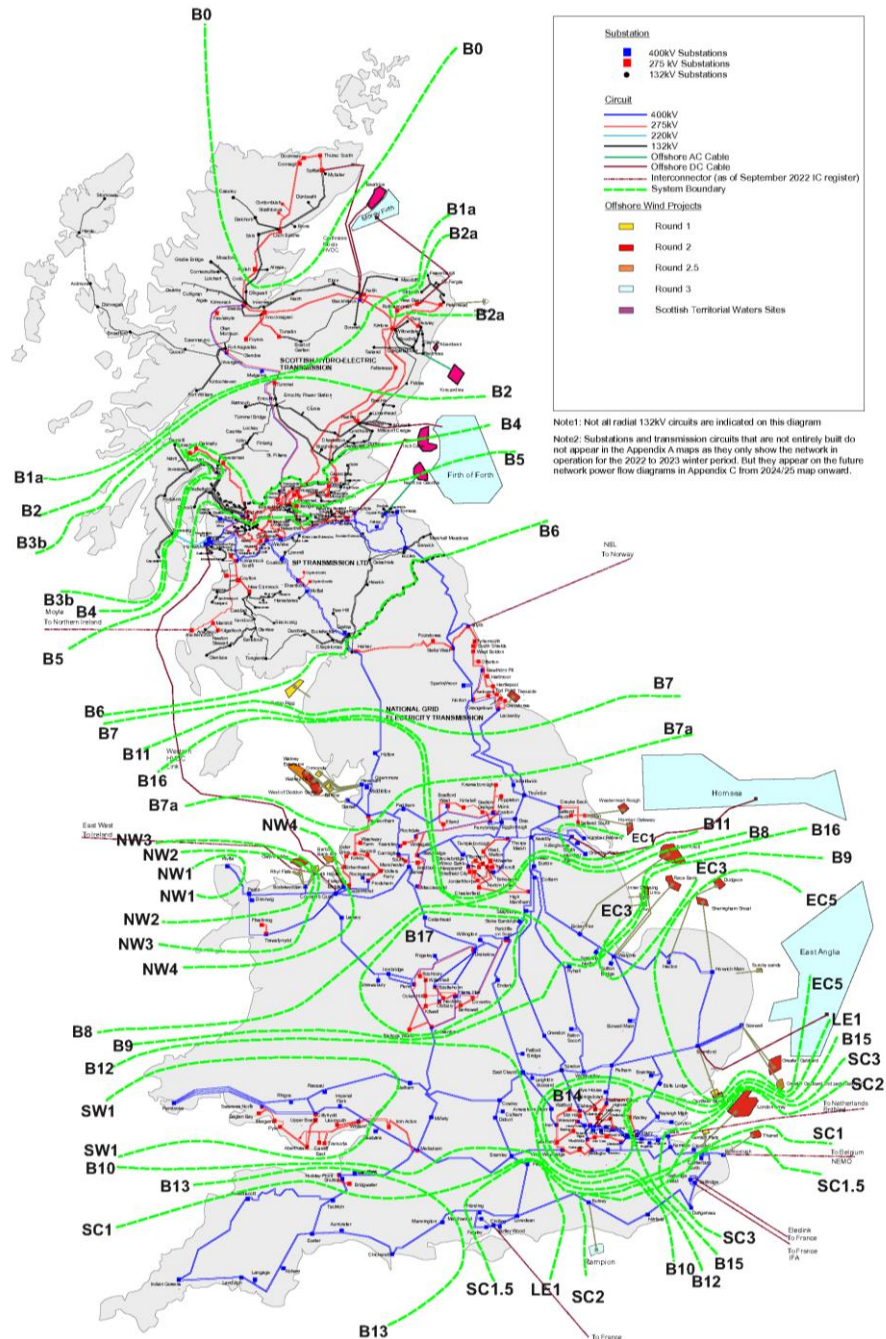
<sup>6</sup> Committee on Climate Change, (2020), The Sixth Carbon Budget. Available at <https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf>. Accessed 09 June 2022.

<sup>7</sup> National Grid, (May 2023), North Humber to High Marnham and Grimsby to Walpole: Strategic Options Report.

- Provide a cost-beneficial level of boundary<sup>8</sup> uplift across network transmission boundaries in order to improve transfer capability facilitating north to south power flows and reduce generation constraints on renewable energy sources resulting from insufficient capacity of the NETS.

1.1.9 The network transmission boundaries across the UK are shown in **Figure 1-4**<sup>9</sup>.

Figure 1-4 – Network Transmission Boundaries

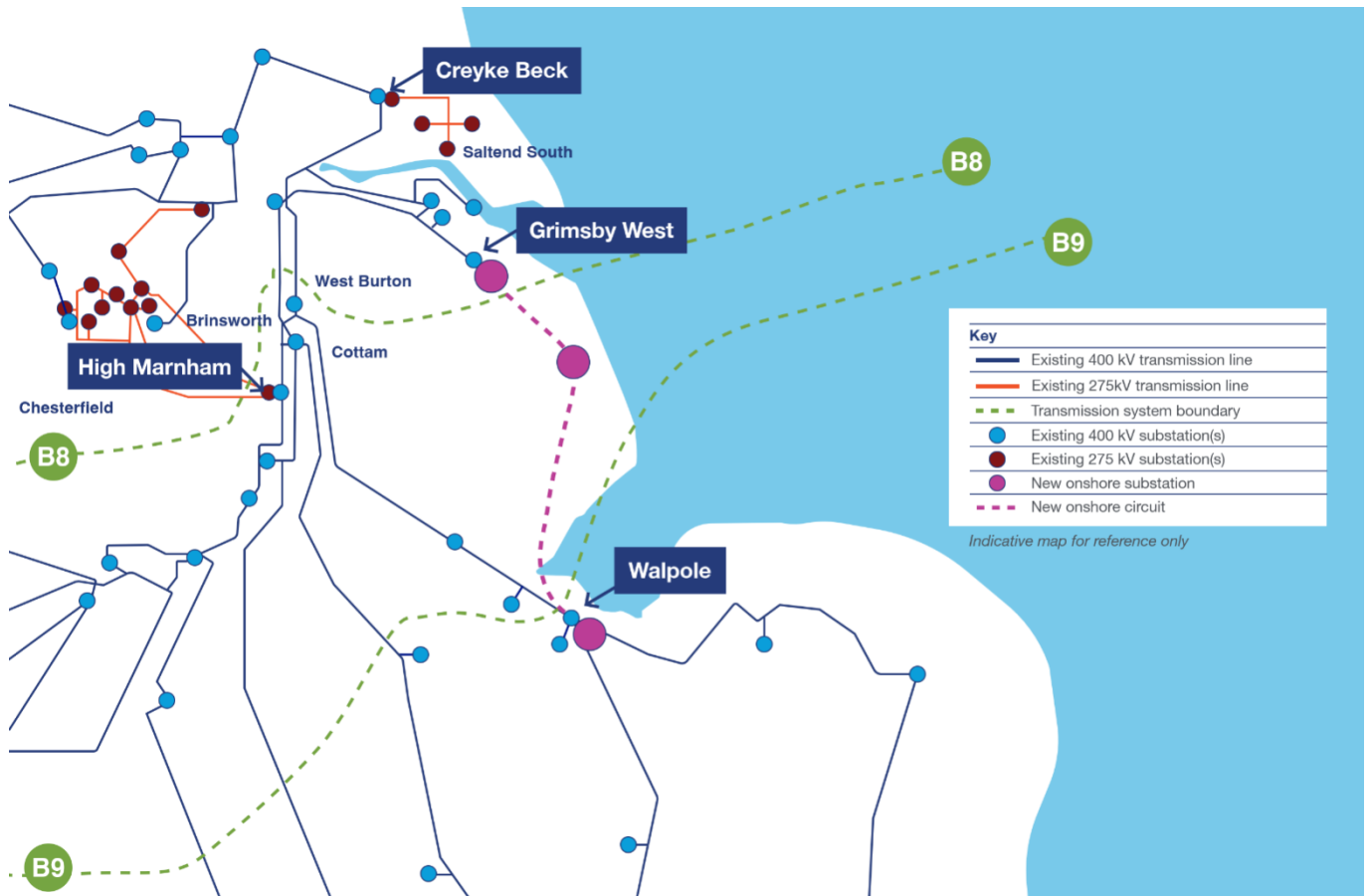


<sup>8</sup> Explained in detailed within Section 2.4 of the SOR.

<sup>9</sup> National Grid, (2017), Electricity Ten Year Statement 2017. Available at <https://www.nationalgrid.com/sites/default/files/documents/ETYS%202017%20Appendix%20A.pdf>. Accessed 08 June 2022.

1.1.10 The SOR considered a range of options for providing the necessary north-south power flows identified as being needed to accommodate the amount of generation being proposed off the East Coast of the UK. It concluded that establishment of a substation, or multiple substations, in Lincolnshire was needed to connect future offshore projects (described in this report as the Lincolnshire Connection substations) and a new electricity transmission route between Grimsby West and Walpole connecting to the Lincolnshire Connection substations, (identified within the SOR as ECO 5, shown below in **Figure 1-5**) represented the most appropriate solution.

Figure 1-5 – ECO 5 - new Grimsby West to new Lincolnshire Connection substation(s), new Lincolnshire Connection substation(s) to new Walpole



1.1.11 The SOR also recommended that Eastern Green Link 3 (EGL 3) and Eastern Green Link 4 (EGL 4) offshore transmission circuits from Scotland should be connected south of the B9 boundary to a Main Interconnected Transmission System substation, identified as new Walpole substation, with one of the projects having the ability to form a three-ended connection<sup>10</sup> connecting to new Lincolnshire Connection substations and the new Walpole substation. It was acknowledged at the time that the EGL 3 and EGL 4 projects would be subject to their own full review of strategic options to confirm this requirement.

1.1.12 Since the publication of the SOR, further work has been undertaken on developing and evolving the strategic options for the East Coast generation group and to evolve the

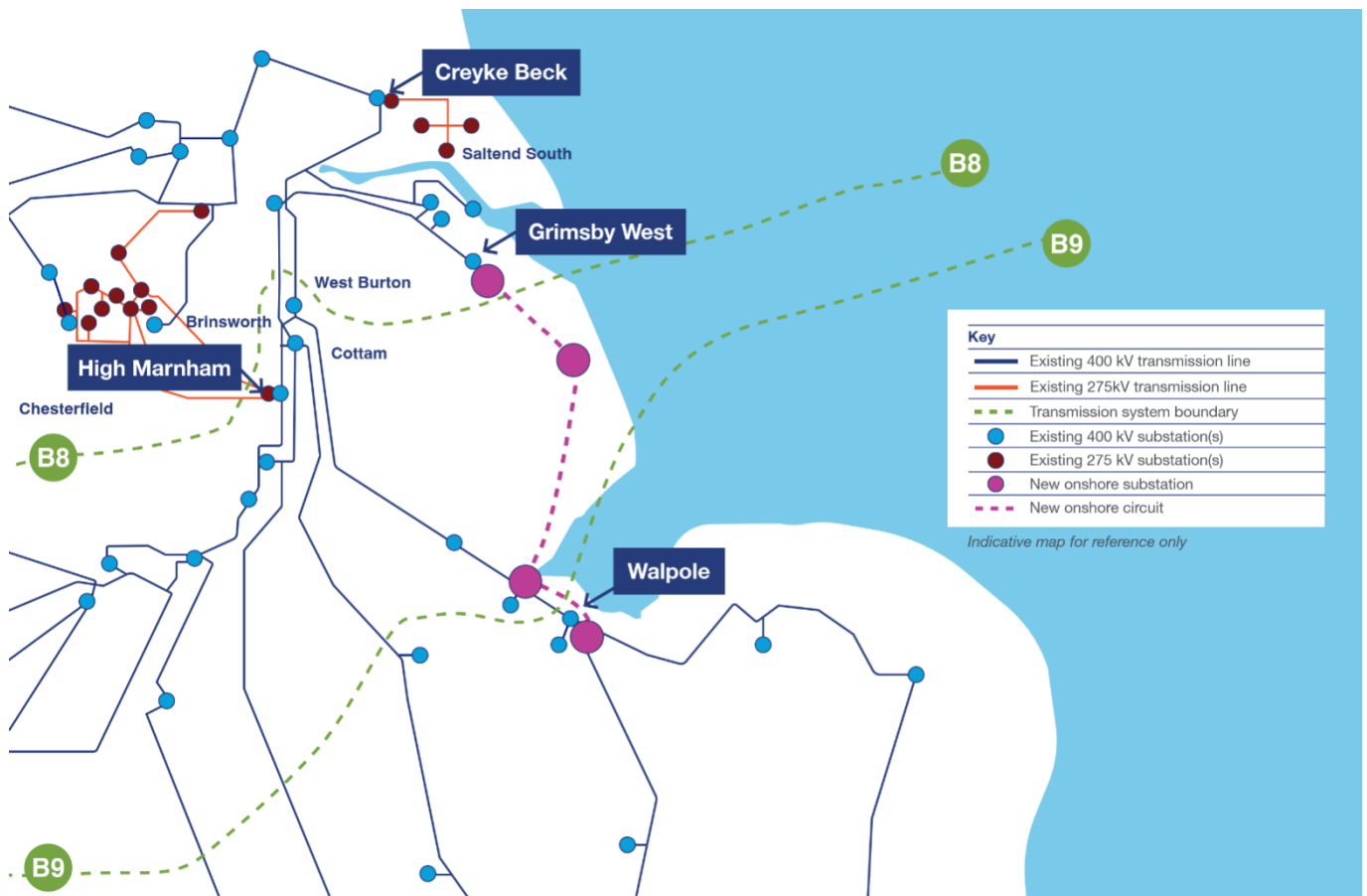
<sup>10</sup> A three-ended connection is to build-in extra resilience into the electricity transmission network and to allow power flows to be rapidly re-routed in the event of an unplanned circuit outage thereby preventing some parts of the network becoming overloaded.

strategic option for works south of the B9 boundary. The Grimsby to Walpole – Addendum to Strategic Options Report (the SOR Addendum) reports the work undertaken on the development of the strategic options including appraisal of refined strategic options. The SOR Addendum concluded that establishment of a new electricity transmission route between a new Grimsby West substation, new Lincolnshire Connection substation(s), new Weston Marsh substation and new Walpole substation (similar to ECO 6 within the SOR, shown below in **Figure 1-6**) represented the most appropriate solution.

- 1.1.13 The SOR and SOR Addendum concluded that establishment of a substation, or multiple Lincolnshire Connection substations was required in Lincolnshire to connect future offshore projects. Since the conclusion of these documents, further work has been undertaken on the identification of the number of Lincolnshire Connection substations required as part of the Options Identification and Selection work presented in this report. This confirmed that two Lincolnshire Connection substations are required to ensure necessary system resilience, to manage security risks, and to ensure the most efficient solution was selected for both the system and the local community to maintain compliance with NGET SQSS, without triggering the requirement for additional circuits in the area.
- 1.1.14 The SOR confirmed that both the EGL 3 and EGL 4 projects (subject to their own full review of strategic options) would connect to the new Walpole substation and require the siting of two converter stations (one for EGL 3 and one for EGL 4) in the vicinity of the new substation. It also confirmed that one of the projects should have the ability to form a ‘three-ended connection’ which would require the siting of a converter station and direct current switching station in the vicinity of the Lincolnshire Connection substations if pursued.



Figure 1-6 – ECO 6 – new Grimsby West to new Lincolnshire Connection substation(s), new Lincolnshire Connection substation(s) via new Weston Marsh to new Walpole



1.1.15 The Project will establish a new 400 kV transmission connection of approximately 140 km in length between a new substation to be built in the vicinity of the existing Grimsby West substation in North East Lincolnshire, two new Lincolnshire Connection substations located south-west of Mablethorpe in East Lindsey, a new substation in the vicinity of the Spalding Tee-Point (where the two existing 400 kV overhead lines, denoted as 4ZM and 2WS, meet) in South Holland District, and a new substation in proximity to the existing Walpole substation in King’s Lynn and West Norfolk District. The connection is expected to wholly or largely comprise a new overhead line. NGET will also need to replace short sections of existing 400 kV overhead line and commission local changes to the lower voltage distribution networks to facilitate the construction of the new overhead line and substations.

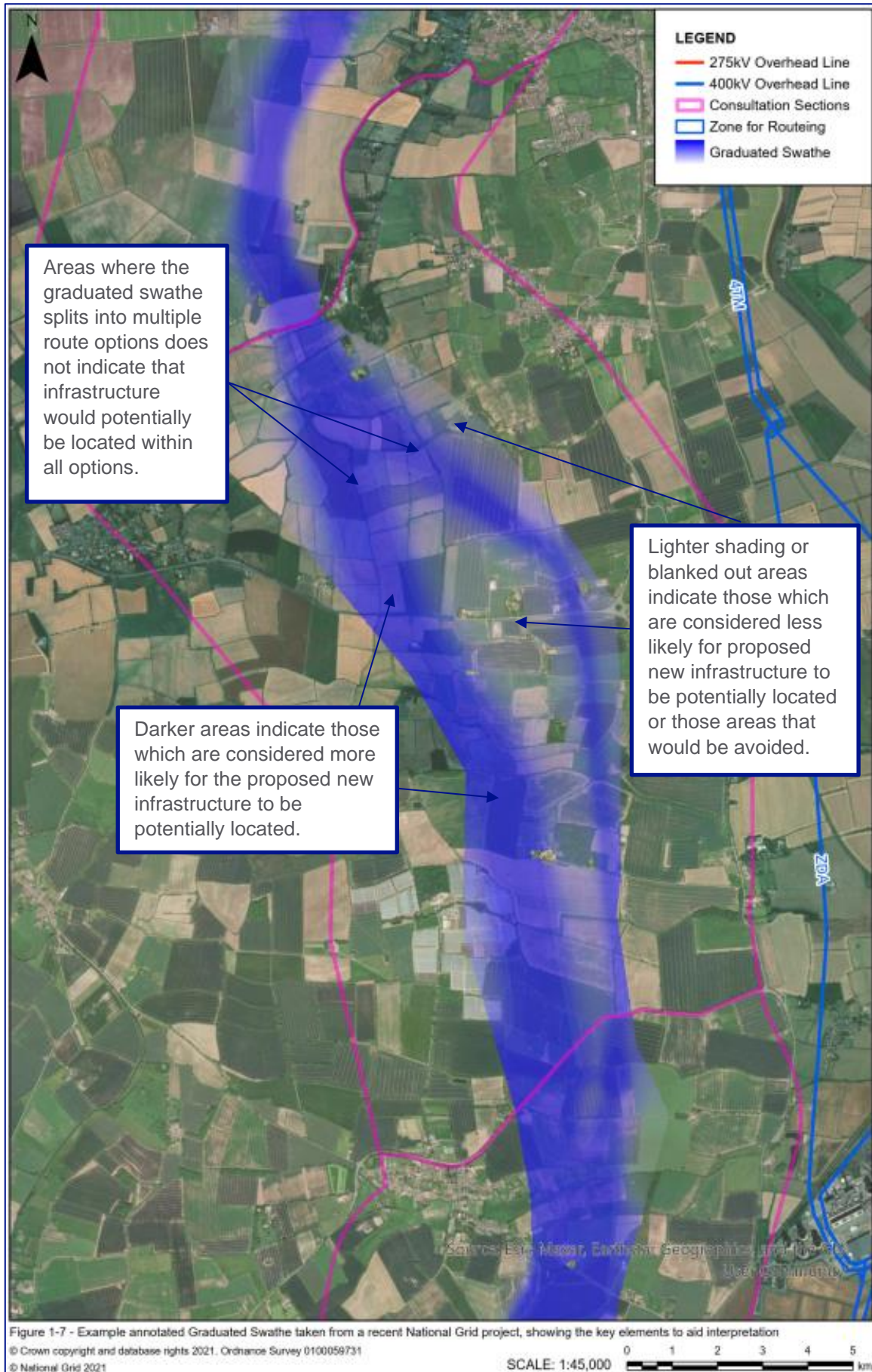
## 1.2 Purpose

- 1.2.1 This report is the Corridor Preliminary Routeing and Siting Study (CPRSS), which has been undertaken to facilitate the gathering of feedback on the Project from all interested parties as part of the non-statutory consultation. The CPRSS reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) shown in **Figure 1-3**, to identify an emerging preferred corridor and emerging preferred siting zones or siting areas within which the required infrastructure for the Project may be located. A description of the proposed Project infrastructure within the scope of this CPRSS is set out in **Chapter 2**.
- 1.2.2 This CPRSS sets out the routeing and siting activities undertaken to date, including the identification, refinement and assessment of preliminary corridors (described in this

report as 'corridors'), preliminary siting zones (described in this report as 'siting zones') and preliminary siting areas (described in this report as 'siting areas') and explains NGET's emerging preferences for the broad location of new infrastructure to meet the need case for the Project, as set out below. These emerging preferences are presented as a 'graduated swathe.'

- 1.2.3 The graduated swathe is a way of showing the areas within the emerging preferred corridors, siting zones and siting areas where the required Project infrastructure is considered more or less likely to be located. The emerging preferred corridor, siting zones, and siting areas are shown with a colour shading, with the depth of shading indicating NGET's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, while lighter shading indicates less likely locations, as shown by the example (not forming part of the Project) in **Figure 1-7**.
- 1.2.4 The use of the graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor, siting zones and siting areas. The feedback received from the non-statutory consultation will be taken into account in the detailed routeing and siting work for the Defined Proposal and Statutory Consultation Stage (Stage 3). This feedback may also lead to modification of the emerging preferred corridor, siting zones and siting areas.

Figure 1-7 – Example annotated Graduated Swathe taken from a recent National Grid project, showing the key elements to aid interpretation



## 1.3 Structure of this Report

1.3.1 The report is structured as follows:

- **Chapter 2: Aspects of the Grimsby to Walpole Project** – summarises the key components of the Project;
- **Chapter 3: National Grid’s Approach to Routeing and Siting** – an overview of National Grid’s guidance, its statutory duties and relevant policy.
- **Chapter 4: Option Identification and Selection Process** – sets out the process used to identify, appraise, and select corridors and siting zones (or siting areas), following National Grid’s guidance and in line with relevant policy.
- **Chapter 5: Study Area, Corridor and Siting Zone Definition** – details the steps undertaken to identify the study area for the Project and to define the corridors and siting zones (or siting areas) for appraisal (including sections and links).
- **Chapter 6: Options Appraisal – Transmission Connection between Grimsby West and Burgh le Marsh:** provides the key environmental and technical constraints for each corridor between Grimsby West and Burgh le Marsh.
- **Chapter 7: Options Appraisal – Transmission Connection between Burgh le Marsh and Weston Marsh:** provides the key environmental and technical constraints for each corridor between Burgh le Marsh and Weston Marsh.
- **Chapter 8: Options Appraisal – Transmission Connection between Weston Marsh and Walpole:** provides the key environmental and technical constraints for each corridor between Weston Marsh and Walpole.
- **Chapter 9: Options Appraisal - Grimsby West Substation:** provides the key environmental and technical constraints for each Grimsby West siting area.
- **Chapter 10: Options Appraisal - Lincolnshire Connection Substations:** provides the key environmental and technical constraints for each Lincolnshire Connection Substation siting zone.
- **Chapter 11: Options Appraisal - Weston Marsh Substation:** provides the key environmental and technical constraints for each Weston Marsh siting area.
- **Chapter 12: Options Appraisal - Walpole Substation:** provides the key environmental and technical constraints for each Walpole siting zone.
- **Chapter 13: Option Selection** – provides comparative analysis of the corridors, siting zones and siting areas to identified those emerging as preferred.
- **Chapter 14: Cost and Programme Performance** – shows the range of the best and worst performing cost and programme estimates for each of the corridors.
- **Chapter 15: Development of Graduated Swathe** – summarises the approach to taken to developing the graduated swathe for the Project and its intended use.
- **Chapter 16: Summary and Next Steps:** presents the conclusions of the CPRSS and outlines the next steps in the Project.

# 2. Aspects of the Grimsby to Walpole Project

## 2. Aspects of the Grimsby to Walpole Project

### 2.1 Introduction

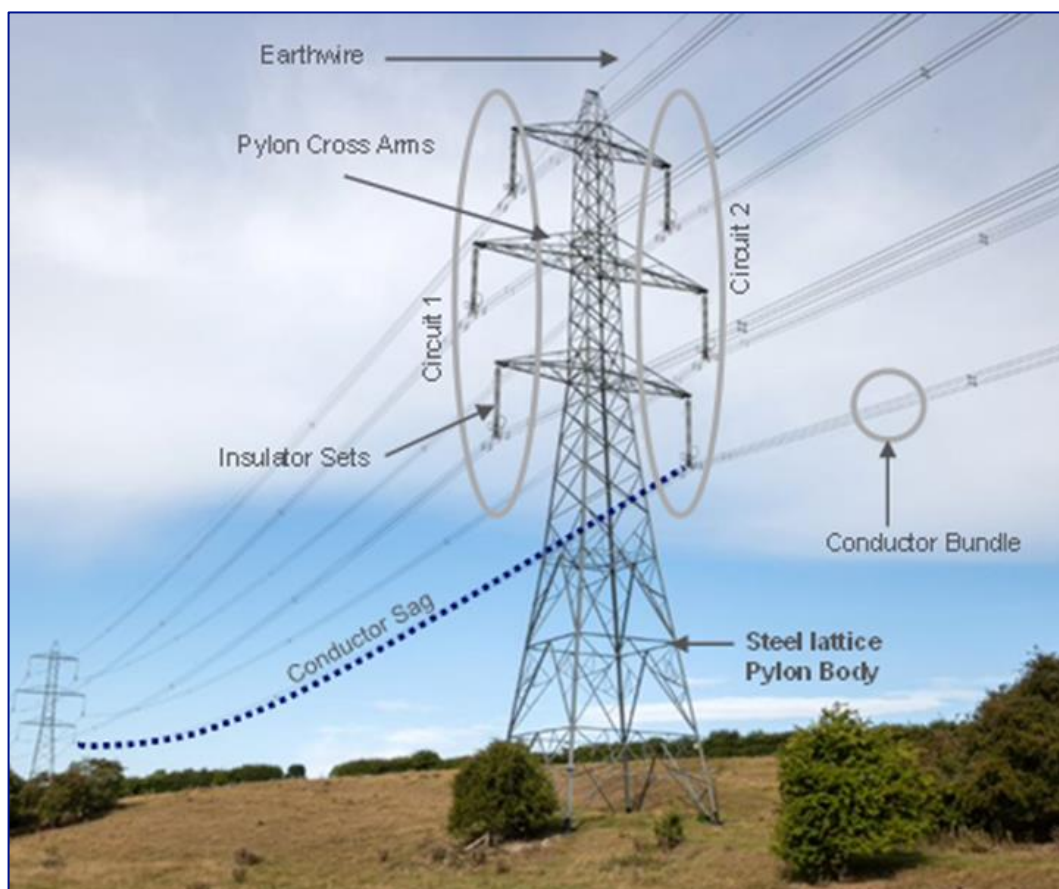
- 2.1.1 To underpin its 2050 net zero ambitions, the UK Government has committed to fully decarbonising the power system by 2035. To fulfil this commitment and meet energy objectives, Government has concluded that there is a critical national priority (CNP) for the provision of nationally significant low carbon infrastructure, and as stated within the Overarching National Policy Statement (NPS) for Energy (EN-1, see **Chapter 3** for further details) “*there is an urgent need for new electricity network infrastructure to be brought forward at pace*” (paragraph 3.3.65).
- 2.1.2 The Project, a CNP, directly supports the delivery of the UK Government’s energy objectives, by reinforcing the electricity transmission system and connecting low carbon infrastructure to the National Electricity Grid. It forms part of a major programme of reinforcement of the electricity transmission system to accommodate major increases in north-south power flows, helping take power generated from low-carbon sources (especially from offshore wind) to areas of consumer demand across the UK.
- 2.1.3 The Project will establish a new 400 kV transmission connection between the following new 400 kV transmission substations, described from north to south:
- a new 400 kV transmission substation in the vicinity of the existing Grimsby West substation, west of the town of Grimsby in North East Lincolnshire;
  - two new 400 kV transmission Lincolnshire Connection substations located south-west of Mablethorpe in East Lindsey;
  - a new 400 kV transmission substation in the vicinity of the Spalding Tee-Point, to the north-east of the town of Spalding in South Holland District and
  - a new 400 kV transmission substation in the vicinity of the existing Walpole substation, west of the village of Walpole St Andrew and north of the town of Wisbech, in King’s Lynn and West Norfolk District.
- 2.1.4 The new 400 kV transmission connection is expected wholly or largely to comprise new overhead line. NGET will also need to replace short sections of existing 400 kV overhead line and commission local changes to the lower voltage distribution networks to facilitate the construction of the new overhead line and substations.
- 2.1.5 This chapter provides more information regarding the new 400 kV transmission connection, including the five transmission substations, and other improvements needed to facilitate the construction of the Project. Such improvements will be to the transmission system and electricity distribution networks operated by NGET, NPG, NGED and UKPN.

## 2.2 Overhead Lines

### Pylons and Conductors

- 2.2.1 Pylons are overhead line structures which carry overhead electrical conductors, insulators and fittings. The main components of an overhead line are shown in **Figure 2-1** below. **Figure 2-1** shows a typical steel lattice pylon. Other pylon types are discussed further in this section.
- 2.2.2 Like most overhead lines owned and maintained by NGET, the Project will carry a voltage of 400 kV. The overhead line for the Project will carry two discrete electrical circuits on either side of the pylons, which can be operated independently of one another, increasing the resilience of the transmission system.

Figure 2-1 - Components of a Typical Transmission Connection



- 2.2.3 Electrical power will be transmitted through conductors (often referred to as 'wires'). The conductors are attached to the end of a set of insulators that hang from the pylon cross arms and electrically isolate the conductors from the main structure. On a typical pylon, as shown in **Figure 2-1**, three pylon cross arms are stacked above each other, and each supports a bundle of phase conductors which together form a single electrical circuit which is operated as a three-phase system. Two circuits are therefore carried, with one on either side of the pylon (indicated by 'Circuit 1 and Circuit 2' in **Figure 2-1**). The top of the pylons supports a single smaller earthwire/fibre optic cable combined that carries data between substations and provides shielding from lightning strikes for the

conductors below. The Project is likely to comprise a maximum of three conductors per bundle, a total of 18 conductors per pylon together with the earthwire/fibre optic cable.

- 2.2.4 The conductors will be a minimum height above the ground. The height will be maintained by pylons spaced intermittently along the route.
- 2.2.5 The minimum heights<sup>11</sup> between the conductors, the ground and various other features must be maintained, to ensure safe operation. The minimum clearance between the conductors and the ground is 7.8 m at the maximum sag, shown in **Figure 2-1**. To maintain these sags, pylons need to be a minimum height at the point that the lowest conductor is attached to the pylon arms. This height is dependent upon a range of factors including the distance between pylons, planned operating temperature and conductor wire composition, the intervening topography and the use of the land being crossed. For example, crossings of major navigable waterways such as the River Welland may require far greater clearances (and hence greater pylon heights) to allow vessels to pass beneath.
- 2.2.6 To a lesser extent, the overall pylon height will also be influenced by pylon types. The pylon illustrated in **Figure 2-1** above is a suspension pylon, with the conductors hanging on insulator sets beneath the pylon arms. Where the route of the overhead line changes direction the use of such a pylon would see the conductors deviate in vertical arrangement. Where this occurs, larger, more bulky angle pylons are required to accommodate the additional sideways strains with the insulators tensioning the conductors horizontally to keep conductors aligned. At the end of overhead lines where they connect with substations or underground cables it is necessary to use terminal pylons (see **Figure 2-6**), they are also of greater bulk to ensure stability.
- 2.2.7 **Figure 2-2** below illustrates the difference between these three main pylon types.
- 2.2.8 A typical pylon operating at 400 kV is approximately 50 m in height. A typical span distance between pylons is approximately 350 m. In broad terms there are typically three pylons for every kilometre of overhead line.
- 2.2.9 During the construction of overhead lines, activities tend to be focussed at the base of each pylon and to either side of tension pylons from where the conductors are winched into position. The most noticeable effects of overhead lines are generally considered to be visual, due to the height of the pylons in relation to most buildings and trees.

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<sup>11</sup> Electrical Networks Association TS 43-8 details the legal clearances for NGET owned and maintained overhead lines. Third party guidance for working near overhead lines is available at: <https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/working-near-our-assets>. Accessed 20 November 2022.



Figure 2-2 – Suspension Pylon (Left) and Angle Pylon (Right)



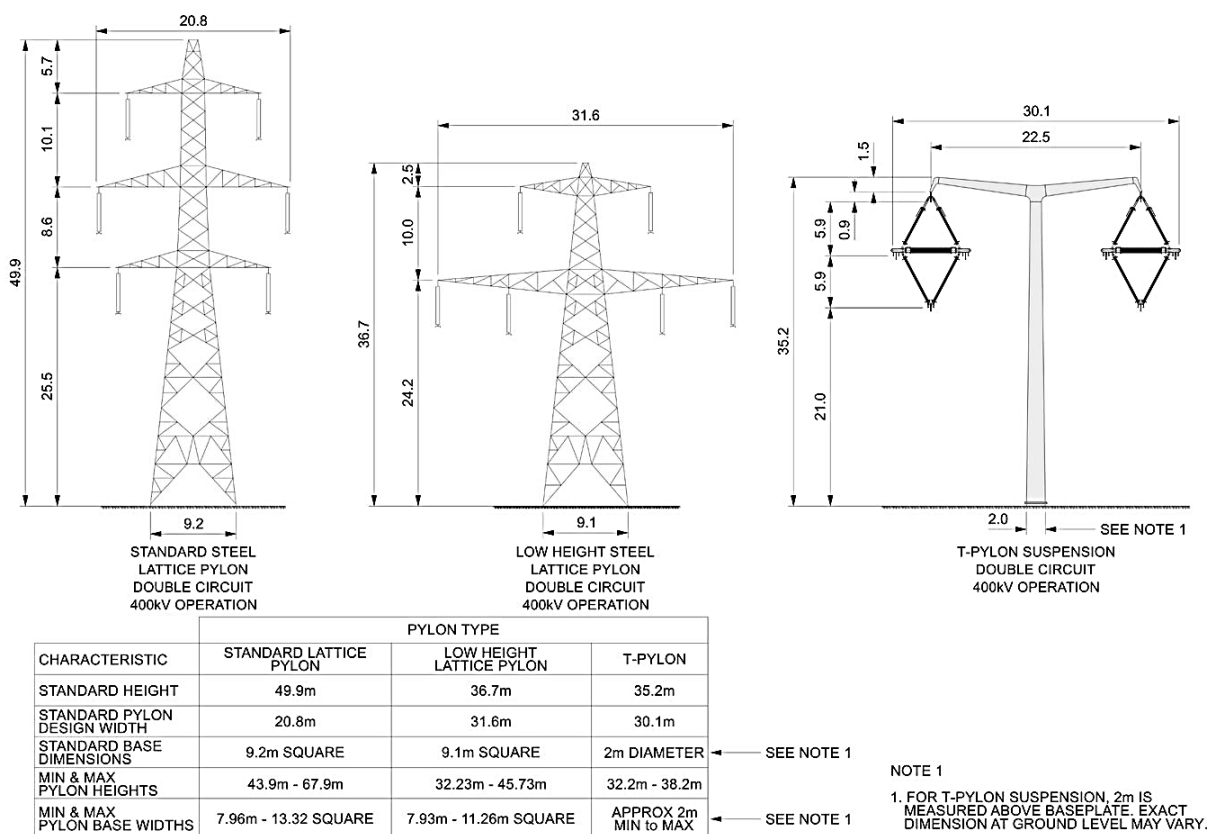
## Pylon Type and Design

- 2.2.10 Most transmission lines in Britain use lattice steel pylons with three sets of cross arms (as shown first in **Figure 2-2** and **Figure 2-3**). Alternative pylon types have been approved for use on the NGET network which may achieve the technical performance required for the Project<sup>12</sup>. These two alternative types of pylon are illustrated in **Figure 2-3**.
- 2.2.11 The first alternative pylon type is a lower height form of lattice steel pylon. This removes the top cross arm, with two bundles of conductors supported on the lowest cross arm. This requires the widening of the lowest cross arm resulting in a shorter but wider pylon when compared to the standard lattice steel pylons. The overall height of this type of pylon is approximately 37 m. This pylon type has tended to be used in proximity to airports and airfields, to avoid flight paths, to reduce landscape impacts and also where bird strike is a risk. This pylon type can also help to reduce the extent of affected views, especially in rolling or wooded landscapes.
- 2.2.12 The second alternative pylon type is the ‘T-pylon.’ Rather than being of lattice steel construction the ‘T-pylon’ is formed from a single steel monopole (similar to a modern wind turbine) supporting a single cast cross arm at the top, which together form a ‘T’ shape. The conductors are hung from this cross arm in two larger groups of three bundles, kept apart by solid insulating rods that together form a diamond configuration. These pylon types are also lower in height than the standard lattice steel pylons, at approximately 35 m. The monopole is a solid structure, approximately 2 m in diameter, in contrast to the less striking and more open lattice form of the two lattice steel pylons.

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<sup>12</sup> With the potential exception of localised requirements, such as major river crossings.

Figure 2-3 – Alternative Pylon Types



2.2.13 In previous projects the visual benefits of utilising standard lattice steel pylons, as opposed to low height steel lattice pylons or T-pylons, has been recognised, especially when siting a new overhead line close to existing lines that use a similar pylon type. In proximity to this Project this is the case with the existing 400 kV overhead lines between Bicker Fen and Walpole. The standard lattice steel pylon also has slightly lower construction costs when compared to the other two pylon types.

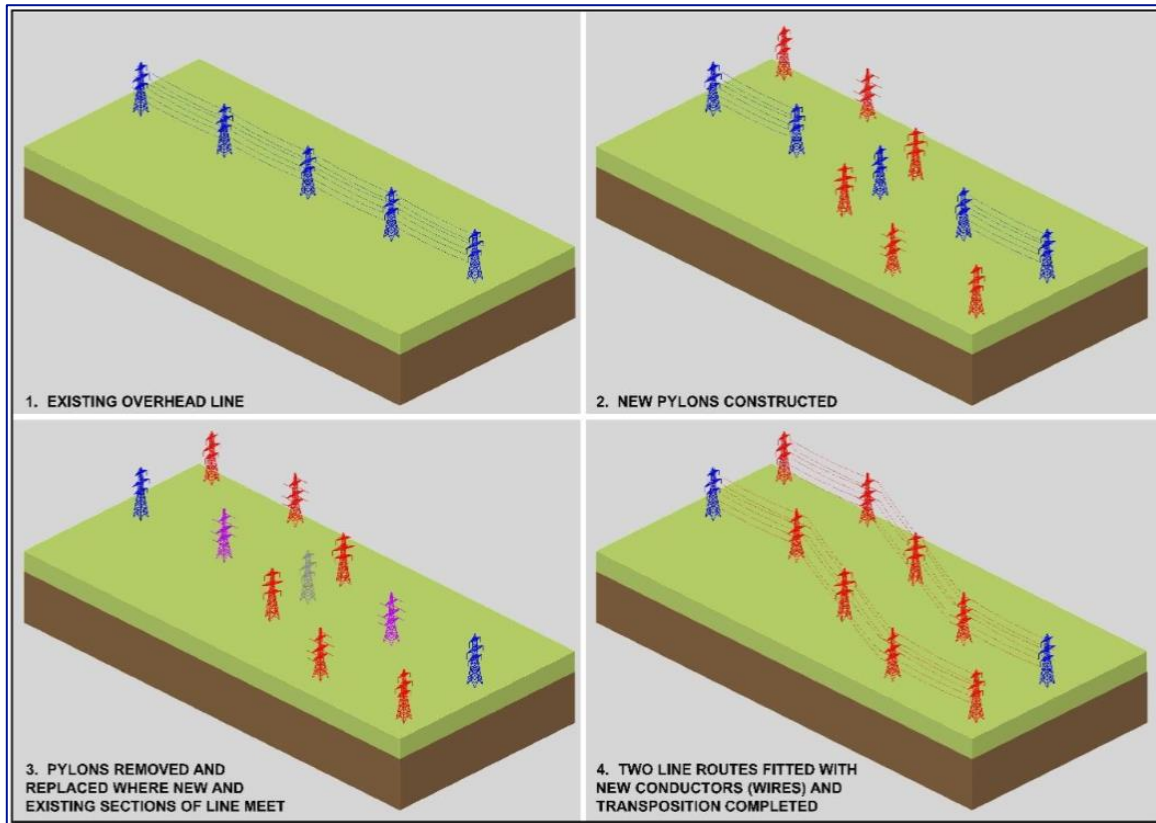
2.2.14 The type of pylons proposed for the Project will be determined through feedback from non-statutory consultation, information from surveys and ongoing design studies but the starting presumption (in line with the NPS and National Grid’s Approach to Consenting) will be a standard lattice pylon.

## Line Swap-Overs

2.2.15 Where two overhead electricity line routes must cross, a number of specific design considerations arise. This need might arise where an existing overhead line crosses the route of a new overhead line, including where local constraints to the routing of an overhead line preclude its construction on the same side of an existing line throughout its entire length.

2.2.16 Where the design of existing pylons is compatible and the direction of power flows across the electricity system allow it, a ‘line swap-over’ can be considered. This is done through the removal of a length of the existing overhead line, allowing the two newly formed ‘ends’ of existing overhead line to be connected to two lengths of new route located on different sides of the existing line. The two resultant routes would then both comprise lengths of newly built and original overhead line. This is illustrated schematically in **Figure 2-4** below.

Figure 2-4 – Sequence of Works to Achieve Line Swap-Over of New and Existing Overhead Lines



- 2.2.17 Where the existing and new overhead lines connect to different points of the transmission system it may be necessary to swap the route back before the destination substation is reached to maintain the same start and end points.
- 2.2.18 The line swap-over of the route of a new overhead line from one side of an existing overhead line to the other can be achieved on adjacent pylons, resulting in up to four angle pylons being located in close proximity. Alternatively, it may be possible to utilise existing angle pylons on the current overhead line to partly form the line swap-over, or to extend the distance over which a line swap-over is achieved. In this way the change of route direction would be more gradual, with greater separation between the angle pylons.
- 2.2.19 Where NGET must maintain electricity supplies through the existing overhead line whilst line swap-over works are being undertaken it may be necessary to locally install one or more temporary overhead lines. These lines would act as a by-pass route for the power whilst the permanent overhead line arrangement is constructed. The temporary lines would be removed, and the land reinstated upon completion.
- 2.2.20 Any line swap-over would increase the technical complexity, cost and potential duration of any new overhead line build but may introduce greater opportunities to reduce environmental and socio-economic effects.

## 2.3 Underground Cables

- 2.3.1 Whilst it is currently assumed that the Project will be developed as an overhead line, electricity can be transmitted through buried cables as well as through overhead conductors. However, at the alternating current (AC) transmission voltage of 400 kV, the

use of buried cables represents a significant technical complexity. The size, number and complexity of the underground cables required is far greater than those that operate at lower voltages or direct current (DC) cables<sup>13</sup>. As a result, direct buried transmission cables at the capacity required for the Project are materially more expensive compared to an equivalent overhead line. Moreover, and as noted within NPS EN-5 which relates to transmission routes supports (described in more detail in **Chapter 3**), underground cables typically bear a significantly higher lifetime cost of repair and later upgrading. The costs for a direct buried transmission cable for the Project are presented within the SOR.

- 2.3.2 For these reasons, the NPS EN-5 supports, in most instances, the starting presumption for the development of overhead lines rather than underground cables<sup>14</sup>.

## Underground Cable Installation Methods

- 2.3.3 There are a number of different underground cable installation methods available including direct buried, ducted, surface troughs and trenchless crossings. The most appropriate for a given project, or location within a project, is subject to environmental, land use, cost and technical factors.
- 2.3.4 Where conditions allow, cables are normally installed in excavated trenches. A cement-bound sand mix is used as backfill to protect the cables and help dissipate any heat generated by the cables in operation.
- 2.3.5 For a new 400 kV transmission circuit installed underground, the working width of the land required for construction is typically between 40 m and 100 m, subject to a range of factors such as the number of circuits being installed, and the number and size of cables needed. For a low-capacity single circuit this could require only three cables. For a high capacity double circuit route up to 18 individual cables would be required. An example of a cable construction is shown at **Figure 2-5** below.

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<sup>13</sup> More information can be found in National Grid's publication ['Undergrounding high voltage electricity transmission lines. The technical issues'](#).

<sup>14</sup> The National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023) states at paragraphs 2.9.20 and 2.9.21 that *"Although it is the government's position that overhead lines should be the strong starting presumption for electricity networks developments in general, this presumption is reversed when proposed developments will cross part of a nationally designated landscape (i.e. National Park, The Broads, or Area of Outstanding Natural Beauty)." ... "In these areas, and where harm to the landscape, visual amenity and natural beauty of these areas cannot feasibly be avoided by rerouting overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line"*.

Figure 2-5 – Example Underground Cable Construction



- 2.3.6 Due to the weight and size of underground cables needed to operate at 400 kV, the maximum single cable length that can be transported to a Project location by road is typically between 800 m and 1,000 m. To achieve cable routes in excess of these lengths individual cables must be joined together on site. This necessitates joint bays at intervals along the route. Where joint bays are located the working width may need to be wider than 120 m.
- 2.3.7 Works to install underground cables take considerably longer than the works associated with installing an equivalent length of overhead line. In addition, and as noted within NPS EN-5 (Paragraph 2.9.25), the installation of underground cables is potentially very disruptive on local communities, habitats, archaeological and heritages assets, soil (including peat soils), hydrology, geology, and for a substantial time after construction, landscape and visual amenity. However effective restoration of the underground cable route following construction can result in fewer long-term landscape and visual effects in comparison with an overhead line.
- 2.3.8 Where specific environmental or infrastructure features preclude the use of underground cables, as described above, it may be practicable to install ducts using a trenchless installation technique such as horizontal directional drilling (HDD). In this instance cables are pulled into pre-installed ducts. The maximum length of HDD installed ducts is limited by the weight of the cables to be installed. Where trenchless techniques are required, the working width may need to be wider than 120 m.
- 2.3.9 Where HDD is not technically viable, then a tunnelled solution for underground cables can be considered. Tunnels can be constructed using a variety of techniques, but all involve major civil engineering activities, which result in substantial additional costs, increased construction risks and extended programme durations. Typically, permanent buildings are required at either end of the tunnel section to support operation, including access to and potential ventilation of the tunnel and for cooling of the underground cables.

## Sealing End Compound (SEC)

- 2.3.10 A SEC is needed at either end of a section of underground cable, where it commences its burial from an overhead line and where it subsequently resurfaces to connect back onto an overhead line. Within these secure compounds, the buried cables are brought to the surface through vertical sealing end structures. These are connected horizontally at a height of approximately 10 m with a set of solid bars (referred to as 'busbars'). The conductor wires from the overhead line drop down to connect onto the solid bars within the secure compound. A similar arrangement occurs where the cables are reconnected to an overhead line.
- 2.3.11 To accommodate the one-way tension of the conductor wires where an overhead line ends, a heavier pylon is needed. Alternatively, the conductors may enter the compound at a slacker angle, connecting onto lower height gantries.
- 2.3.12 SECs typically extend to around 30 m by 80 m for a double circuit 400 kV transmission, but this will vary dependent upon local considerations. Examples of SECs are shown in **Figure 2-6** below.

Figure 2-6 – Example 400 kV Sealing End Compounds



## 2.4 Other Technical Considerations

- 2.4.1 To construct the five new transmission substations a range of other minor temporary and permanent improvement works will need to be carried out to facilitate the construction of the Project. Such improvements will be to the transmission system and electricity distribution networks operated by NGET, NPG, NGED and UKPN.
- 2.4.2 A number of the more significant elements of these improvement works are detailed below.

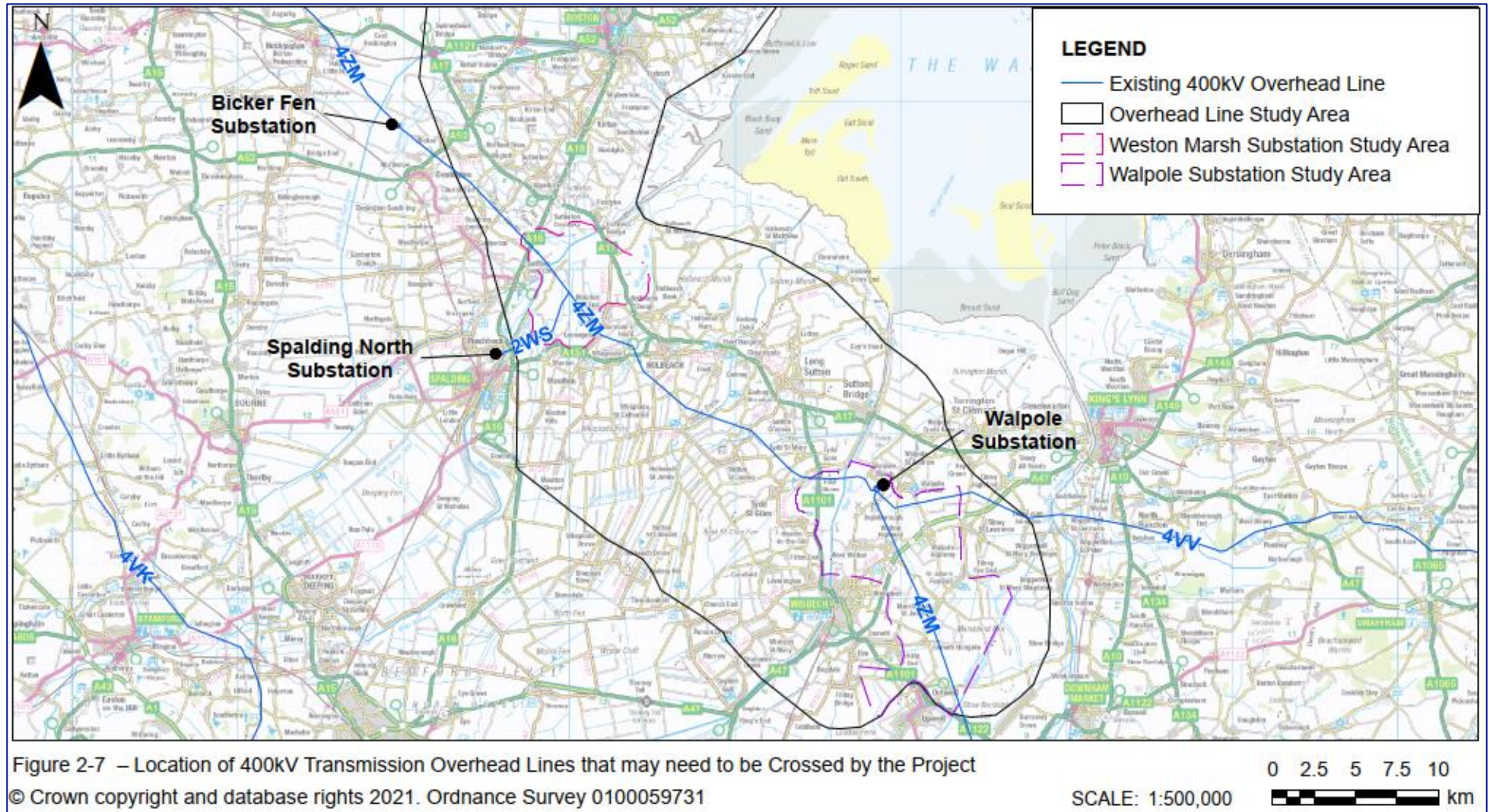
### Crossings of Existing Transmission Overhead Lines

- 2.4.3 Where two overhead electricity line routes must cross but a line swap-over, as described above, is not possible or applicable (for example the design of existing pylons is not compatible or the direction of power flows across the electricity system do not allow it) then other design considerations require consideration. The Project route may need to cross one or more existing 400 kV overhead lines in Lincolnshire. Of particular note is the existing 400 kV 4ZM overhead line that runs north-west to south-east,

somewhat perpendicular to the required route for the Project, to the north of Heckington and south-west of King's Lynn, as shown in **Figure 2-7** below.

- 2.4.4 Whilst it is practicable to cross one overhead line with another using technical solutions such as cable duck unders where one line is routed underneath another, this results in significantly taller pylons on the higher line and introduces operational and safety concerns. As a result, it is typically considered more appropriate to leave an existing overhead line in place and underground a section of a new overhead line. In this way operational and safety concerns are substantially reduced, and taller pylons which may have increased visual effects can be avoided.
- 2.4.5 In the context of this Project, the 400 kV 4ZM overhead line may require crossing. The need to cross, and therefore requirement for section/s of underground cables and the associated costs and effects of the cable installation have been considered as part of the identification and appraisal of corridors for the Project. Any works to cross the 400 kV 4ZM overhead line will form part of this Project. Further information on the 400 kV 4ZM overhead line in the context of this Project is provided in **Chapter 5**.

Figure 2-7 – Location of 400 kV Transmission Overhead Lines that may need to be crossed by the Project





## Managing interfaces with Existing NGET Overhead Lines

- 2.4.6 The route and any line swap-overs required by the Project may result in interactions with other NGET overhead lines. For example, a line swap-over is likely to mean that the new end-to-end connection for the Project is carried in part on existing pylons through existing conductor wires. If this is the case, subject to information from surveys and ongoing design studies, it may be necessary to replace these sections of existing conductor wire as part of the Project to align with the new overhead line.
- 2.4.7 Managing interfaces with existing NGET overhead lines will form part of this Project.

## Managing interfaces with Other Utility Companies' Overhead Lines

- 2.4.8 In addition to NGET transmission lines, it will be necessary for the new overhead line to cross overhead lines of a lower voltage owned and operated by the local electricity distribution network operators (DNOs). The transmission system and electricity distribution networks in the vicinity of the Project are operated by NPG, NGED and UKPN.
- 2.4.9 When crossing lower voltage overhead lines it will be necessary to deploy a range of mitigation measures whilst maintaining supplies. It is likely that the Project will need to cross the routes of existing 11 kV, 33 kV and 132 kV overhead lines in multiple locations dependent upon the final route. As the Project design evolves the mitigation measures will be developed and assessed on a case-by-case basis.
- 2.4.10 NGET will work with the distribution network operators to design and undertake the replacement or rationalisation of any affected low voltage overhead lines with underground cables wherever this would be technically practicable and not prohibitively expensive.
- 2.4.11 Managing interfaces with existing NPG, NGED and UKPN overhead lines will form part of this Project.

## 2.5 New Transmission Substations

### Substations

- 2.5.1 Substations are an essential component in the energy network, connecting sources of generation, such as wind farms and power stations. They connect overhead and underground circuits and can connect nearby utility systems. Substations manage electricity flows within the network, which can include connection and disconnection of circuits to direct the flow, transform voltages to higher or lower ratings (step-up or step-down – for example 132 kV stepping-up to 400 kV), manage the frequency of the electricity and increase efficiency and reliability of the power supply.
- 2.5.2 Substations are critical in maintaining an efficient and healthy energy network, as they monitor and report back to operators on statistics and events to provide live information on the network. This allows for the following functions:
- Fault monitoring and identification which allows for isolation to protect the network and allow repairs.
  - Allow for redirection and disconnection of energy to allow for demand/maintenance.

- Provide data such as voltage, current and power flow to allow for efficient running and future predictions.

### **Types of substations**

- 2.5.3 There are two main types of substations; Air Insulated Switchgear (AIS) substations and Gas Insulated Switchgear (GIS) substations.
- 2.5.4 An AIS substation is constructed with switchgear which relies on open air components, which can require large clearance areas for operation and safety, which takes up a larger area of land compared to a GIS substation. AIS substations are typically lower cost and typically involve less construction time, with fewer components required and easier maintenance. However, they require a larger area of land and, as they are exposed to the elements, are not recommended for certain environments such as coastal areas.
- 2.5.5 A GIS substation is constructed with switchgear using gas filled components, which allows operation and safety clearances to be reduced when compared to an AIS substation. GIS substations typically require less space, and this may have a reduced visual impact as a result. However, they tend to be more costly, require specialised operation and maintenance, have longer outage repair times and typically require the use of sulphur hexafluoride (SF<sub>6</sub>) - a greenhouse gas that has a global warming impact 22,800 times that of carbon dioxide.
- 2.5.6 As noted within NPS EN-5 (Paragraph 2.9.61), it should be considered carefully whether proposed development could be reconceived during the design phase to avoid the use of SF<sub>6</sub>-reliant assets. NGET policy generally precludes the use of gas insulated technologies due to the negative environmental impacts of SF<sub>6</sub> based insulation gases, the reduced operational maintainability of the technology when compared to AIS, and the significantly increased cost of gas insulated equipment. However, due to the proximity of the coast at some of the potential substation sites, there may be greater justification for using gas insulated equipment due to the accelerated corrosion of air insulated equipment in coastal environments. There may also be additional benefits in using gas insulated technology as these generally require less land take and in some instances may be less visually intrusive to the surrounding landscape. Further investigations into the levels of salt pollution at the substation siting areas identified as preferred, and into the historical performance of AIS equipment in the area will be required following non-statutory consultation to confirm whether GIS equipment will be required on this basis. SF<sub>6</sub>-free alternatives are also currently in development and may be type-registered by the time the Project enters the construction phase; this would reduce the environmental risk of GIS equipment although not to a level comparable to AIS as current alternatives use fluorinated gases which present another set of environmental challenges. The use of gas insulated solutions is therefore being monitored and has not been discounted completely at this point. However, based on NGET policy an air insulated solution is currently considered the preferred option. For the purposes of the current stage of the Project and to inform the siting work, the use of AIS substations has been assumed.

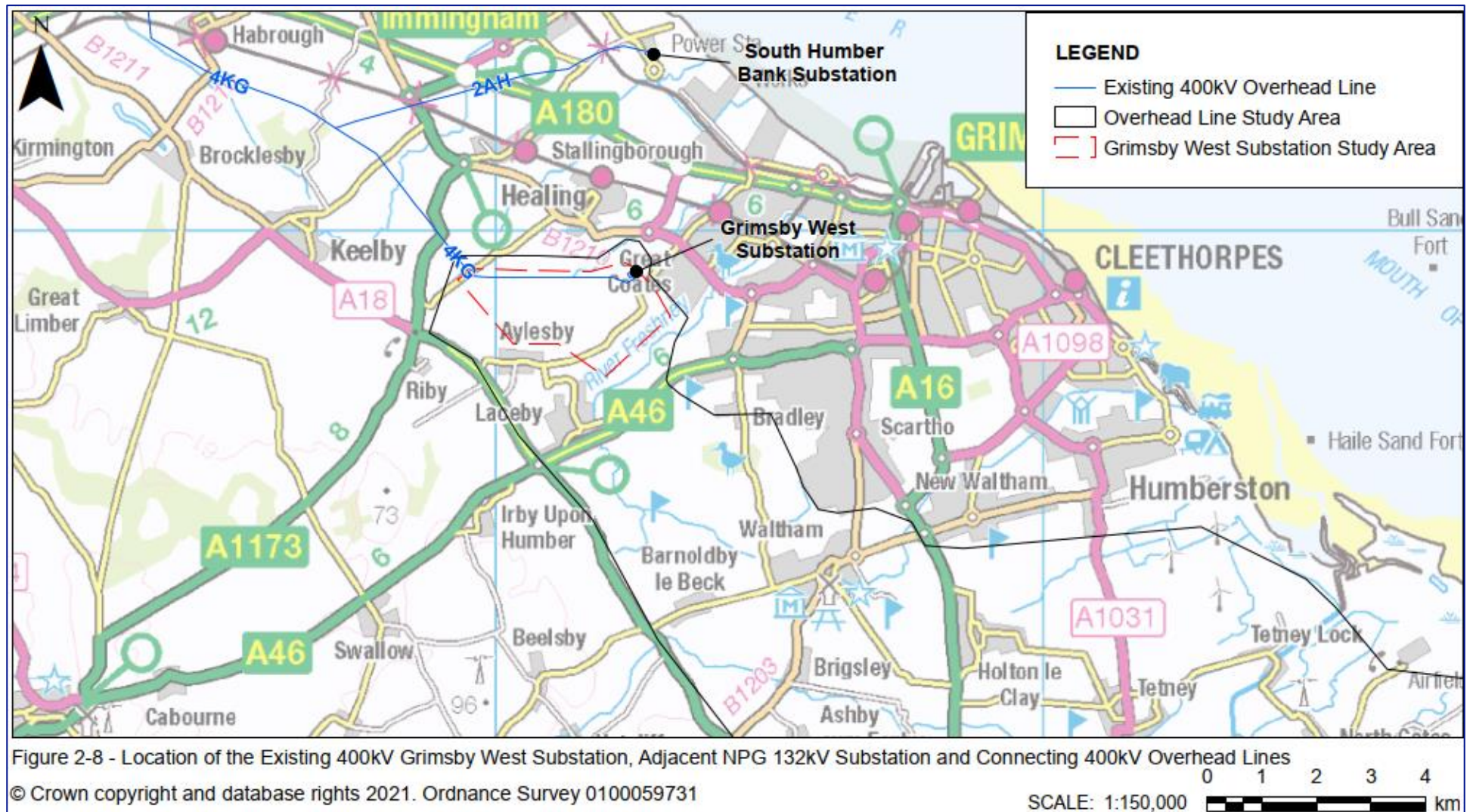
### **New Grimsby West Substation**

- 2.5.7 NGET's existing 400 kV Grimsby West substation, to the west of Grimsby, was built in 1969 to supply electricity from large power stations via 400 kV transmission lines to the town of Grimsby and the surrounding area. The existing NGET substation incorporates two supergrid transformers (SGTs) which supply the adjacent NPG 132 kV substation.

These SGTs are due to be replaced to ensure electricity supply is maintained to the local area. The electricity is distributed to the town and area from the adjacent 132 kV substation via electricity distribution lines owned and operated by NPG.

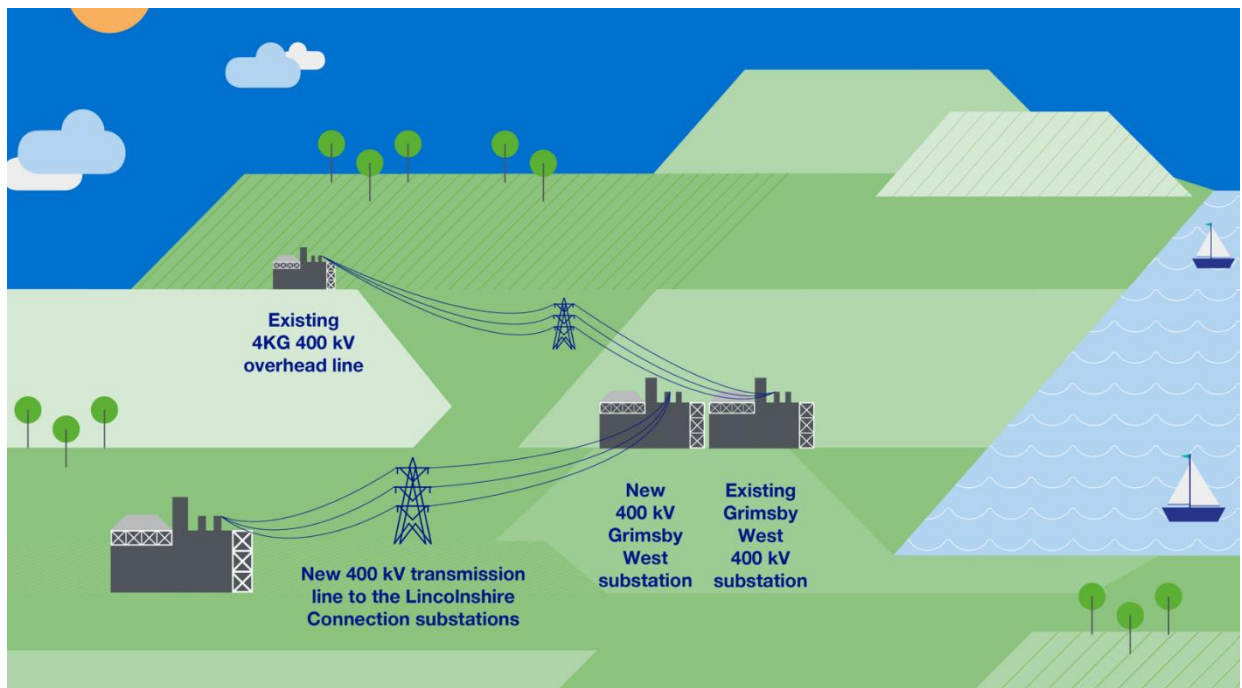
- 2.5.8 The location of the existing 400 kV Grimsby West substation, adjacent to the 132 kV substation and connecting overhead lines is shown in **Figure 2-8** below.

Figure 2-8 – Location of the Existing 400 kV Grimsby West Substation, Adjacent NPG 132 kV Substation and Connecting 400 kV Overhead Lines



2.5.9 As part of the Project, a new Grimsby West substation is currently being developed by NGET. This is to facilitate the connection of increasing numbers of customers and transfer power further south along the proposed overhead lines towards the new Lincolnshire Connection substations and beyond. Alongside the new overhead lines from the new Lincolnshire Connection substations, the existing 4KG 400 kV transmission line that runs westward from the existing Grimsby West substation towards Keelby will also connect into the new substation. Minor diversions of that line will be necessary to connect it back into the new Grimsby West substation. Temporary diversions of the route may also be required to maintain electricity supplies whilst the permanent works are undertaken. A schematic diagram of this is shown in **Figure 2-9**.

Figure 2-9 – Proposed connections at the New Grimsby West Substation



2.5.10 The final technology type for the new Grimsby West substation has not yet been confirmed. For the purposes of the current stage of the Project and to inform the siting work it is anticipated that an AIS substation could extend to approximately 600 m by 200 m (approximately 12 ha) dependent upon the number of connections required. Regardless of the technology choice, permanent access would be needed to the new Grimsby West substation, together with peripheral landscaping, drainage, and other related works.

2.5.11 The new Grimsby West substation will provide a new connection point for generation customers as previously mentioned. The dimensions of the new substation, and the equipment it is required to consist of, are partially driven by the number and size of connections which are proposed to connect at the new substation. The currently contracted generation connection offers are:

- Eonergy Solar and Battery Energy Storage System (BESS);
- Stallingborough Solar and BESS;
- Carbon Free 2030 Solar and BESS;
- Stallingborough Carbon Capture; and
- NPG Demand Connection.

## New Lincolnshire Connection Substations

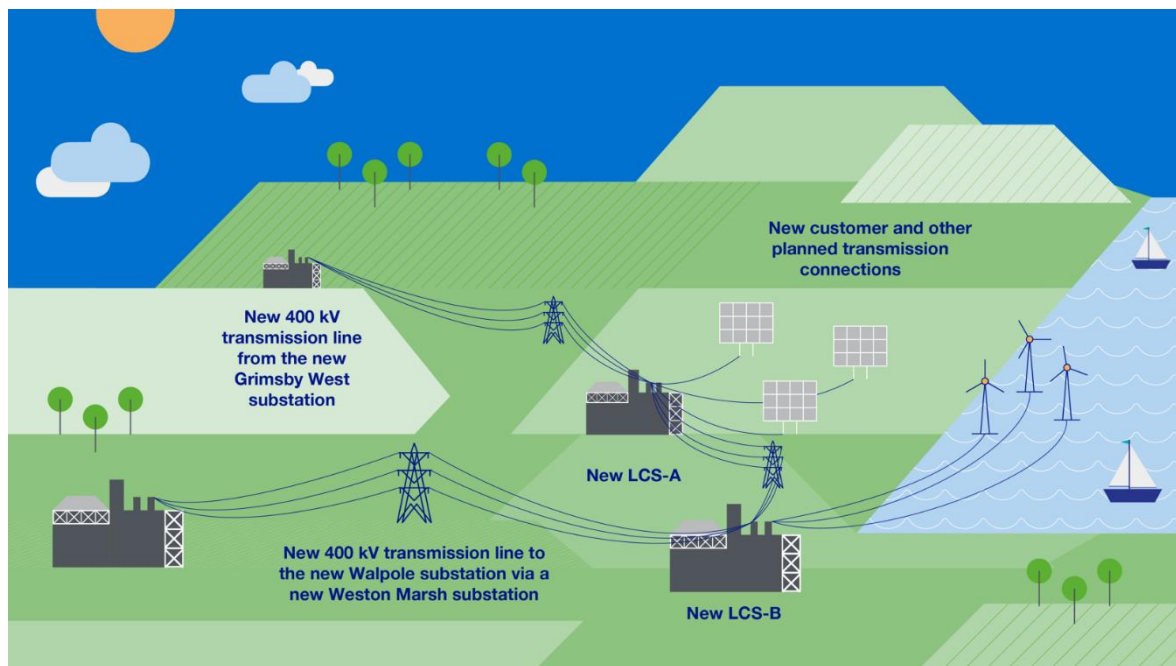
- 2.5.12 The Project also proposes the construction of two new 'Lincolnshire Connection substations' (LCS) (as set out in Chapter 1) which are required to provide new points on the network where connections for new customers can be made. The SOR and the SOR Addendum identified that more than one LCS may be required as part of the preferred strategic option. As detailed in **Paragraph 1.1.3**, further work as part of the Options Identification and Selection (Stage 2) work has confirmed the requirement for two LCS to ensure necessary system resilience, to manage security risks, and to ensure the most efficient solution was selected for both the system and the local community to maintain compliance with NGET SQSS without triggering the requirement for additional circuits in the area.
- 2.5.13 The northernmost LCS will be described in this report as LCS-A, whilst the southernmost LCS will be referred to as LCS-B. A new 400 kV transmission line will connect the new Grimsby West substation to LCS-A, LCS-A to LCS-B, and LCS-B to the new Walpole substation (described below) via a new substation at Weston Marsh (described below). This will form four separate sections of 400 kV transmission line that will constitute a continuous route from Grimsby West to Walpole, connecting LCS-A and LCS-B to each other and to the wider 400 kV transmission network.
- 2.5.14 The final technology type for each of the two LCS has not yet been confirmed. For the purposes of the current stage of the Project and to inform the siting work it is anticipated that each new AIS LCS could extend approximately 700 m by 200 m (approximately 14 ha) dependent upon the number of connections required. Regardless of the technology chosen, permanent access would be needed to each LCS, together with peripheral landscaping, drainage, and other related works.
- 2.5.15 The two LCS will be a new point on the network where new connections for customers and other planned transmission connections can be made and is therefore assumed to act as an attractor to customers and the infrastructure required for a connection to the network. Assumptions about the number of connections that will be required and the infrastructure that is likely to come forward because of such connections have been made to inform the siting work. The contracted customers and planned onshore and offshore transmission connections that the Project needs to accommodate are:
- EGL 3 or EGL 4, as detailed in **Chapter 1** and the SOR, will transfer 4 GW of renewable energy between Scotland and England to meet the requirements of generation connections in Scotland. As part of an assumed technical solution for the EGL 3 and EGL 4 projects, either EGL 3 or EGL 4 should have the ability to form a three-ended connection by siting a converter station and a direct current switching station (DCSS) in proximity to either LCS-A or LCS-B and would also route south to site a converter station in proximity to the new Walpole substation;
  - Aminth (Volta Energy) Interconnector;
  - Mablethorpe Storage (Statera) Electrolyser and Combined Cycle Gas Turbine (CCGT);
  - Frontier Power (formerly SENECA) Interconnector;
  - Race Bank Offshore Wind Farm (OWF) Extension;
  - EcoMablethorpe Solar and BESS;
  - Mablethorpe Green Energy (Inova) Solar and BESS; and

- Offshore DC link (OWF connection recommended by the ESO in the Holistic Network Design (HND)).
- 2.5.16 Separate consents will be required by these projects to bring the cables from their projects to connect to their own associated onshore substations or converter stations with further cables then required to connect the new generation into LCS-A or LCS-B (as applicable) to allow the power to be transported on the new overhead lines comprised in the Project. These customer and other planned transmission connection components do not specifically form part of the Project. However, as the LCS will act as attractors for customers and other planned transmission connections, a coordinated approach (in line with Paragraph 2.13.16 of NPS EN-5) has been adopted and the potential for new infrastructure associated with connecting these projects is taken into consideration as part of the siting of the two LCS.
- 2.5.17 Each of the substations or converter stations required to allow customers and other planned transmission connections to connect into each LCS are likely to require areas in the order of 400 m by 200 m and 500 m by 200 m respectively (approximately 8 ha and 10 ha). At present, the exact configuration of the connections to LCS-A and LCS-B is still subject to change. Therefore, for the purposes of the current stage of the Project and to inform the siting work, a reasonable worst-case assumption has been made for the connection infrastructure connecting at LCS-A and LCS-B. The following is a list of the customer and other planned transmission connection substation or converter station infrastructure assumed to feasibly connect at a single LCS (i.e. either LCS-A or LCS-B):
- EGL 3 or EGL 4 converter station and Direct Current Switching Station (DCSS) of approximately 10 ha (the EGL 3 or EGL 4 project which has the ability to form a three-ended connection at the LCS will be confirmed following more detailed system studies, however this will have no impact on assumed land take);
  - Statera Electrolyser and CCGT substation of approximately 10 ha;
  - Frontier Power Interconnector converter station of approximately 10 ha;
  - Race Bank OWF Extension export substation of approximately 10 ha;
  - Outer Dowsing OWF export converter station of approximately 10 ha (subsequent to assessments being undertaken, it was confirmed by the ESO that Outer Dowsing OWF would connect at Weston Marsh. The assumptions have not been updated as this confirmation happened late in the assessment process. This will be reviewed and considered further as the project develops on the basis that additional connections could be connected at the LCS substations in the future).
  - Offshore DC link converter station of approximately 10 ha.
- 2.5.18 It is assumed that a total of approximately 120 ha (60 ha for LCS-A and 60 ha for LCS-B) of substation or converter stations is required to allow customers and other planned transmission connections to connect into the LCS.
- 2.5.19 There is no standard distance within which substations or converter stations must be located in order to allow customers and other planned transmission connections to connect into each LCS. The final locations of these substations or converter stations will be subject to other developers' own siting work and the decisions they will make on location preferences. However, for the purposes of the current stage of the Project and to inform the siting work, NGET has assumed that substations or converter stations would be located within 4 km of each LCS 400 kV substation, as it is considered that other developers (subject to each project's own technical requirements) would seek to

limit the lengths of high voltage alternating current (HVAC) connections wherever possible.

- 2.5.20 Each of the identified connections to each LCS is also likely to require their own permanent access, together with peripheral landscaping, drainage, and other related works. In addition, other factors such as sterilised land by underground cable entries into LCS-A and LCS-B, the orientation of transmission corridors and alignment of infrastructure, likely drainage requirements, and accesses will influence the layout of infrastructure.
- 2.5.21 The proposed connection arrangements for LCS-A and LCS-B are shown in **Figure 2-10**.

Figure 2-10 – Proposed connections at LCS-A and LCS-B



## New Weston Marsh Substation

- 2.5.22 A proposal for a new Weston Marsh substation is currently being developed by NGET as part of the Grimsby to Walpole Project to facilitate future projects requiring connections into the electricity transmission system. Future projects potentially requiring connections include:
- Holbeach Marsh Energy Park;
  - Spalding Photovoltaic (PV) and BESS Station; and
  - Outer Dowsing OWF connection.
- 2.5.23 The new Weston Marsh substation will connect to the new 400 kV transmission line from LCS-B and the new 400 kV transmission line to the new Walpole substation (described below). In addition, the new Weston Marsh substation will connect to the 400 kV 4ZM transmission line that runs south-east of Sleaford towards King's Lynn, and the 400 kV 2WS transmission line that runs east of Spalding towards a Tee-Point with the 400 kV transmission line between Sleaford and King's Lynn. The location of the Spalding Tee-Point is shown in **Figure 2-11** and a schematic of the proposed connections and Weston Marsh is shown in **Figure 2-12**.



2.5.24 The final technology type for the new Weston Marsh substation has not yet been confirmed. For the purposes of the current stage of the Project and to inform the siting work it is anticipated that a new AIS Weston Marsh substation could extend approximately 700 m by 200 m (approximately 14 ha) dependent upon the number of connections required. Regardless of the technology chosen permanent access would be needed to the new Weston Marsh substation, together with peripheral landscaping, drainage, and other related works.

Figure 2-11 – Location of the Spalding Tee at Weston Marsh and Connecting Overhead Lines

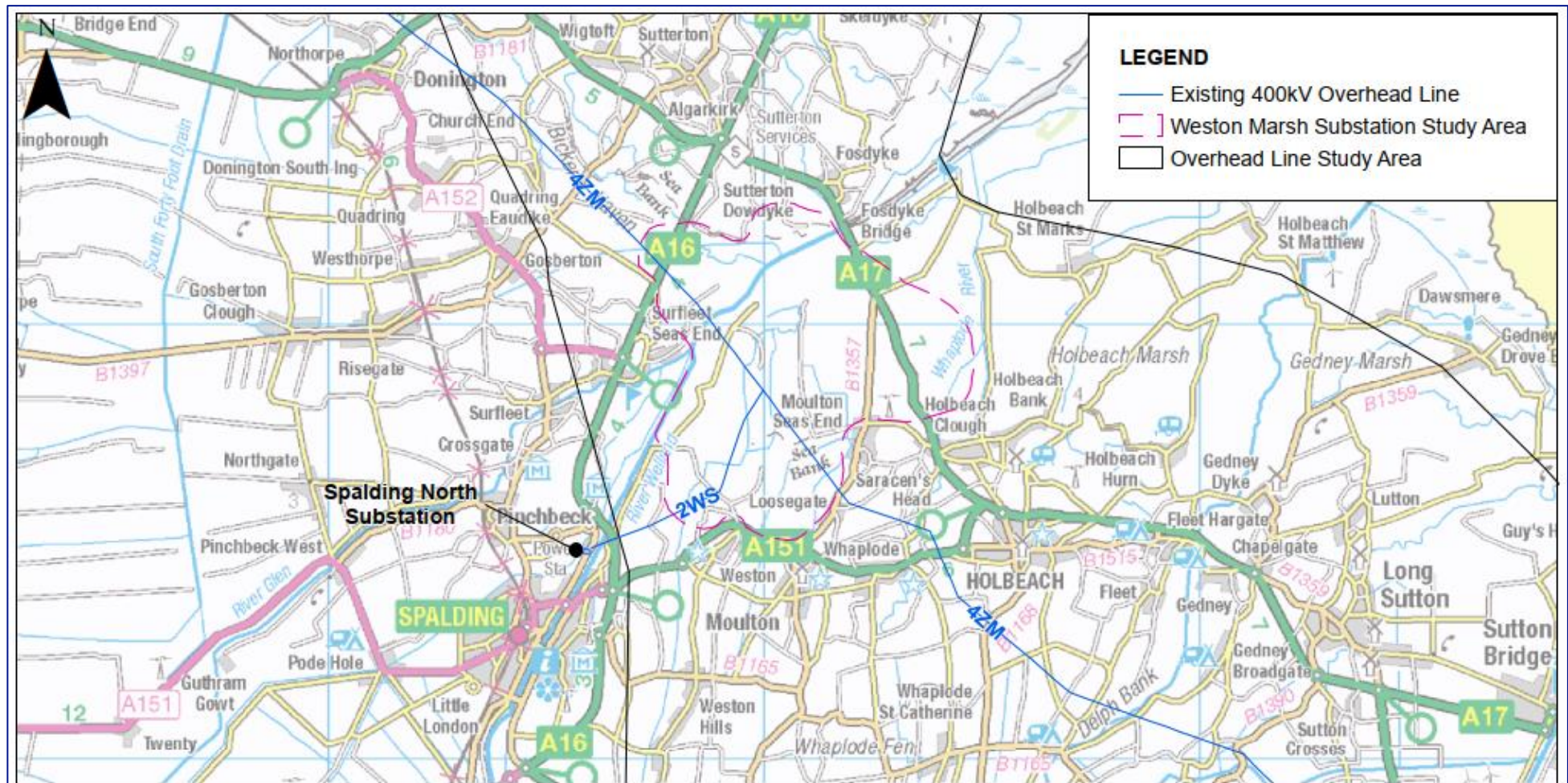


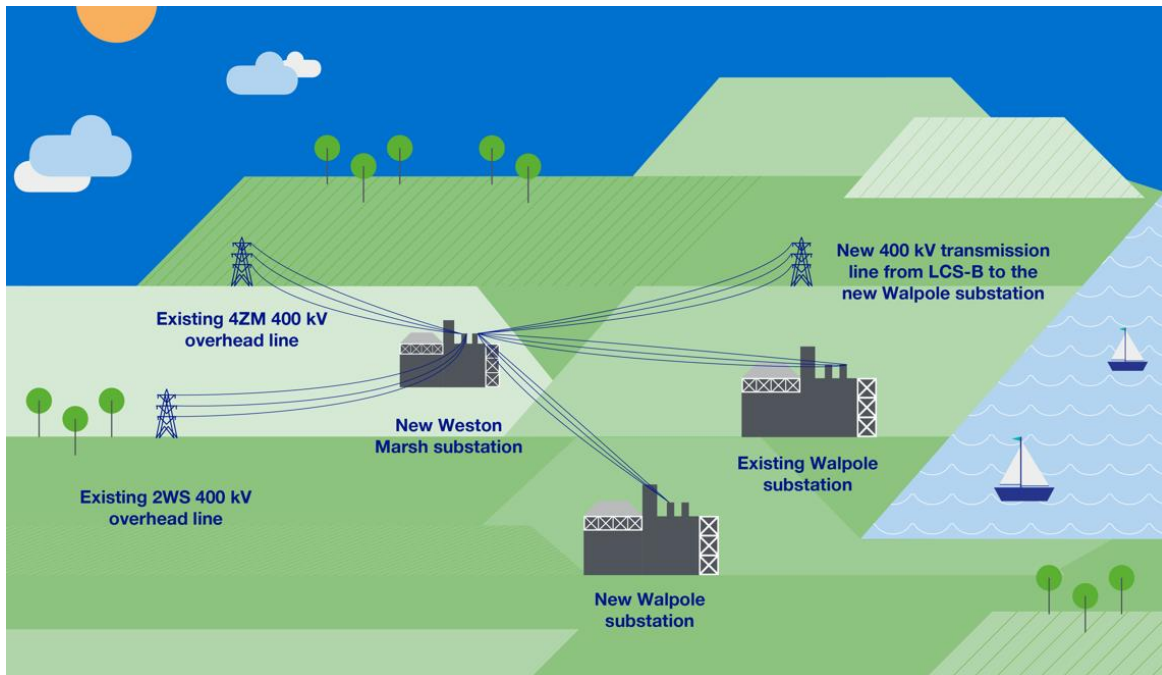
Figure 2-11 – Location of the Spalding Tee at Weston Marsh and Connecting Overhead Lines

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SCALE: 1:200,000



Figure 2-12 – Proposed connections at Weston Marsh



## New Walpole Substation

- 2.5.25 NGET’s existing 400 kV Walpole substation, to the west of Walpole St Andrew, was built in 1969 to supply electricity to the town of Wisbech and the surrounding area and as a connection point at the convergence of the 400 kV transmission lines connecting the Bicker Fen, Burwell Main, and Norwich Main substations. The electricity is distributed to the surrounding area from the adjacent UKPN 132 kV substation via electricity distribution lines owned and operated by UKPN and NGED. More recently, the substation has become a connection site for numerous electricity generation customers in the area.
- 2.5.26 The location of the existing 400 kV Walpole substation, adjacent UKPN 132 kV substation and connecting overhead lines is shown in **Figure 2-13** below.
- 2.5.27 A proposal for a new Walpole substation is currently being developed by NGET as part of the Grimsby to Walpole Project to facilitate the connection of future projects requiring connections into the electricity transmission system. Future transmission and generation projects requiring connections include:
- EGL 3 and EGL 4, as detailed in **Chapter 1** and the SOR will transfer 4 GW of energy between Scotland and England to meet the requirements of generation connections in Scotland. As part of an assumed technical solution where either of EGL 3 or EGL 4 should have the ability to provide a three-ended connection at the LCS. Both EGL 3 and EGL 4 would connect directly to the new Walpole substation; and
  - Statera Electrolyser and CCGT.
- 2.5.28 The new Walpole substation will connect to the 400 kV 4ZM transmission line that runs north from Burwell towards the existing Walpole substation. Diversions of the 4ZM 400 kV overhead line will be necessary to connect the line into the new Walpole substation. Temporary diversions of the route may also be required to maintain electricity supplies

whilst the permanent works are undertaken. The proposed connection arrangement at Walpole is shown in **Figure 2-14**.

- 2.5.29 The final technology type for the new Walpole substation has not yet been confirmed. For the purposes of the current stage of the Project and to inform the siting work it is anticipated that a new AIS Walpole substation could extend approximately 800 m by 200 m (approximately 16 ha) dependent upon the number of connections required. Regardless of the technology chosen permanent access would be needed to the new Walpole substation, together with peripheral landscaping, drainage, and other related works.
- 2.5.30 As stated above, the new Walpole substation will be a new connection point on the network for the EGL 3 and EGL 4 projects. A separate consent will be required for the EGL 3 and EGL 4 projects to bring the cables for their projects to the new Walpole substation and for converter stations required to connect into the new Walpole substation. As such, these components do not form part of the Project. However, as the new Walpole substation would facilitate the connection of these projects (and their associated infrastructure), a coordinated approach (in line with Paragraph 2.13.16 of NPS EN-5) has been adopted. Therefore, the components of the EGL 3 and EGL 4 projects are taken into consideration as part of the siting for the new Walpole substation. Converter stations for the EGL 3 and EGL 4 projects required to connect into the new Walpole substation are each likely to require an area in the order of 500 m by 200 m (approximately 10 ha). It is assumed that this infrastructure would be located near to the new Walpole substation. Therefore, for the purposes of the current stage of the Project and to inform the siting work, it has assumed that the following permanent infrastructure could connect at the new Walpole substation:
- EGL 3 converter station of approximately 10 ha; and
  - EGL 4 converter station of approximately 10 ha.
- 2.5.31 As with the new Walpole substation, the EGL 3 and EGL 4 connections will also require permanent access, together with peripheral landscaping, drainage, and other related works.

Figure 2-13 – Location of the Existing 400 kV Walpole Substation, Adjacent UKPN 132 kV Substation and Connecting 400 kV Overhead Lines

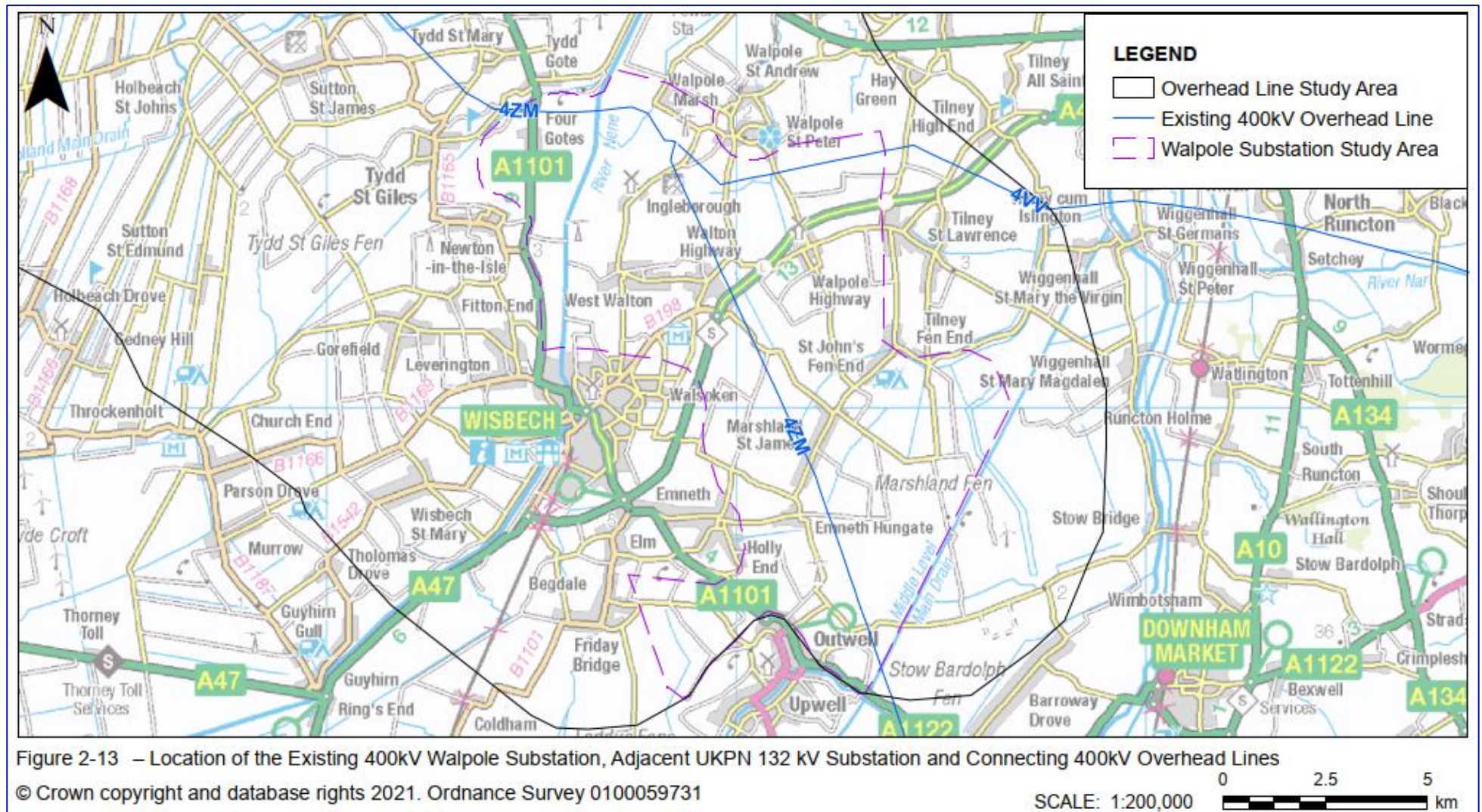
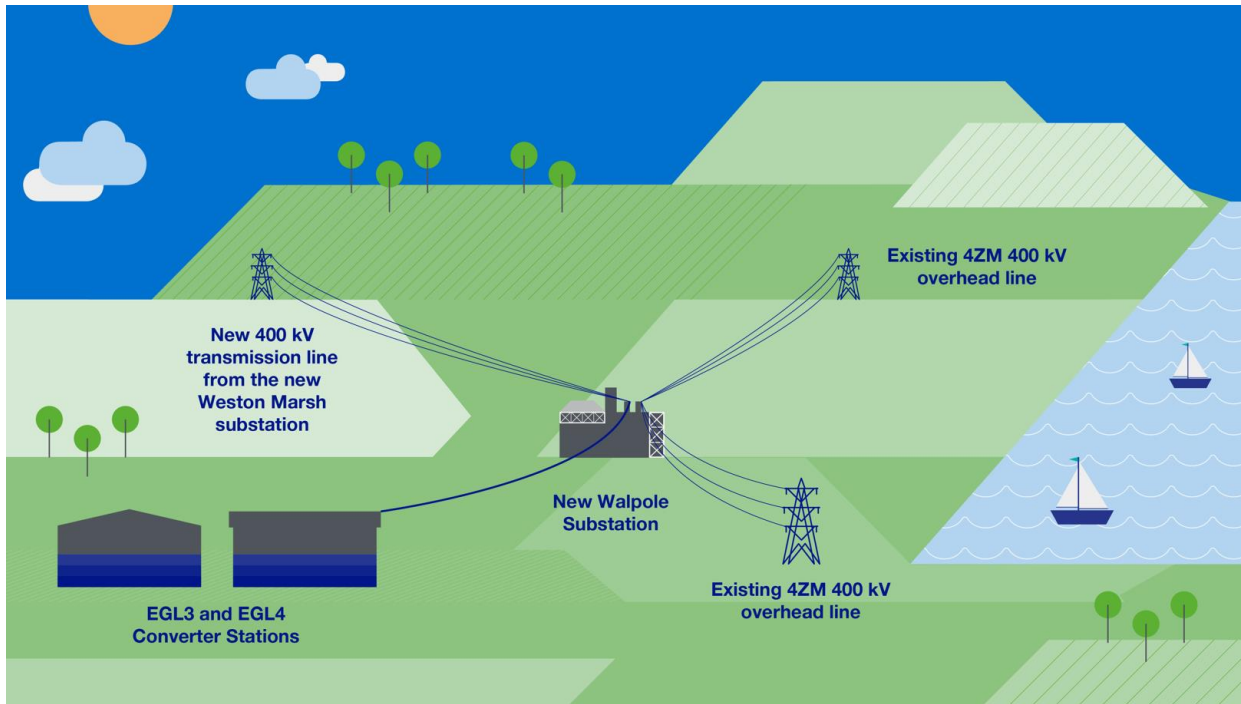


Figure 2-14 – Proposed Connections at the new Walpole Substation



# **3. National Grid's Approach to Routeing and Siting**

# 3. National Grid’s Approach to Routeing and Siting

## 3.1 Overview

3.1.1 This chapter provides an overview of the key legislation, policy, and guidance applicable to National Grid’s routeing and siting (implemented by NGET), a summary of National Grid’s approach to routeing and siting and the technology options considered for this Project.

## 3.2 NGET’s Statutory Duties (Electricity Act 1989)

3.2.1 NGET has duties placed upon it by the Electricity Act 1989 ('the Electricity Act') and operates under the terms of its transmission licence. Those duties and terms of particular relevance to the development of the proposed connection described in this report are set out below. Where NGET develops new infrastructure, it is required to have regard to these following statutory duties under the Electricity Act:

- Section 9 (General duties of licence holders) of the Electricity Act states that:

*“It shall be the duty of the holder of a licence authorising him to participate in the transmission of electricity:*

*(a) to develop and maintain an efficient, co-ordinated and economical system of electricity transmission;...*”

- Electricity Act – Schedule 9 (preservation of amenity including: considering impacts upon communities, landscape, visual amenity, cultural heritage, and ecological resources); and
- Section 38 and Schedule 9 of the Electricity Act state that:

*“(1) In formulating any relevant proposals, a licence holder or a person authorised by exemption to generate, distribute, supply or participate in the transmission of electricity:*

*(a) shall have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and*

*(b) shall do what he reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects.”*

3.2.2 NGET have also had due regard to other statutory obligations and requirements, where relevant, in the undertaking of Options Identification and Selection Stage (Stage 2).



### 3.3 British Energy Security Strategy (2022)

- 3.3.1 In response to concerns over the security, affordability, and sustainability of the UK's energy supply the UK Government published its British Energy Security Strategy in July 2022.
- 3.3.2 The British Energy Security Strategy proposes to accelerate the UK towards a low-carbon and energy independent future. It has a focus on expanding domestic UK energy supply and accelerating the connecting network infrastructure to support an expansion in domestic UK energy supply whilst also working with international partners to maintain stable energy markets and prices.
- 3.3.3 Regarding offshore wind, the British Energy Security Strategy states that:  
*“By the end of 2023 we are set to increase our capacity by a further 15 per cent. But now we must go further and faster, building on our global leadership in offshore wind.” [It aims to] “deliver up to 50 GW by 2030, including up to 5 GW of innovative floating wind.”*
- 3.3.4 The British Energy Security Strategy recognises that:  
*“Accelerating our domestic supply of clean and affordable electricity also requires accelerating the connecting network infrastructure to support it. Within this decade, our modern system will prioritise two key features: anticipating need because planning ahead minimises cost and public disruption; and hyper-flexibility in matching supply and demand so that minimal energy is wasted. This more efficient, locally-responsive system could bring down costs by up to £10 billion a year by 2050.”*
- 3.3.5 To support this the British Energy Security Strategy includes several aims including, to:
- set out a *“blueprint for the whole system by the end of 2022 in the Holistic Network Design (HND) and Centralised Strategic Network Plan (CSNP). The HND will identify strategic infrastructure needed to deliver offshore wind by 2030.”*; and
  - *“Dramatically reduce timelines for delivering strategic onshore transmission network infrastructure by around three years. We will work with Ofgem, network operators and the supply chain to find further savings, for example in the procurement, manufacture and construction stages. Overall, we aspire to halve the end-to-end process by the mid-2020s.”*
- 3.3.6 The Powering Up Britain paper<sup>15</sup> was published in March 2023 by the UK Government. This document provides an update of the strategy for secure, clean and affordable British energy for the long term future.
- 3.3.7 When considering new electricity infrastructure, NGET have had regard to the British Energy Security Strategy and Powering Up Britain paper.

### 3.4 National Policy Statements (NPS)

- 3.4.1 National Policy Statements EN-1 and EN-5 set the policy context within which the routing and siting for electricity infrastructure networks is undertaken. Taken together

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<sup>15</sup> Energy White Paper: Powering our net zero future, December 2020  
<https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future>

these National Policy Statements provide the primary national policy context for decisions on applications for electricity transmission projects classified as Nationally Significant Infrastructure Projects.

- 3.4.2 The process undertaken as part of the Options Identification and Selection Stage and reported within this CPRSS was primarily undertaken in 2023 and based on the 2011 NPSs (adopted July 2011) which comprised the designated National Policy Statements at the time. Revised versions of EN-1 (Overarching National Policy Statement for Energy) and EN-5 (National Policy Statement for Electricity Networks Infrastructure) were published in November 2023 and are due to be designated in early 2024, at which point they will become the relevant NPSs for the Project. Therefore, the commentary below reflects the November 2023 NPSs. NGET has reviewed the changes introduced by the revised versions of the NPSs and concluded that they do not change the policy appraisals undertaken to inform this CPRSS or the conclusions reached.

## Overarching National Policy Statement for Energy – EN-1 (2023)

- 3.4.3 EN-1 sets out the need for new nationally significant infrastructure to be brought forward at pace to meet out energy objectives. This includes meeting energy security and carbon reduction strategies, the need for more electricity capacity to support increased supply from renewables, and the need to meet future increases in electricity demand. EN-1 Paragraph 3.3.70 states that all new grid projects have a role in efficiently constructing, operating, and connecting low carbon infrastructure to the National Electricity Grid.
- 3.4.4 EN-1 sets out the critical national priority (CNP) for low carbon infrastructure. The Government’s energy security and net zero ambitions will only be delivered if the UK can enable the development of new low carbon sources of energy at speed and scale. Paragraph 4.2.5 of EN-1 specifically notes that all power lines in scope of EN-5 (as described in **Paragraph 3.4.15**) including network reinforcement and upgrade works, and associated infrastructure such as substations are considered to be critical low carbon infrastructure. These works do not have to be associated with a specific generation technology, as it is considered that new grid projects will contribute towards greater efficiency in constructing, operating and connecting low carbon infrastructure to the existing electricity transmission system.
- 3.4.5 EN-1 sets out the generic impacts and means of mitigation that are anticipated to arise most frequently from energy infrastructure developments. However, EN-1 (Paragraph 3.1.1.) recognises that due to the significant amounts of new large-scale energy infrastructure required to meet the UK’s energy objectives, it will not be possible to develop the necessary amounts of such infrastructure without some significant residual adverse effects. The application of policies set out in Parts 4 and 5 of EN-1 seek to minimise these effects.
- 3.4.6 In line with Part 5 of EN-1, this CPRSS considers the following topics (listed in the order used in National Grid’s Approach to Consenting<sup>4</sup>):
- Landscape (covering the ‘landscape’ impacts described in EN-1);
  - Visual (as described in EN-1);
  - Ecology (covering the ‘biodiversity’ impacts described in EN-1);
  - Historic environment (as described in EN-1);

- Air quality (covering the ‘air quality and emissions’ and ‘dust’ impacts described in EN-1);
  - Noise and vibration (as described in EN-1);
  - Geology and soils (covering the ‘geological conservation’ impacts described in EN-1);
  - Water (covering the ‘flood risk’ and ‘water quality and resources’ impacts described in EN-1);
  - Economic activity (covering the ‘socio-economic’ impacts and ‘land use including open space, green infrastructure and green belt’ impacts described in EN-1);
  - Aviation and defence (covering the ‘civil military aviation and defence interests’ impacts described in EN-1); and
  - Traffic and transport (as described in EN-1).
- 3.4.7 Greenhouse Gases, Coastal change, odour, artificial light, smoke, steam, insect infestation and waste management impacts, as described in EN-1, would not have a significant impact on the determination of the preferred routeing and siting for this Project. Where relevant these topics will be considered as the Project development progresses into the Defined Proposal and Statutory Consultation Stage (Stage 3).
- 3.4.8 Electromagnetic fields will be considered as the Project development progresses into the Defined Proposal and Statutory Consultation stage (Stage 3). However, NGET designs all of its infrastructure to be compliant with current regulations and guidance<sup>16</sup> on such matters.
- 3.4.9 EN-1 explains that in terms of:
- Biodiversity (Paragraph 4.6.6) – applicants, such as NGET, should seek opportunities to contribute to and enhance the natural environment by providing net gains for biodiversity;
  - Historic Environment (Paragraph 5.9.25) – there is a desirability to sustaining and where appropriate enhancing the significance of heritage assets, their setting, and the positive contribution they can make to communities. Section 5.9.30 of EN-1 also makes clear that substantial harm to or loss of designated assets of the highest significance, including scheduled monuments; registered battlefields; grade I and II\* listed buildings; grade I and II\* registered parks and gardens; and world heritage sites, should be wholly exceptional;
  - Landscape and Visual (Paragraph 5.10.6) – projects need to be designed carefully, taking account of the potential impact on the landscape and on sensitive visual receptors. The aim should be to minimise harm to the landscape and sensitive visual receptors, providing reasonable mitigation where possible and appropriate. Section 5.10.32 of EN-1 confirms that National Parks and Areas of Outstanding Natural Beauty (AONBs) have been confirmed by the Government as having the highest status of protection in relation to landscape and scenic beauty. It makes clear that development consent in these areas can be granted in exceptional circumstances. In

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<sup>16</sup> Energy Networks Association (2017) Electric and magnetic fields: the facts. London, Energy Networks Association. Present on the dedicated National Grid EMFs website [www.emfs.info](http://www.emfs.info)

such instances, the development should be demonstrated to be in the public interest and consideration of such applications should include an assessment of:

- *“the need for the development, including in terms of national considerations, and the impact of consenting or not consenting it upon the local economy;*
- *the cost of, and scope for, developing elsewhere outside the designated area or meeting the need for it in some other way, taking account of the policy on alternatives; and*
- *any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.”*
- Socio-economics – applicants for a given project should identify the impacts of new energy infrastructure and potential mitigation measures.
- Flood Risk – The relevant policy on flood risk for energy transmission Nationally Significant Infrastructure Projects (NSIPs) is set out in section 5.8 of EN-1. This requires that, when making a decision on an application for an energy NSIP, the Secretary of State must be satisfied of the following:
  - *“the application is supported by a Flood Risk Assessment (FRA).*
  - *the Sequential Test has been applied and satisfied as part of site selection [discussed further below].*
  - *a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk.*
  - *the proposal is in line with any relevant national and local flood risk management strategy.*
  - *Sustainable urban Drainage Systems (SuDS) have been used unless there is clear evidence that their use would be inappropriate.*
  - *in flood risk areas, the project is designed and constructed to remain safe and operational during its lifetime, without increasing flood risk elsewhere (subject to the exceptions set out in paragraph 5.8.42).*
  - *the project includes safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development.*
  - *land that is likely to be needed for present or future flood risk management infrastructure has been appropriately safeguarded from development to the extent.”*

## **Sequential Test**

3.4.10 The Sequential Test is set out in Planning Practice Guidance<sup>17</sup> and is explained within EN-1 at Paragraph 5.8.21. The Sequential Test ensures that a systematic, risk-based approach is followed to guide new development to areas with the lowest risk of flooding. It applies to all types of development and is used to assess the flood risk associated with potential sites<sup>17</sup>.

3.4.11 In summary, the Sequential Test requires the following steps:

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<sup>17</sup> See Paragraph: 024 Reference ID: 7-024-20220825 of the Planning Practice Guidance ('PPG').

- Initially, the focus is on locating development in low-risk areas (i.e., Flood Zone 1). Paragraph 5.8.21 of EN-1 states that preference should be given to locating new development to areas with the lowest risk of flooding.
- If it is not possible to locate development in low-risk areas, the test moves on to compare reasonably available sites<sup>18</sup> within medium risk areas (i.e., Flood Zone 2). If there is no reasonably available site in Flood Zone 1, then projects can be located in Flood Zone 2 provided that the Secretary of State is satisfied that the Sequential Test is met.
- Only where there are no reasonably available sites in low and medium risk areas, the test considers high-risk areas (i.e., Flood Zone 3a<sup>19</sup>). In these circumstances, energy NSIPs can be located in Flood Zone 3 provided that Secretary of State is satisfied that the requirements of the Sequential Test and Exception Test (discussed further below) are met.

3.4.12 Therefore, the Sequential Test must be applied both during the site selection process and at the site level when a site has been selected. In other words, as well as applying the Sequential Test when selecting a site, development should take place on the area(s) of the selected site(s) with the lowest flood risk. Note that implicitly the application of the test at the site level will inform site selection – sites best able to accommodate development will perform better against the site selection test.

### **The Exception Test**

3.4.13 If, following application of the Sequential Test, it is not possible for the project to be located in zones of lower probability of flooding than Flood Zone 3 the Exception Test can be applied. The test is intended to provide a method of managing flood risk while still allowing necessary development to occur. EN-1 is clear that the Exception Test is only appropriate for use where the Sequential Test alone cannot deliver an acceptable site. Given the sheer extent of Flood Zone 3 across the Study Area this is likely to apply to the Project.

3.4.14 The Exception Test is explained in Paragraphs 5.8.9, 5.8.10 and 5.8.11 of EN-1. For the Test to be passed:

- it must be demonstrated that the project provides wider sustainability benefits to the community<sup>20</sup> that outweigh flood risk; and
- it must be demonstrated that the project will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall<sup>21</sup>.

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<sup>18</sup> 'Reasonably available sites' are defined in the PPG as those in a suitable location for the type of development with a reasonable prospect that the site is available to be developed at the point in time envisaged for the development.

<sup>19</sup> Note that the Flood Zone 3 category also contains Flood Zone 3b, which is 'functional floodplain'. EN-1 provides that, energy projects proposed in Flood Zone 3b should only be permitted if the development will not result in a net loss of floodplain storage, and will not impede water flows.

<sup>20</sup> This includes the wider benefits of the infrastructure project, including the national need for it as set out in the NPS.

<sup>21</sup> Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the SoS may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, the nationally significant energy infrastructure.

## National Policy Statement for Electricity Networks Infrastructure— EN-5 (2023)

3.4.15 EN-5 sets out the factors influencing routing and siting selection and the impacts and other matters which are specific to electricity networks infrastructure. In summary:

- Paragraph 1.1.2 of EN-5 states that a significant amount of new network infrastructure is required in the near term to directly support the government's ambition to deploy up to 50 GW of offshore wind capacity by 2030.
- Biodiversity (Paragraph 2.9.6) – particular consideration should be given to the effects on large birds, including feeding and hunting grounds, migration corridors and breeding grounds.
- Landscape and Visual – Paragraphs 2.9.7 and 2.9.9 of EN-5 state that:

*“While the Government does not believe that the development of overhead lines is incompatible in principle with applicants’ statutory duty under Schedule 9 to the Electricity Act 1989, to have regard to visual and landscape amenity and to reasonably mitigate possible impacts thereon, in practice new overhead lines can give rise to adverse landscape and visual impacts.*

*These impacts depend on the type (for example, whether lines are supported by towers or monopole structures), scale, siting, and degree of screening of the lines, as well as the characteristics of the landscape and local environment through which they are routed.*

*New substations, sealing end compounds (including terminal towers), and other above-ground installations that serve as connection, switching, and voltage transformation points on the electricity network may also give rise to adverse landscape and visual impacts.”*

3.4.16 EN-5 makes clear that the Horlock Rules should be followed by developers when designing their proposals for substations, and EN-5 also makes clear that the Holford Rules should be followed by developers when designing their proposals for overhead lines. Paragraphs 2.9.20 to 2.9.21 state that, *“Although it is the government’s position that overhead lines should be the strong starting presumption for electricity networks developments in general, this presumption is reversed when proposed developments will cross part of a nationally designated landscape (i.e., National Park, The Broads, or Area of Outstanding Natural Beauty). In these areas, and where harm to the landscape, visual amenity and natural beauty of these areas cannot feasibly be avoided by rerouting overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line.”*

3.4.17 However, EN-5 Paragraph 2.9.22 goes on to state that *“undergrounding will not be required where it is infeasible in engineering terms, or where the harm that it causes...is not outweighed by its corresponding landscape, visual amenity and natural beauty benefits. Regardless of the option, the scheme through its design, delivery, and operation, should seek to further the statutory purposes of the designated landscape. These enhancements may go beyond the mitigation measures needed to minimise the adverse effects of the scheme.”*

## 3.5 The Holford and Horlock Rules

3.5.1 NGET consistently employs two sets of rules/guidelines for the routeing and siting of new energy transmission infrastructure:

- Holford Rules – guidelines for the routeing of new overhead lines; and
- Horlock Rules – guidelines for the design and siting of substations, converter stations and SECs)<sup>22</sup>.

3.5.2 When considering new electricity infrastructure, NGET have regard to the degree to which routeing and siting options comply or deviate from these rules.

### Holford Rules

3.5.3 Paragraph 2.9.16 of NPS EN-5 makes clear that the Holford Rules are “*a common-sense approach to overhead line route design*” and “*should be embodied in the applicants’ proposals for new overhead lines*”. In summary, the Holford Rules state that routeing of high voltage overhead transmission lines should where practicable:

- Avoid altogether the major areas of the highest amenity value;
- Choose the most direct line with no sharp changes in direction;
- Be positioned against tree and hill backgrounds as far as possible;
- Prefer moderately open valleys with tree cover;
- Be kept as far as possible independent from smaller lines, converging routes and other poles, masts, wires, and cables to avoid a concentration of lines or ‘wirescape’<sup>23</sup>; and
- Approach urban areas through industrial zones, where they exist; and when residential and recreational land intervenes between the approach line and the substations, carefully assess the comparative costs of undergrounding.

3.5.4 Whilst the guidelines were initially developed in 1959, they have been reviewed on a number of occasions by NGET and by the other UK transmission licence holders. One of the reviews was against the Electricity Act 1989. The guidelines have stood the test of time and have become accepted industry best practice in overhead line routeing.

3.5.5 The general principles underlying the Holford Rules – the avoidance of adverse impacts by careful routeing – are to a degree also relevant to the routeing of underground cables, although the balance of impacts and constraints will often be different.

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<sup>22</sup> The National Policy Statement for Electricity Networks Infrastructure EN-5 NPS has incorporated the Horlock Rules. At Paragraph 2.9.18 it states “*The Horlock Rules – guidelines for the design and siting of substations – were established by National Grid in 2009 in pursuance of its duties under Schedule 9 to the Electricity Act 1989. These principles should be embodied in applicants’ proposals for the infrastructure associated with new overhead lines*”.

<sup>23</sup> Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.

## Horlock Rules

- 3.5.6 Paragraph 2.9.18 of NPS EN-5 makes clear that the Horlock Rules (guidelines for designing and siting substations) “*should be embodied in the applicants’ proposals for the infrastructure associated with new overhead lines*”. The Horlock Rules state that<sup>24</sup>:
- In the development of system options, consideration must be given to environmental issues from the earliest stage to balance the technical benefits and capital cost requirements of new developments against the consequential environmental effects, in order to keep adverse effects to a reasonably practicable minimum;
  - Siting should seek to avoid areas of the highest amenity, cultural or scientific value by the overall planning of the system connections;
  - Areas of local amenity value, important existing habitats and landscape features should be protected as far as reasonably practicable;
  - Siting should take advantage of the screening provided by landform and existing features and the potential use of site layout and levels;
  - Proposals should keep visual, noise and other environmental effects to a minimum;
  - Land use impacts of the proposal should be considered when planning siting;
  - Early consideration should be given to the options available for pylons and ancillary development appropriate to individual locations;
  - Space should be used effectively to limit the area required consistent with appropriate mitigation measures and to minimise the adverse impacts on existing land use and rights of way, whilst also having regard to the potential for any future extension;
  - The design of access roads, perimeter fencing, earth shaping, planting and ancillary development should form an integral part of the site layout and design to fit in with the surroundings;
  - In open landscape especially, high voltage line entries should be kept, as far as possible, visually separate from low voltage lines and other overhead lines so as to avoid a confusing appearance; and
  - The inter-relationship between pylons, ancillary structures and background and foreground features should be studied to reduce the prominence of structures from main viewpoints. Where practicable the exposure of pylons on prominent ridges should be minimised by siting pylons against a background of trees rather than open skylines.
- 3.5.7 The Horlock Rules predominately apply to the siting of substations and line approaches. The general principles underlying the Horlock Rules - the avoidance of areas of high amenity - apply equally to the siting of SECs, although the balance of impacts and constraints will often be different.
- 3.5.8 As detailed above, the National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023) in paragraph 2.9.18 confirms that the Horlock Rules “*should be embodied in Applicants’ proposals for the infrastructure associated with new overhead lines*”.

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<sup>24</sup> <https://www.nationalgrid.com/sites/default/files/documents/13796-The%20Horlock%20Rules.pdf>  
(nationalgrid.com)



## 3.6 National Planning Policy Framework (NPPF)

3.6.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. The policies set out in this framework apply to the preparation of local and neighbourhood plans and to decisions on planning applications.

3.6.2 Paragraph 5 of NPPF states that the:

*“Framework does not contain specific policies for nationally significant infrastructure projects. These are determined in accordance with the decision making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major infrastructure, as well as any other matters that are relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and may be a material consideration in preparing plans and making decisions on planning applications.”*

3.6.3 When considering new electricity infrastructure, NGET has regard to the NPPF.

## 3.7 National Grid's Approach to Consenting

3.7.1 National Grid's Approach to Consenting<sup>4</sup> outlines the project development process for major infrastructure projects, from initial inception to consent and construction. National Grid's Approach to Consenting is divided into six stages:

- Stage 1: Strategic Proposal;
- Stage 2: Options Identification and Selection;
- Stage 3: Defined Proposal and Statutory Consultation;
- Stage 4: Assessment and Land Rights;
- Stage 5: Application; and
- Stage 6: Examination, Decision Construction.

3.7.2 A stepped approach (within Stage 2) has been adopted to identify potential routing and siting options for the Project. This considered the potential impacts on the environment, the local community, relevant planning policy, other existing and proposed developments as well as technical and engineering design information.

3.7.3 The aim of the approach is to balance consideration of these factors and identify an emerging preferred corridor, emerging preferred siting zones within which the overhead lines, underground cables, substations and upgrade works to existing transmission infrastructure could be routed and sited.

3.7.4 **Figure 3-1** presents an overview of National Grid's Approach to Consenting; a summary of the main objectives of this stage of the consenting process can be seen below each stage. The Project is at the Options Identification and Selection Stage (Stage 2).

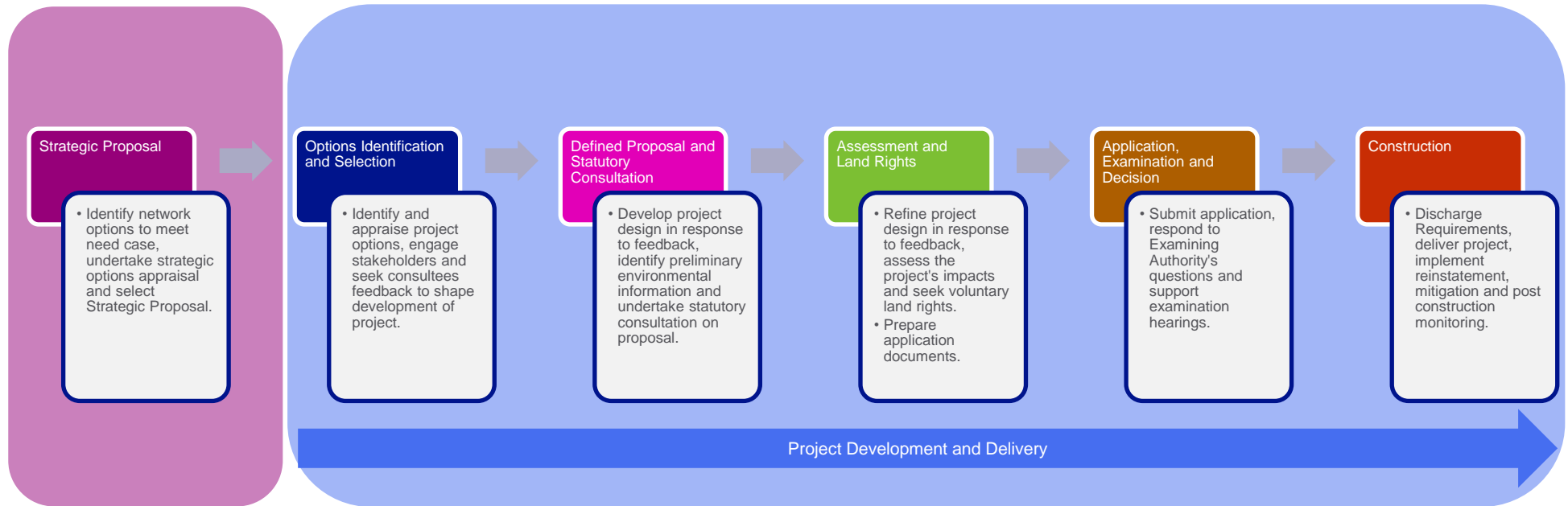
3.7.5 This CPRSS has been undertaken as part of the Stage 2. For the Project, the activities identified in National Grid's Approach to Consenting as being required at Stage 2 were broken down into the following nine steps (as detailed in **Chapter 4**):

- Step 1 – Definition of the study area/s and data gathering;
- Step 2 – Scoping of environmental topics and baseline data-gathering;

- Step 3 – Ascribe weight to, confirm, and heat map features;
- Step 4 – Identifying and defining siting zones, siting areas and corridors;
- Step 5 – Confirm siting zones, siting areas and end-to-end corridors for appraisal;
- Step 6 – Undertake site visits and refinement of siting zones, siting areas and corridors;
- Step 7 – Options appraisal of siting zones, siting areas and corridors;
- Step 8 – Confirm emerging preferred siting zone, siting areas and corridor and develop graduated swathe for consultation; and
- Step 9 – Undertake non-statutory consultation.

3.7.6 This CPRSS sets out the findings of the first eight steps of Stage 2 for the Project. This CPRSS will inform subsequent non-statutory consultation, Step 9.

Figure 3-1 – NGET’s Approach to Project Development and Delivery



# 4. Options Identification and Selection Process (Stage 2)

# 4. Options Identification and Selection Process (Stage 2)

## 4.1 Introduction

- 4.1.1 The Strategic Proposal<sup>25</sup> Stage (Stage 1) was completed in 2023 and a Strategic Proposal was selected, as described in **Section 1.2**. This CPRSS presents the findings of the Options Identification and Selection Stage (Stage 2) and identifies the corridor, siting zones and/or siting areas which are emerging as preferred for the Project. The findings of this CPRSS will be used as part of the non-statutory consultation. The feedback received on the Project during non-statutory consultation will be used to inform the design and alignment of the Project. Following non-statutory consultation, the Project will progress to the Defined Proposal and Statutory Consultation Stage (Stage 3).
- 4.1.2 The methodologies employed for the nine steps, as defined for this Project, of the Options Identification and Selection Stage (Stage 2) are summarised in **Figure 4-1** and are described below.
- 4.1.3 The following key terms are used throughout this CPRSS:
- Indicative Study Area – the indicative area of the preferred strategic option identified at the Strategic Options Appraisal at the Strategic Proposal Stage (Stage 1).
  - Study Area – the broad areas within which infrastructure corridors and siting zones required for the Project could be located and within which detailed environmental and socio-economic data is gathered to inform Stage 2.
  - Corridor – a broad area within the study area, which new transmission infrastructure (overhead lines, underground cables and SECs) could be routed. The study area will contain a number of ‘corridors.’
  - Siting Zone – an area of land within which multiple siting areas (described below) could be located.
  - Siting Area – an area of land within a study area, within which a new substation or SEC could be sited.
  - Emerging Preferred Corridor – a broad area within which the overhead line and/or underground cable infrastructure for the Project may be located, based on the findings of Stage 2.
  - Emerging Preferred Siting Zone – a broad area within which the Emerging Preferred Siting Area may be located, based on the findings of Stage 2.
  - Emerging Preferred Siting Area – a broad area within which the substation infrastructure for the Project may be located, based on the findings of Stage 2.
  - Graduated Swathe – shaded areas within the emerging preferred corridor, siting zones and siting areas within which Project infrastructure is considered more or less

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<sup>25</sup> The Strategic Proposal is defined by the Strategic Options Report, summarised in Section 1.1.

likely to be located, shown by the varying levels of shading. Darker shaded areas represent where infrastructure is likely to be better located, in NGET’s emerging view at this stage, within the corridor, siting zone and siting areas.

- Non-statutory consultation – an engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the emerging preferred corridor, siting zone and siting areas, and the graduated swathe. The feedback received will inform the further development of the Project.

Figure 4-1 – CPRSS Methodology



## 4.2 Step 1: Define the Study Areas

- 4.2.1 The study areas are the broad areas within which transmission infrastructure required for the Project will be located. The study areas are also the areas within which detailed environmental and socio-economic data will be gathered to inform Stage 2.
- 4.2.2 Given the large geographical extent of the Project, distinct, but interrelated study areas have been defined for the new Grimsby West substation, the two new LCS, the new Weston Marsh substation, the new Walpole substation and the 400 kV double-circuit transmission connection between these connection points.
- 4.2.3 The study areas that have been developed are informed by:
- The connection points (start / end points) and strategic zones identified by the Strategic Proposal Stage (Stage 1);
  - The distribution of areas of the highest amenity value or environmental features (for example internationally designated sites);
  - The nature of the physical and human geography. The presence of major geographical features such as estuaries or hills, or major settlements that may represent a natural boundary to a study area or dictate a need for a study area to extend to support routes around such features;
  - Consideration of the likely balance of environmental impact between direct and indirect transmission routes; and
  - Consideration of the Holford Rules (for routing of an overhead line) and Horlock Rules (for siting of a substation, overhead line entries and SECs).
- 4.2.4 Based on these factors, the study areas developed should encompass the maximum extent within which a Project design which satisfies the statutory duties and obligations of NGET and meets the Project objectives (as detailed in the SOR for the Project) is likely to be located.
- 4.2.5 An indicative study area was defined as part of the Strategic Proposal Stage (Stage 1) undertaken in 2023. The indicative study area informed the study areas developed at this stage (Stage 2).
- 4.2.6 The study areas developed must encompass the area within which corridors and siting zones may be identified but exclude areas where these are unlikely to be feasible. They are defined in part by Holford Rule 1 and allow for the application of the principles of the Holford and Horlock Rules as described in **Chapter 3**. The study areas, described in **Chapter 5**, therefore encompass an area within which the identification and assessment of corridors and siting zones could be completed.
- 4.2.7 The study areas and factors that have influenced their definition are described in **Chapter 5**.

## 4.3 Step 2: Scope Environmental Topics and Baseline Data-gathering

### Scoping of Environmental Topics

- 4.3.1 National Grid's Approach to the appraisal of design options considers the following topics and sub-topics:
- **Environmental:** Landscape and Visual Amenity; Ecology; Historic Environment; Air Quality; Noise and Vibration; Soils and Geology; Water; Greenhouse Gas Emissions;
  - **Socio-economic:** Economic Activity; Traffic and Transport; Aviation and Defence;
  - **Technical:** Technical Complexity; Construction / Delivery issues; Technology issues (which includes sustainability issues); Capacity issues; Network efficiency / benefits (which includes energy efficiency); and
  - **Cost:** Capital cost; Lifetime cost; and Constraint costs (where applicable).
- 4.3.2 The environment and socio-economic topics are aligned with applicable requirements of Section 5 of EN-1 and Section 2 of EN-5.
- 4.3.3 NGET acknowledges that sub-topics (and potentially whole topics), may be scoped-out if it is likely that there would be no material impact because of the nature of the Project, or it will not be a differentiating factor between any of the options identified.
- 4.3.4 To identify the data-gathering required to contribute to the effective evaluation of options, and ultimately help inform decision-making, a review of the environmental topics and their constituent sub-topics was undertaken. The review considered the presence of features for a particular topic or sub-topic within the study areas, and whether the Project could have a material impact on the features. If there were either no features, or no risk of a material impact, the topic or sub-topic was scoped-out of the appraisal process. This ensured that the CPRSS and appraisal process only addressed those sub-topics that are potentially material to the decision-making process.
- 4.3.5 It should be noted that scoping out a sub-topic simply reflected the fact that either: (i) there are no features for that sub-topic in the vicinity of a study area or option that could be affected; or (ii) the different options could not be distinguished based on that sub-topic. It does not mean that the topic or sub-topic is not important, nor does it mean that it would necessarily be scoped out during subsequent stages.
- 4.3.6 At this early development stage of the Project coastal change, odour, artificial light, smoke, steam, insect infestation and waste management impacts were scoped out on the basis that with the other topics applied, these topics would not be differentiating factors in the identification and selection of corridors and siting zones. Furthermore, NGET designs all its infrastructure to be compliant with current regulations and guidance on electromagnetic fields and therefore this was scoped out.
- 4.3.7 The environmental and socio-economic topics scoped into the appraisal of this Project at Stage 2 include air quality and emissions, dust, landscape and visual amenity, ecology, historic environment, noise and vibration, soils and geology, water, economic activity, traffic and transport, and aviation and defence.
- 4.3.8 At this stage of the Project, air quality and emissions and noise and vibration are accounted for by considering proximity to settlements, residential and other sensitive



features. Climate change with regards to flood risk is accounted for within the water topic. Waste management, electric and magnetic fields and climate change related to transmission losses are not considered material to the decision-making process at this stage and will be considered as the Project development progresses into the Defined Proposal and Statutory Consultation Stage (Stage 3).

## Data Gathering

- 4.3.9 To identify connection options which best satisfy NGET's statutory duties and obligations and meet the need case for the Project, it is necessary to understand the presence, and distribution of, environmental, socio-economic, and technical constraints and opportunities within the study areas. As part of this process, geographical information system (GIS)<sup>26</sup> web mapping was developed comprising available environmental, socio-economic, and technical data within the study areas.
- 4.3.10 Data for each topic was gathered through a desk-based review of information on potentially international, national, regional and locally important features. This data was collated to inform the scoping and the comparative environmental, socio-economic and technical appraisal of options. This included the following:
- Identification of designated sites and other features from British Geological Survey, Civil Aviation Authority, Environment Agency, Forestry Commission, Joint Nature Conservation Committee, Marine Management Organisation, Ministry of Defence (MoD), Department for Levelling Up, Housing and Communities, Natural England, Office for National Statistics, Ordnance Survey (OS), Sustrans, The Royal Society for the Protection of Birds (RSPB) and relevant local authorities;
  - Identification of archaeological designations and other recorded sites, using GIS datasets available from Historic England;
  - Review of the Local Development Plans for Lincolnshire County Council, Cambridgeshire County Council, Norfolk County Council, North-east Lincolnshire Council, East Lindsey District Council, Boston Borough Council, South Holland District Council, Fenland District Council and King's Lynn and West Norfolk District Council to identify further environmental features and opportunities, such as county and regional level designation or other locations important to the public;
  - Review of Landscape Character Assessments of relevance to the study areas;
  - Review of OS mapping (1:50,000 mapping and terrain data) and aerial photography (where available) to identify other potential features such as settlements, properties, walking routes, cycling routes etc;
  - Extrapolation of OS OpenData to identify further environmental features including locations of watercourses and waterbodies; and
  - Review of other local information through online and published media such as tourism sites and walking routes.

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<sup>26</sup> GIS is a system that enables the creation, management, analysis and mapping of all types of data.

## 4.4 Step 3: Ascribe a weight to, confirm and ‘Heat Map’ features

- 4.4.1 To allow for the identification of corridors and siting zones, the various elements within the scoped-in sub-topics which may constrain routing and siting were mapped.
- 4.4.2 Once mapped the data sets were assigned a classification or “sensitivity weighting” based on their sensitivity to the technology likely to be required for the Project. This classification was determined using professional judgement, whilst having regard to relevant environmental legislation, policy and best practice. A six-point scale was used to determine the “sensitivity weighting,” as shown in **Table 4-1**.

Table 4-1 – Description Associated with Sensitivity Weighting

Classification Value	Classification Value Description
0	Areas with no identified constraint.
1	Very low potential to constrain the Project.
2	Low potential to constrain the Project.
3	Intermediate potential to constrain the Project.
4	High potential to constrain the Project.
5	Very High potential for the Project to be constrained.

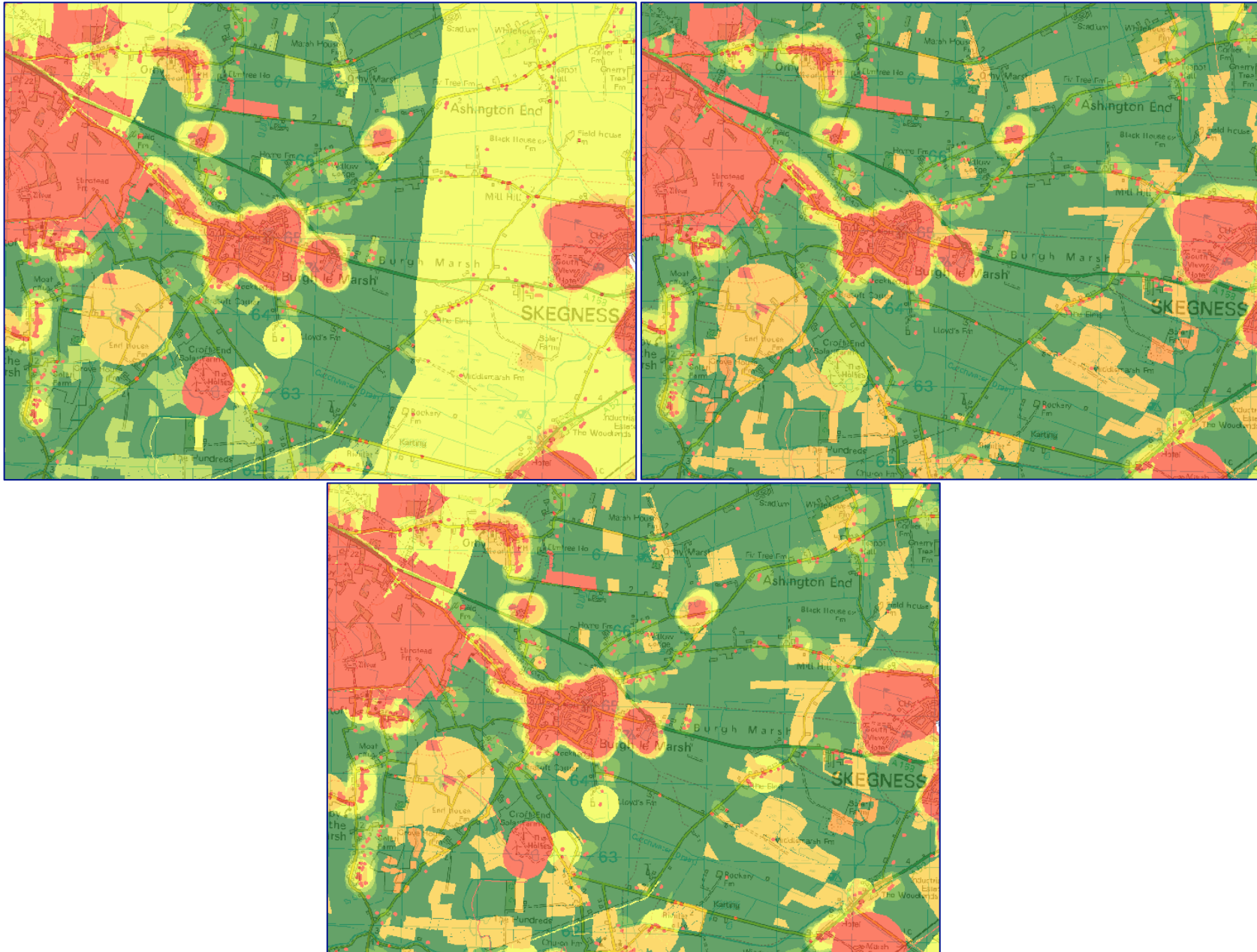
- 4.4.3 The weighting of the different features varies between the potential technologies of the Project (overhead lines, underground cables and substations). For example, areas containing Priority Habitats and areas of Traditional Orchard Habitats are weighted intermediate for underground cables due to the increased risk to terrestrial species and orchard habitats that would be caused by the cable excavation works (which is also noted in Paragraph 2.9.25 of EN-5) but very low or low for overhead lines as excavation works would be limited to the area required for the pylons.
- 4.4.4 The sensitivity weighting effectively formed a robust scoping exercise to ensure a focus on features that materially inform decision making. This gave the highest weight to features of national or international value, whilst not excluding features of more local importance in accordance with the Holford and Horlock Rules.
- 4.4.5 Sensitivity weightings associated with these features were reviewed and confirmed between NGET and the Front-end engineering design (FEED) Contractor and were then combined to produce separate composite ‘heat maps’<sup>27</sup>, showing the highest ‘weight’ for each cell<sup>28</sup> of the map. Examples of the heat maps produced for overhead line,

<sup>27</sup> A heat map is a graphical representation of data where values are depicted by colour. In the context of the Project the data is the environmental features which are weighted and the colour will be determined by the sensitivity weighting allocated to each feature.

<sup>28</sup> The map was divided into 10 m-by-10 m square cells based on the OS National Grid.

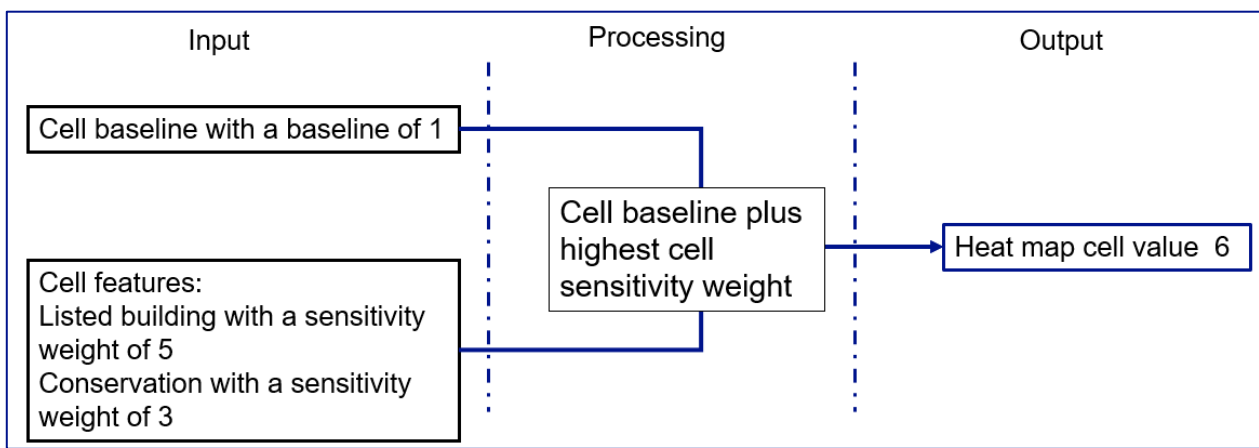
underground cable and substation are shown in **Figure 4-2**. These composite heat maps reflect the relative importance of different features and help to visualise the constraints to developing infrastructure for the Project and, when combined with professional judgement, informed the identification of corridors and siting zones, as described in **Chapter 5**.

Figure 4-2 – Example Sections of Heat Mapping for the Overhead Line (left), Underground Cable (right) and Substation (below)



- 4.4.6 For composite heat maps, and to enable further GIS analysis of the information within the heat maps, the study areas were broken down into 10 m square ‘cells’ based on the OS grid. Within each of these cells the sensitivity weighting of a feature is added to a ‘baseline’ score of one<sup>29</sup>. The heat map therefore shows numerical weightings of one to six.
- 4.4.7 To avoid the risk of double-counting, the composite heat map shows the highest individual ‘weight’ identified in each cell, not the combined total of different weights identified. For example, if a cell has a baseline of one, contains a listed building with a weight of five and is located within a conservation area with a weight of three, then the cell would have a weight of six (baseline of one, plus listed building, five). This process is shown in **Figure 4-3**.

Figure 4-3 – Example of how sensitivity weighting is incorporated into heat mapping



- 4.4.8 The sensitivity weighting enabled the exercise to focus on features that materially inform decision making. This gave the highest weight to features of national or international value, whilst not excluding features of more local value. Features of the highest weight primarily informed the development of corridors and siting zones whilst the lower weighted features (small areas of high weight) informed the development of the corridors and siting zones, once the larger areas of higher weight had been avoided where practicable.
- 4.4.9 The sensitivity weightings were reviewed prior to the development of indicative corridors and siting zones, particularly to allow the refinement of buffer zones and to test the weighting assumptions. An example of this is for the setting of heritage assets. For the development of a preliminary corridor, siting zone, or where applicable, siting area, an appropriate buffer all-round the asset was weighted. However, prior to the development of the corridors and siting zones, the assets within a corridor and siting zones were preliminarily reviewed to identify any ‘directionality’ in the setting. For example, a listed building with a designed outlook would have a more extensive setting along the line of that outlook than in other directions. This review would be backchecked and verified by site visits as the Project progresses.
- 4.4.10 The heat maps reflected the relative importance of different features and helped to visualise the constraints to developing infrastructure for the Project and informed the identification of corridors, as described in **Chapter 5**.

<sup>29</sup> The entire study area starts with an even ‘weight’ of one, so that the lowest cost across a ‘level playing field’ is a straight line - the shortest line.

## 4.5 Step 4 – Identifying and Defining Corridors, Siting Zones and Siting Areas

- 4.5.1 At this stage of the Project, identification of preliminary routeing and siting options involves little detailed engineering design. It is led by landscape and environmental specialists who have due regard to the environmental and socio-economic considerations alongside the required technical parameters. The aim of identifying early corridors, siting zones and siting areas is balancing high-level mitigation with engineering requirements; routeing and siting to avoid designated sites and other large-scale features, to minimise impacts upon the environment and local population as far as practicable, whilst ensuring options identified meet the Project engineering requirements. In this respect, and as noted in EN-5 (Paragraph 2.2.7) *“the connection between the initiating and terminating points will often not be via the most direct route”*. Instead, as outlined above, siting constraints such as engineering, environmental or community considerations are important in determining a feasible route and / or site.

### Identifying and Defining Siting Zones and Siting Areas

- 4.5.2 A siting area is an area which has the capacity to accommodate the siting of a single substation. A siting zone is an area which has the capacity to accommodate multiple siting areas.
- 4.5.3 The identification of the siting zones and siting areas was led by the environmental specialists from the Project team. Identification takes into consideration the key drivers for each substation (as set out below), the technical parameters (detailed in **Chapter 2**) and the relevant environmental and technical constraints identified from Step 1.
- 4.5.4 In siting substations (and where applicable SECs) areas that benefit from the below factors were identified:
- Appropriate topography;
  - The availability of existing screening elements and the potential to introduce additional screening elements;
  - Proximity to major roads, to minimise the extent of required new access roads; and
  - Outside of flood zones of a medium risk (Flood Zone 2) and high risk (Flood Zone 3), in line with the policy tests (sequential and exception tests) as set out in Section 5 of NPS EN-1.
- 4.5.5 Key drivers for the location of a new Grimsby West substation, two new LCS, new Weston Marsh substation and new Walpole substation include:

#### Grimsby West substation

- Seek to minimise the length of connections between the new substation and the existing 400 kV overhead line between Grimsby and Keelby, for reasons of operational efficiency and to minimise environmental impacts (by reducing the geographical extent of effects) and costs.
- Seek to minimise the length and technical complexity of connections between the new substation and the existing NPG 132 kV substation, for reasons of operational efficiency and to minimise environmental impacts (by reducing the geographical extent of effects) and costs.

- Seek to utilise land owned by NGET, to minimise the extent of development which would be required on third-party land, and therefore socio-economic impacts and costs.

### **Two Lincolnshire Connection substations**

- Seek to identify locations which provide the potential for infrastructure (required to facilitate a connection to the two new LCS and into the electricity transmission network) for contracted and planned projects, to be in reasonable proximity to the two new LCS as part of a co-ordinated approach to transmissions applications outlined in NPS EN-1. The connection of these projects to the two new LCS is a key project driver.
- Balance the distance from the coast (to minimise the length of connections from potential landfall locations for contracted and planned projects) against the potential need for considerable overhead line deviations.
- Consider the pattern of development and / or environmental features between the two new LCS and the coast to avoid locating where these may significantly constrain connections by contracted and planned projects.

### **Weston Marsh substation**

- The existing 400 kV 2WS overhead line currently has lower capacity conductors compared to the remainder of the circuits between Bicker Fen and Walpole. This is currently limiting the amount of power which can safely flow on the 400 kV 4ZM overhead line. By turning in both the 400 kV 4ZM and 2WS overhead line routes into a new Weston Marsh substation this issue is resolved, as north-south power flows between the Bicker Fen substation and Walpole substation can bypass the 400 kV 2WS overhead line via the new Weston Marsh substation. Seeking to locate close to the Spalding Tee-Point will minimise the extent of required diversions to the existing overhead lines to facilitate the turn-in of the circuits to the new Weston Marsh substation.
- Seek to identify locations which provide the potential for infrastructure (required to facilitate a connection to the new Weston Marsh substation and into the electricity transmission network) for contracted projects to be in reasonable proximity to the new Weston Marsh substation. The connection of these projects to the new Weston Marsh substation is a key driver for the substation.
- Seek to have two separate circuits heading south from the Spalding Tee-Point to the existing Walpole substation and a new Walpole substation to improve overall resilience of the energy network.
- Seek to locate close to the Spalding Tee-Point to minimise the length of circuit reconfiguration of the existing 400 kV 4ZM overhead line between Sleaford and the Walpole substation, and the 400 kV overhead lines into the new substation, for reasons of operational efficiency and resilience and to minimise environmental impacts (by reducing the geographical extent of effects) and costs.

### **New Walpole substation**

- Seek to identify locations south of the B9 boundary to provide the required reinforcement of the electricity transmission system to provide additional north-south power flows per the SOR Addendum.

- Seek to identify locations which provide the potential for EGL 3 and EGL 4 infrastructure (required to facilitate a connection to the new Walpole substation and into the electricity transmission network) to be in reasonable proximity to the new Walpole substation as part of a co-ordinated approach to transmission applications outlined in NPS EN-1. The connection of these future projects to the new Walpole substation is one of the key drivers for the substation.
- Seek to locate close to the existing 400 kV 4ZM overhead line between Burwell and the existing Walpole substation to minimise the length of circuit reconfiguration and 400 kV overhead lines into the new substation for reasons of operational efficiency and to minimise environmental impacts (by reducing the geographical extent of effects) and costs.

4.5.6 Where the identified area for siting zones results in the identification of one zone, then preliminary siting areas are identified. Identification of the siting zones and siting areas was informed by the Horlock Rules and Holford Rules to take account of the combined effects of both the substation/s (and SEC where applicable) and the overhead line connections. The following guiding principles informed identification:

- Using or adapting existing infrastructure will generally be of benefit/advantage compared with creating new infrastructure.
- Using available brownfield land<sup>30</sup> will generally be of benefit/advantage compared with utilising greenfield land<sup>31</sup>.
- Shorter routes (for overhead line or underground connections) will generally be of benefit/advantage compared with longer routes, as smaller scale infrastructure projects are generally likely to have lower environmental, safety, sustainability, and cost implications (for comparable technology options).
- Financially less-expensive options, both in terms of capital and lifetime cost, will generally be of benefit/advantage, as these support NGET's statutory duty under Section 9 of the Electricity Act 1989 to develop and maintain an '*efficient, co-ordinated and economical*' transmission network.
- Options which avoid or minimise and mitigate impacts on environmental or socio-economic features will generally be of benefit/advantage compared with those which have likely significant residual effects, as less environmentally damaging or socially disruptive sites support NGET's statutory duty under Schedule 9 of the Electricity Act 1989 to '*have regard to the desirability of preserving amenity*', and will more readily achieve consent.

4.5.7 The identification of siting zones and siting areas was then used to inform the identification of corridors for overhead lines and, where required, underground cables, as set out below.

## Identifying and Defining Corridors

4.5.8 The heat maps produced in Step 3 were used to undertake a GIS 'corridor analysis'. This is a GIS tool that takes the weight applied to each cell as the 'cost' of crossing it and calculates the total cost of every possible path between the start and end points.

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<sup>30</sup> Land that is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure.

<sup>31</sup> Land, usually farmland, that has not previously been developed.



From this it is possible to identify potential corridors that minimise the environmental 'cost,' where the environmental 'cost' is determined by the combination of distance and the sensitivity weighting applied by the heat map.

- 4.5.9 The GIS tool helps identify potential corridors with the likely least potential for adverse impacts on those aspects of the environment that can be mapped, by finding routes across the heat map surface to connect the start and end points of the Project which have the least environmental 'cost' – the least interaction with environmental features. The analysis is run separately for overhead lines and underground cables, identifying potential corridors for each. This approach ensures that potential corridors prioritise key issues, including mapped technical constraints, whilst retaining all data to be considered so that further analysis can be undertaken to address areas identified as particularly constrained ('pinch points') and later for developing the graduated swathe.
- 4.5.10 The corridors generated through the GIS corridor analysis provided a starting point for the Project team landscape and environmental specialists, working with the wider Project team as appropriate, and employing professional judgement and their understanding of routing considerations, to identify technically feasible preliminary corridors. Corridors that were identified respond to the geographical features that have been identified, in some places this will result in a narrow corridor being available, whereas in areas with fewer features, the width could be considerably wider. This has resulted in a variety of widths for the preliminary corridors ranging between 120 m and 4 km. Corridors included aspects which cannot be mapped but are no less important considerations to the routing of a transmission connection. For the overhead line options this included for example, avoiding the use of too many angle pylons (Holford Rule 3), finding the best 'landscape fit' i.e., how an overhead line would sit in the landscape (Holford Rules 4 and 5) and how it would affect visual amenity (Holford Rule 6).
- 4.5.11 The options identified were then subject to review by the FEED Contractor and the Project team who used their professional judgement to recommend amendments (i.e., to park, refine or expand) to the corridors. For example, where possible, corridors were refined to avoid (or include areas where an alignment could avoid) flood zones of a medium risk (Flood Zone 2) and high risk (Flood Zone 3), in line with the policy tests (sequential and exception tests) as set out in NPS EN-1. These recommendations were reviewed and implemented by the landscape and environmental specialists to ensure that changes were made in a manner consistent with landscape and environmental considerations.
- 4.5.12 As part of this exercise, the distribution and density of constraints (environmental, technical and socio-economic) was examined to identify areas where it might be particularly challenging to identify a technically feasible and / or environmentally acceptable overhead line connection (subject to further analysis). The starting assumption (in accordance with national planning policy (NPS EN-5, as detailed in Paragraph 2.9.20)) is that new transmission connections comprise overhead lines, except in nationally designated landscapes. Where such areas were identified, underground cable corridors<sup>32</sup> were developed following the same process as the overhead line corridors (i.e., use of GIS analysis, employing professional judgement and Project team review).

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<sup>32</sup> Chapter 2 described underground cable technologies, and the associated SECs.

- 4.5.13 To enable a clear comparative analysis and understanding of the early corridors, the complex network of corridors were divided into ‘sections,’ with a series of connection links. This exercise was undertaken so that an emerging preference can be identified using a series of sections of one corridor then via a connection link to a series of sections of another, to bypass an area of greater constraint and create an ‘end-to-end’ solution taking account of the siting of substations. The corridors and links are described in **Chapters 6, 7 and 8.**
- 4.5.14 The outcome of Step 4 is a set of corridors, links, siting zones and siting areas to be subject to further analysis and informed by field observations at Steps 5 and 6. This approach allowed for the continued appraisal of multiple and interrelated options.

## **4.6 Step 5 – Confirm Corridors, Siting Zones and Siting Areas for Appraisal**

- 4.6.1 The corridors, links, siting zones and siting areas were then further reviewed by NGET and the FEED Contractor to confirm the technical feasibility and ensure that key issues, and the interaction of constraints, had been fully considered.
- 4.6.2 At this point the corridors, links, siting zones and siting areas were also reviewed to ensure that all had the potential to form ‘end-to-end’ solutions.
- 4.6.3 Prior to progressing to Step 6, the corridors, links, siting zones and siting areas were confirmed by the Project team.

## **4.7 Step 6 – Site Visits and Refinement of Corridors, Siting Zones and Siting Areas**

- 4.7.1 Following the identification of the corridors, links, siting zones and siting areas (Steps 4 and 5), site visits were undertaken by landscape, heritage and ecology specialists, the FEED Contractor and NGET. The purpose of these visits was to ground truth the key landscape, environment, community and technical features, to allow closer consideration of particularly constrained areas during the desk studies and to identify further construction and design hazards that might mean corridors, links, siting zones or siting areas would not be feasible.
- 4.7.2 Once the site visits were complete, a further review was undertaken of the corridors, links, siting zones and siting areas by the Project team to identify any options which are less preferred, new options identified or amendments to existing options where applicable. Where agreed, these changes were incorporated into the evolving routeing and siting process before progressing to Options Appraisal (Step 7).

## **4.8 Step 7 – Options Appraisal of Corridors, Siting Zones or Siting Areas**

- 4.8.1 In Step 7, the corridors, links, siting zones and siting areas agreed at Step 6 are subject to Options Appraisal in accordance with National Grid’s Approach to Consenting. National Grid’s guidance provides a thorough and consistent framework to inform the appraisal of project options and decision making. Its aim is to ensure that decisions regarding the location or technology of a given project are based on a full understanding of the technical, socio-economic, environmental, and cost implications of identified

options. It also enables NGET to document in a transparent manner the information on which judgements have been based.

- 4.8.2 National Grid's Approach to Consenting notes that the analysis at the Options Identification and Selection Stage (Stage 2) is largely desk based. However, as described in Step 6, the Options Appraisal for this Project has also been informed by observations from site visits undertaken by the Project team. These observations have provided additional information to inform the Options Appraisal, which, in conjunction with that drawn from the desk-based studies, has provided an evidence-base appropriate to inform this stage of the Project. As the Project progresses to subsequent stages of more detailed design and assessment, additional surveys and analysis will add further information to the evidence base, which will be used to back-check the findings of this study.
- 4.8.3 The overall objective throughout the Options Appraisal was to take full consideration of all known environmental factors to minimise the risk of significant adverse impacts on the environment and communities whilst also considering engineering and economic considerations.
- 4.8.4 For each of the relevant environmental and socio-economic sub-topics (outlined in Step 2) the appraisal considers the potential impacts on relevant features, and whether such impacts could be avoided or mitigated through careful routeing or siting. Where impacts cannot be avoided or mitigated by careful routeing, other forms of mitigation were considered in accordance with NGET's mitigation hierarchy, including:
- Different lattice pylon design / conductor configuration;
  - Alternative pylon design (such as low height pylons);
  - Reduction of wirescape through distribution network rationalisation;
  - Reduction of wirescape through transmission network rationalisation; and
  - Alternative transmission technology (such as undergrounding).
- 4.8.5 Once such mitigation measures were considered, a judgement was made as to the potential for residual impacts. The residual impacts considered in the Options Appraisal do not take account of further Project-specific environmental, socio-economic or technical mitigation measures which are likely to be included as part of the Environmental Impact Assessment (EIA) process undertaken at the Defined Proposal and Statutory Consultation Stage (Stage 3). The findings of the Options Appraisal for the relevant sub-topics are detailed within **Chapters 6 to 10**.
- 4.8.6 The Options Appraisals also took cognisance of the requirements of the Environment Act (2021) regarding biodiversity net gain (BNG) and climate resilience and greenhouse gas emissions. The Environment Act introduces new environmental targets across waste and resource efficiency, air quality, water, nature, and biodiversity. Although not yet in force, the most notable of these is the mandatory 10% BNG requirement for developments, including in respect of nationally significant infrastructure projects. The Options Appraisal noted where land may be available and / or may be suitable to support BNG requirements (subject to collaboration with landowners and Local Nature Partnerships). The consideration of BNG in detail will form part of the later stages of the Project.
- 4.8.7 The Project itself (classed as CNP, as specified in Paragraph 3.4.4) is designed to enable renewable energy generation thus contributing to combating climate change. At

the subsequent stages, the Project will need to assess climate change both in terms of greenhouse gas emissions and climate resilience and adaptation (in line with NPS EN-1). However, both components of climate change have been inherently considered at a high-level in the Options Appraisals i.e., consideration of presence of peaty soils, Flood Zones and overhead line / underground cable lengths. With regards to Flood Zones specifically, the Options Appraisal took cognisance of the policy tests (sequential and exception tests) as described within NPS EN-1, thus where possible supporting a preference for options that fall within areas of lower flood risk. At this stage of the Project a high-level carbon cost exercise was undertaken across options and further information on this is provided in **Chapter 10**.

4.8.8 The process of comparison and selection of options is described under Step 8.

## **4.9 Step 8 – Confirm Emerging Preferred Siting Zone, Siting Areas and Corridor and Develop Graduated Swathe for Consultation**

4.9.1 Following completion of Step 7, a ‘challenge and review’ workshop was held and attended by NGET, the FEED Contractor and the landscape and environmental specialists. The purpose of the workshop was to review environmental preferences and, in accordance with EN-1 and EN-5, balance these against technical and cost inputs to reach a conclusion on the emerging preferred corridor, siting zones and siting areas that provides the optimum balance of efficiency and economy, whilst having appropriate regard to environmental and socio-economic impacts.

4.9.2 Further to this workshop, the emerging preferred corridor, siting zone and siting areas were identified, and a graduated swathe developed (within those corridors, siting zones and siting areas emerging as preferred) for non-statutory consultation.

4.9.3 The landscape team and FEED Contractor then sought to identify areas within the emerging preferred corridor, siting zones and siting areas where the infrastructure for the Project might be best located based on the work undertaken to date. Identified preliminary areas were then sifted taking into consideration the initial heat mapping, the requirements of sequential and exception tests (as described within NPS EN-1), and Holford and Horlock Rules. Particular regard was given to Holford Rules 1, 2 and 3 to avoid areas of amenity value and while taking this into consideration selecting a direct route and Horlock Rules 2, 3, 4, 5 and 6 to avoid areas of amenity value and minimise noise, visual and land use impacts. A workshop attended by the Project Team was then undertaken to discuss the outputs of the routing and siting and to review the technical requirements for creating a graduated swathe. The outcome of this workshop is graphically represented in the form of a graduated swathe.

## **4.10 Step 9 - Undertake Non-Statutory Consultation**

4.10.1 The final step in the CPRSS was to prepare a report to record the entire process for the purpose of non-statutory consultation. The CPRSS process and outcomes are captured in this Report. This Report is intended to support public consultation to engage stakeholders, statutory consultees and interested parties, including the public.

# **5. Study Area, Corridor and Siting zone Definition**

# 5. Study Area, Corridor, Siting Zone and Siting Area Definition

## 5.1 Introduction

5.1.1 **Figure 1-1** shows the location of the Project, which is in the Humber, East Midlands, East of England and East Anglia regions. This chapter presents the details of defining the study areas for the Project (Step 1 as shown in **Section 5.2**), the baseline data gathered for the study areas (Step 2 as shown in **Section 5.4**), production of the heat mapping (Step 3 as shown in **Section 5.5**), identifying and defining the corridors, links, siting zones and siting areas (Steps 4 to 6 as shown in **Section 5.6**).

## 5.2 Defining the Study Areas (Step 1)

- 5.2.1 The following sections provide an overview of each of the five distinct but interrelated and overlapping study areas<sup>33</sup> for the Project as shown in **Figure 5-1**.
- 5.2.2 The approach to developing the study area for the Project was based on balancing NGET's duty to develop an efficient, co-ordinated and economical system of transmission (Section 9 of the Electricity Act 1989), NGET's environmental duties under Section 38 and Schedule 9 of the Electricity Act 1989, Holford Rule 1 (which is to *"avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the first line in the first place, even if the total mileage is somewhat increased in consequence"*) and Horlock Rule 2 (which is to *"as far as reasonably practicable seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the system connections"*).
- 5.2.3 The indicative study areas defined as part of the Strategic Proposal Stage, as described in **Chapter 1** were used alongside the connection points as a starting point for the definition of the study areas for the Project. These indicative study areas included those for a:
- 400 kV double circuit overhead line connection between a new Grimsby West substation, to the west of Grimsby, and the LCS, to the south-west of Mablethorpe. This indicative study area extended from the existing Grimsby West substation in the north to the Lincolnshire coast south of Wainfleet All Saints.
  - 400 kV double circuit overhead line connection between the LCS and a new Walpole substation, in the vicinity of the existing Walpole substation, via a new substation at Weston Marsh. This indicative study area extended from South Cockerington in the north to Wisbech in the south.
- 5.2.4 A broad strategic zone was identified between the Lincolnshire Wolds AONB ('the AONB') and the Lincolnshire Coast to accommodate the LCS. This is to facilitate future

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<sup>33</sup> An area within which a range of potential corridor options, substation siting zones or areas for the new infrastructure will be considered.

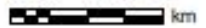
connection of projects, including planned offshore wind proposals and interconnectors to the electricity transmission system as part of a co-ordinated approach to transmission. The zone identification took account of the overlap of the Strategic Proposal Stage's indicative study areas (as described in **Paragraph 5.2.3** above). The broad strategic zone therefore covered the area (north to south) between South Cockerington in the north, to the Lincolnshire coast south of Wainfleet All Saints. It extends inland to the edge of the AONB to the coast, covering a large area of the Lincolnshire Coast.

- 5.2.5 Given the large geographical extent of the Project, distinct but interrelated study areas have been defined since the SOR and SOR Addendum for each component of the Project (new 400 kV overhead line connection, new Grimsby West substation, LCS-A & LCS-B, new Weston Marsh substation, and new Walpole substation), as shown in **Figure 5-1** and are described below. The study areas were defined to be sufficient to encompass the initial design (as outlined in **Chapter 2**) for the Project, whilst satisfying NGET's statutory duties and obligations, meeting the Project objectives and not extending to include areas unlikely to yield such a design which could not be consented. The development of the five study areas is explained below.

Figure 5-1 – Study Areas



Figure 5-1 – Study Areas  
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0 2.5 5 7.5 10  
SCALE: 1:500,000  km



## Overhead line

- 5.2.6 The study area for the overhead line was defined through a five-phase process which is outlined below and shown in **Figure 5-2**
- 5.2.7 The approach to defining the study area for the overhead line was based on balancing NGET's duty to develop an efficient, co-ordinated and economical system of transmission (Section 9, Electricity Act 1989), NGET's environmental duties under Section 38 and Schedule 9 of the Electricity Act 1989 and Holford Rule 1 which is to *"avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the first line in the first place, even if the total mileage is somewhat increased in consequence"*.

### Phase I: Connection Points

- 5.2.8 The first phase involved joining four connection points<sup>34</sup> (the proposed substations), comprising Grimsby West substation in the north and Walpole substation in the south via Weston Marsh substation and the LCS in the centre, in the most economic manner: a straight line between the connection points. The connection points used were the centre points of each substation study area (the process of defining the study areas for each substation is described below from **paragraph 5.2.27**). All other things being equal, a straight line would be the shortest route and therefore represent both the least cost solution and the least amount of new development that would potentially give rise to environmental impacts.

### Phase II: High-level Constraints Review

- 5.2.9 A high-level desk-based review was then undertaken of the features representing major potential constraints between each of the connection points: the major areas of highest amenity value, main centres of population and major technical constraints. Major areas of highest amenity value included the AONB; Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar Site; Greater Wash SPA; Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC; Gibraltar Point SPA and Ramsar; The Wash SPA and Ramsar Site; The Wash and North Norfolk Coast SAC and the Inner Dowsing, Race Bank and North Ridge SAC. The main centres of population identified included Grimsby, Boston, Spalding, Skegness and Wisbech. No major technical constraints for the overhead line, at this scale, were identified.
- 5.2.10 The straight line was then amended to avoid the major areas of highest amenity value and main centres of population that had been identified. The following amendments were made at this stage:
- The straight line was deviated to avoid the AONB and to avoid the National site network (NSN) sites (SACs and SPAs) and Ramsar sites along the Lincolnshire coast;
  - The straight line was deviated to avoid the main centres of population of Grimsby, Skegness, Boston and Spalding.

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<sup>34</sup> For the purposes of this first phase the two LCS (LCS-A and LCS-B) are considered to represent one connection point.

### Phase III: Initial Search Area

- 5.2.11 A search area was then introduced around the line established following Phase II, to allow for the development of a reasonable range of early corridors. A search area totalling 20 km wide was considered sufficient to enable the development of early corridors that avoid the major constraints.

### Phase IV: Refinement of Search Area

- 5.2.12 This initial 20 km wide search area was then reviewed and refined to exclude the major areas of highest amenity value and the main centres of population identified in Phase II.
- 5.2.13 At this stage, the search area was refined to avoid the populated area of Grimsby; to avoid the AONB; to avoid the populated area of Skegness; to avoid the populated area of Spalding; and to avoid the NSN sites and Ramsar sites along the coast.

### Phase V: Expansion of Search Area

- 5.2.14 A high-level desk-based review of the unconstrained areas within the likely study area for the overhead line identified in Phase IV was then undertaken to identify areas where the likely study area could be expanded to avoid constraints and provide opportunities to reduce environmental impacts.
- 5.2.15 Two areas were identified for expansion. The first was an expansion to the area between Croft and Boston, as initial consideration of OS maps and the Department for Environment, Food & Rural Affairs (Defra) MAGIC GIS dataset showed the area to be relatively unconstrained, thus providing further options for potential corridors that avoid major areas of highest amenity and centres of population. The second expansion was to the area between Spalding and Wisbech, as initial consideration of OS maps and the Defra MAGIC GIS dataset showed the area to be relatively unconstrained, thus providing further options for potential corridors that avoid major areas of highest amenity and centres of population.
- 5.2.16 Whilst undertaking Phase V, and having regard to the pattern of settlements beyond the major built-up areas, two heavily constrained areas with limited space ('pinch-points'), see **Figure 5-3**, were identified:
- the extent of settlements and other features between the edge of Grimsby/Cleethorpes and the AONB; and
  - the scattered but relatively dense rural settlement pattern in the Fens along the Wash.
- 5.2.17 At the point of defining the study area for the overhead line (the 'Overhead Line Study Area'), it was acknowledged that it may not be possible to identify a technically feasible and / or consentable corridor for an overhead line through these pinch-points. Two "annex study areas" (see **Figure 5-3**) were therefore identified to provide further routing opportunities should an underground cable route be required. The inclusion of these annex study areas acknowledges that the lesser effect on the landscape of an underground cable route means that routing through the AONB would potentially be acceptable in planning policy terms.
- 5.2.18 One annex study area is located within the AONB between the villages of Ribby and Beesby, west of Grimsby in Lincolnshire. The other is located at the southern tip of the AONB between Alford and Toynton St Peter in Lincolnshire.

- 5.2.19 The northern annex study area, west of Grimsby, was introduced because it was recognised that the density of built-up areas and extent of existing infrastructure between the AONB and Grimsby was such that finding a technically feasible overhead line corridor might be challenging. The southern annex study area, at the southern tip of the AONB, was introduced to allow for the possibility of a shorter cable corridor should the need for an underground cable connection arise.
- 5.2.20 As these annex study areas are located within the AONB, a nationally designated landscape as identified in the existing NPS EN-5, the Project assumption was that any connections through these areas would be assumed to be underground cable.
- 5.2.21 A preliminary review by the FEED Contractor confirmed that finding a technically feasible and consentable overhead line corridor in the area between the AONB and Grimsby/Cleethorpes would be challenging, but that there were more opportunities between Alford and Wainfleet All Saints, despite the scattered but relatively dense rural settlement pattern.
- 5.2.22 Therefore, the northern annex study area was considered from the outset whilst it was agreed that the southern annex study area would only be considered should further investigation identify no technically feasible and / or consentable overhead line corridors. Due to the potential challenge in routeing in the area between the AONB and Grimsby/Cleethorpes it was therefore considered that an alternative underground cable corridor to the west of the Overhead Line Study Area (within the AONB) should be considered as a viable alternative.
- 5.2.23 The Overhead Line Study Area as presented in **Figure 5-3** begins to the west of Grimsby, which is the northern connection point for the Project, as shown by the red pin. The Overhead Line Study Area extends to Burgh Le Marsh, then west to Spalding and to Wisbech in the south, which is the southern connection point for the Project, and is shown by the blue pin.

Figure 5-2 – Process of Defining the Overhead Line Study Area

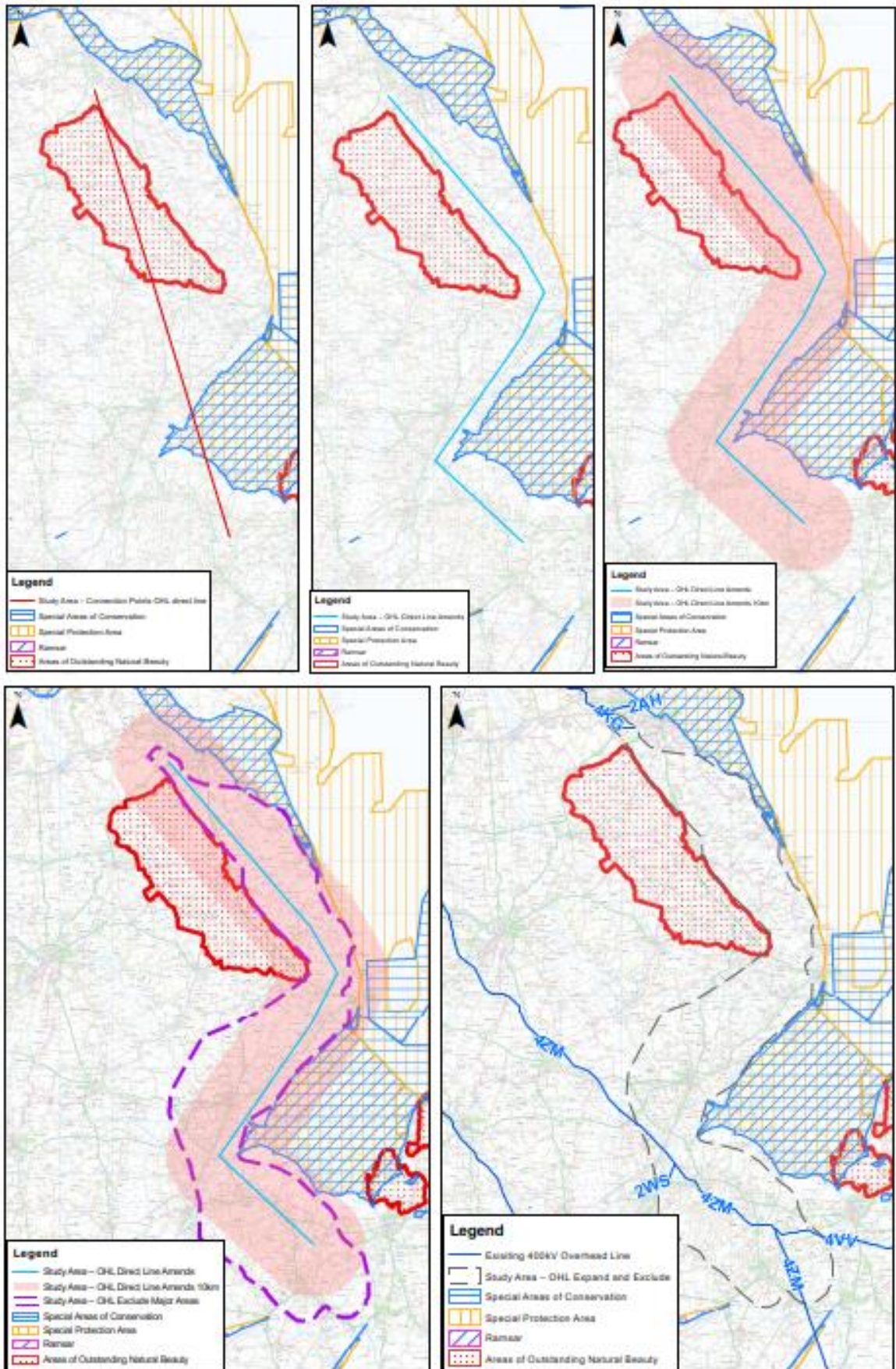


Figure 5-2 - Process of defining the study area

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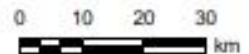


Figure 5-3 –The Overhead Line Study Area

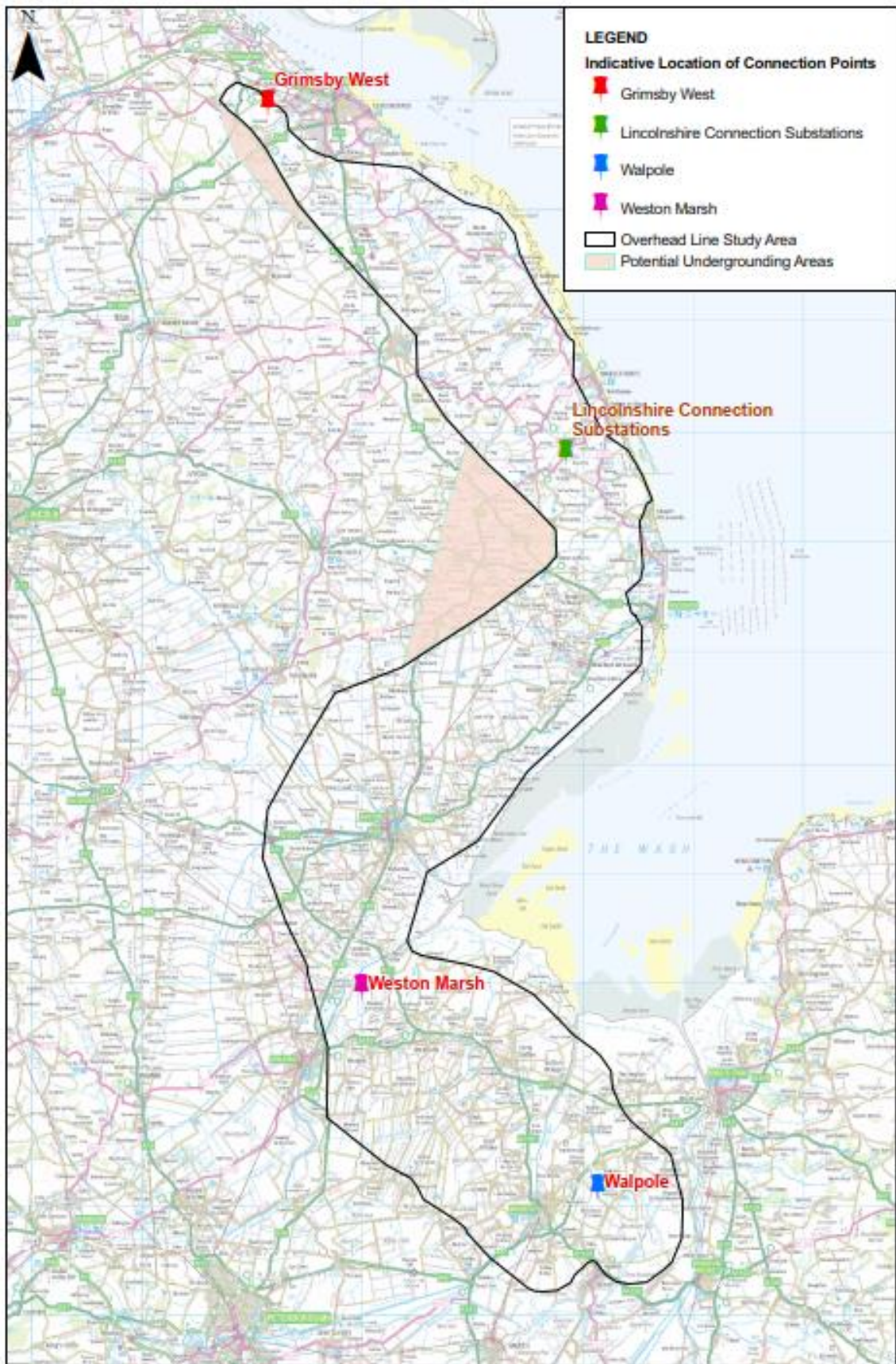


Figure 5-3 – The Overhead Line Study Area  
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SCALE:1:550,000 0 5 10 km

## Overhead Line Study Area - Existing 132 kV and 400 kV Overhead Line Infrastructure

5.2.24 The Overhead Line Study Area between Grimsby West and Burgh le Marsh extends from the west of Grimsby in the north to Burgh le Marsh in the south-east, running parallel to the Lincolnshire Coast. The northern boundary of the Overhead Line Study Area within this area is defined by the existing 400 kV 4KG overhead line, shown as the blue line in **Figure 5-4**, which routes west out of the existing Grimsby West substation, parallel to the top of the Overhead Line Study Area. Here, the eastern boundary is also defined by an existing NPG 132 kV overhead line which heads south out of the existing Grimsby West substation. This overhead line then cuts across the Overhead Line Study Area from Grimsby Road in the east to the A18 Barton Street in the west, forking in the middle to cross back to the eastern boundary to the north of Waltham.

Figure 5-4 – The Overhead Line Study Area – Existing 132 kV and 400 kV Overhead Line Infrastructure between Grimsby and Burgh le Marsh



5.2.25 Between Burgh le Marsh and Weston Marsh, the Overhead Line Study Area continues south-west, following the line of the Lincolnshire Coast. Here, an existing NGED 132 kV overhead line runs through the centre of the Overhead Line Study Area from Burgh le Marsh to Boston where it then forks. One branch of this heads west across the Overhead Line Study Area to the south of Heckington, and the other broadly defines the eastern boundary to Weston Marsh. As the Overhead Line Study Area approaches Weston Marsh, the western boundary is defined by the existing 400 kV 4ZM overhead line from Heckington down to Weston Marsh, shown in **Figure 5-5**.

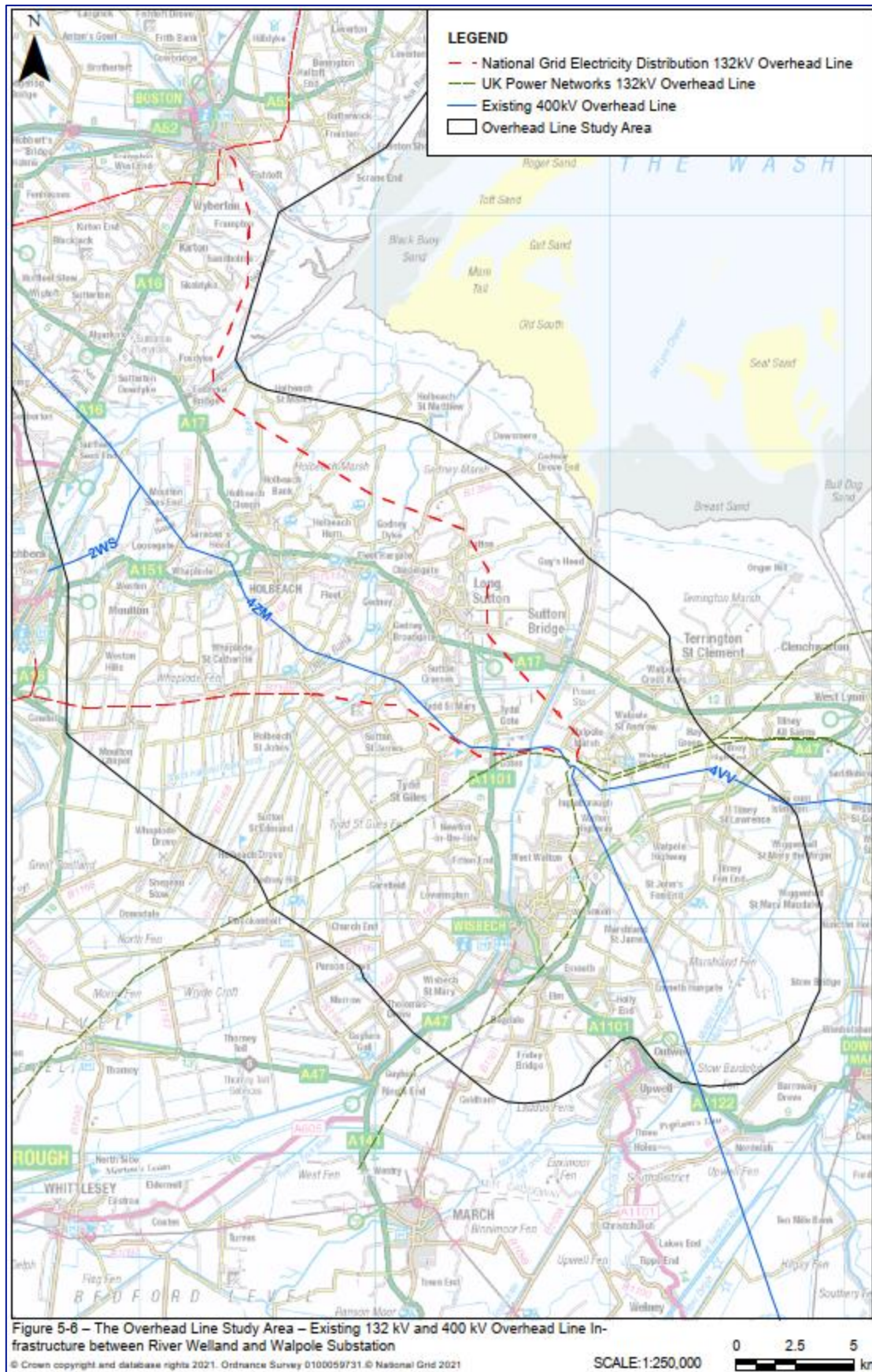
Figure 5-5 – The Overhead Line Study Area – Existing 132 kV and 400 kV Overhead Line Infrastructure between Burgh le Marsh and River Welland



5.2.26 From Weston Marsh to Walpole, the Overhead Line Study Area then continues to follow the route of the 400 kV 4ZM existing overhead line which passes through the centre of the area, allowing potential opportunities for close paralleling of the route between these points. The Overhead Line Study Area expands west towards Spalding to incorporate the existing 400 kV 2WS overhead line and east beyond the existing Walpole substation where the 400 kV 4VV and 4ZM existing overhead lines meet, as shown in **Figure 5-6**. The NGED 132 kV overhead line from the eastern boundary by Weston Marsh also continues along the north-eastern boundary of this area until it reaches the existing Walpole substation. Another NGED 132 kV overhead line joins the existing substation here, cutting south-east across the Overhead Line Study Area from Spalding. There are also four UKPN 132 kV overhead lines in the south-eastern corner of the Overhead Line Study Area which come from Peterborough, Wisbech and King's Lynn (from which there are two), respectively, which meet at the existing Walpole 400 kV substation.



Figure 5-6 – The Overhead Line Study Area – Existing 132 kV and 400 kV Overhead Line Infrastructure between River Welland and Walpole Substation



## Substation Study Areas

### New Grimsby West Substation

- 5.2.27 The definition of the study area for the new Grimsby West substation involved a three-phase process taking into consideration the key drivers for the location of the new substation (as described in **Paragraph 4.5.5**).
- 5.2.28 For the first phase, an initial search area of 2 km was identified, from the existing Grimsby West substation and the existing 400 kV 4KG overhead line between the Grimsby West substation and Wells Road (where the existing 400 kV 4KG overhead line then routes north). An initial search area of 2 km was considered likely to yield suitable locations for siting while addressing the key drivers. Increasing the distance further north and west was discounted as this would increase the length of the proposed transmission connections (either by overhead line or underground cables) to the existing NPG 132 kV Grimsby West substation, the LCS, and would require more significant modifications to the existing 400 kV 4KG overhead line. This increase in distance would increase the geographical spread of development and be likely to increase the scale of environmental and socio-economic impacts, costs and the duration of construction. The initial search area of 2 km is shown in **Figure 5-7**.
- 5.2.29 For the second phase, following identification of the initial search area, a high-level desk-based review was undertaken to identify the major areas of highest amenity, main centres of population and major technical constraints. Those identified for the new Grimsby West substation include:
- Centres of population at Grimsby (Wybers Wood and Laceby Acres), Laceby, Aylesby, and Healing;
  - The existing 400 kV overhead line between the existing Grimsby West substation and Kealby;
  - The existing NGET 400 kV Grimsby West substation and existing NPG 132 kV Grimsby West substation. It was also noted that an existing NGET landholding is located adjacent to the existing 400 kV Grimsby West substation;
  - Laceby Beck Statutory Main River ('Main River') and Water Framework Directive (WFD) waterbody, North Beck WFD waterbody and associated Flood Zone 3 areas;
  - Two moated sites at Healing Hall Scheduled Monument;
  - Grade I and Grade II listed buildings located at Aylesby, Laceby, Healing;
  - Two wind turbines;
  - A consented solar farm development (DM/0899/21/FUL) by Aura Power ('Aura Power Solar Farm'); and
  - Lindens Farm Airstrip.
- 5.2.30 For the third phase, the initial search area was subject to a review and refinement process which sought to avoid the identified constraints where practicable and reduce the amount of connection infrastructure required. The initial search area for the new Grimsby West substation was amended as follows:
- to avoid the identified centres of population at Aylesby, Wybers Wood, Laceby, Laceby Acres and Healing, and the listed buildings located within these populated areas;

- to avoid the two moated sites at Healing Hall Scheduled Monument, Laceby Beck and Flood Zone 3 areas; and
- to seek areas in closer proximity to the existing 400 kV overhead line and NGET landholding.

5.2.31 Due to requirement to connect into the existing transmission infrastructure these were not avoided. In addition, due to the location of the two wind turbines and the Aura Power Solar Farm within the initial search area these were not avoidable and were considered as part of the siting zone / siting area process at Stage 4.

5.2.32 The study area for the new Grimsby West substation (the 'Grimsby West Study Area') following this final phase is shown in **Figure 5-7**.

Figure 5-7 – Grimsby West Initial Search Area, Study Area and Key Features

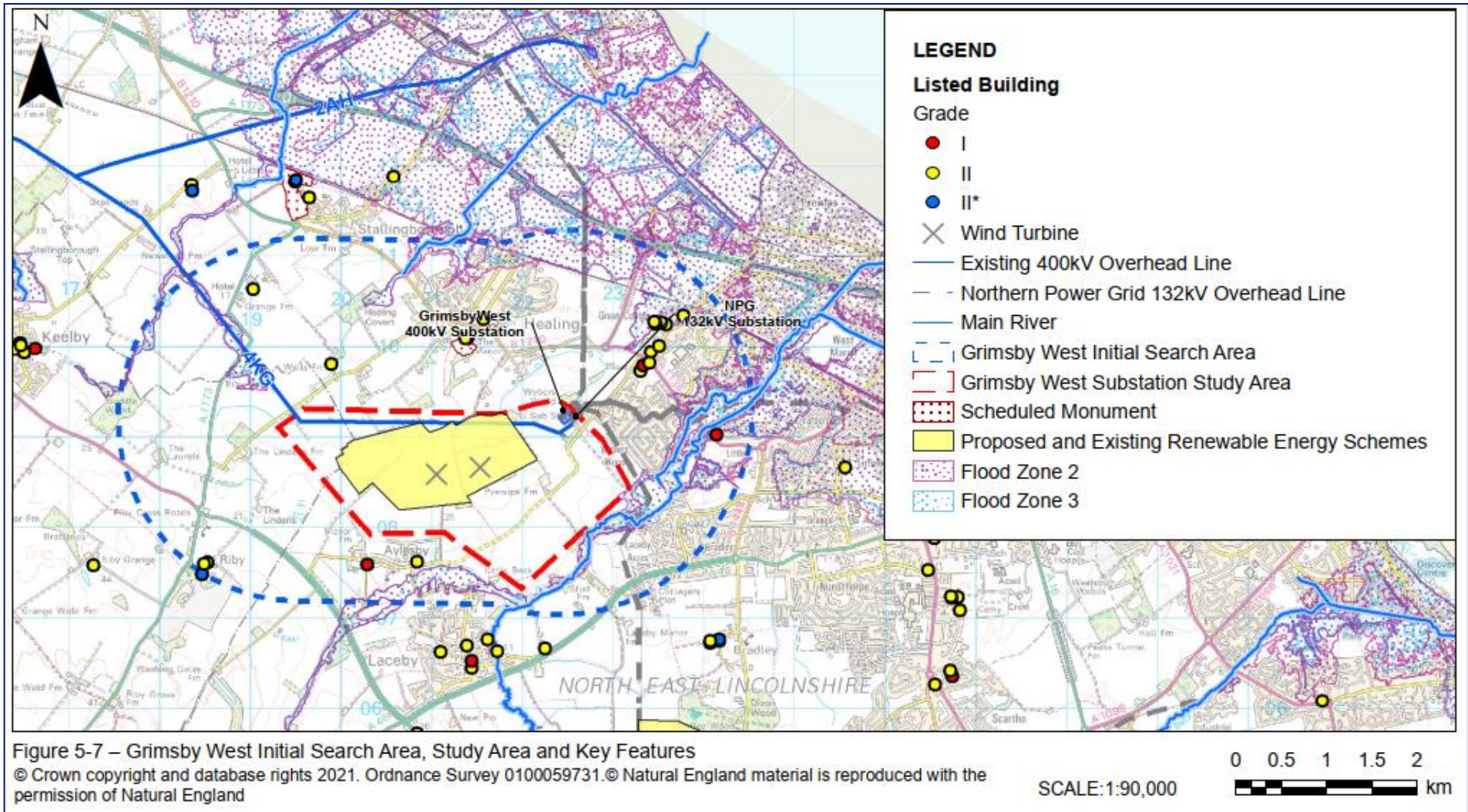


Figure 5-7 – Grimsby West Initial Search Area, Study Area and Key Features

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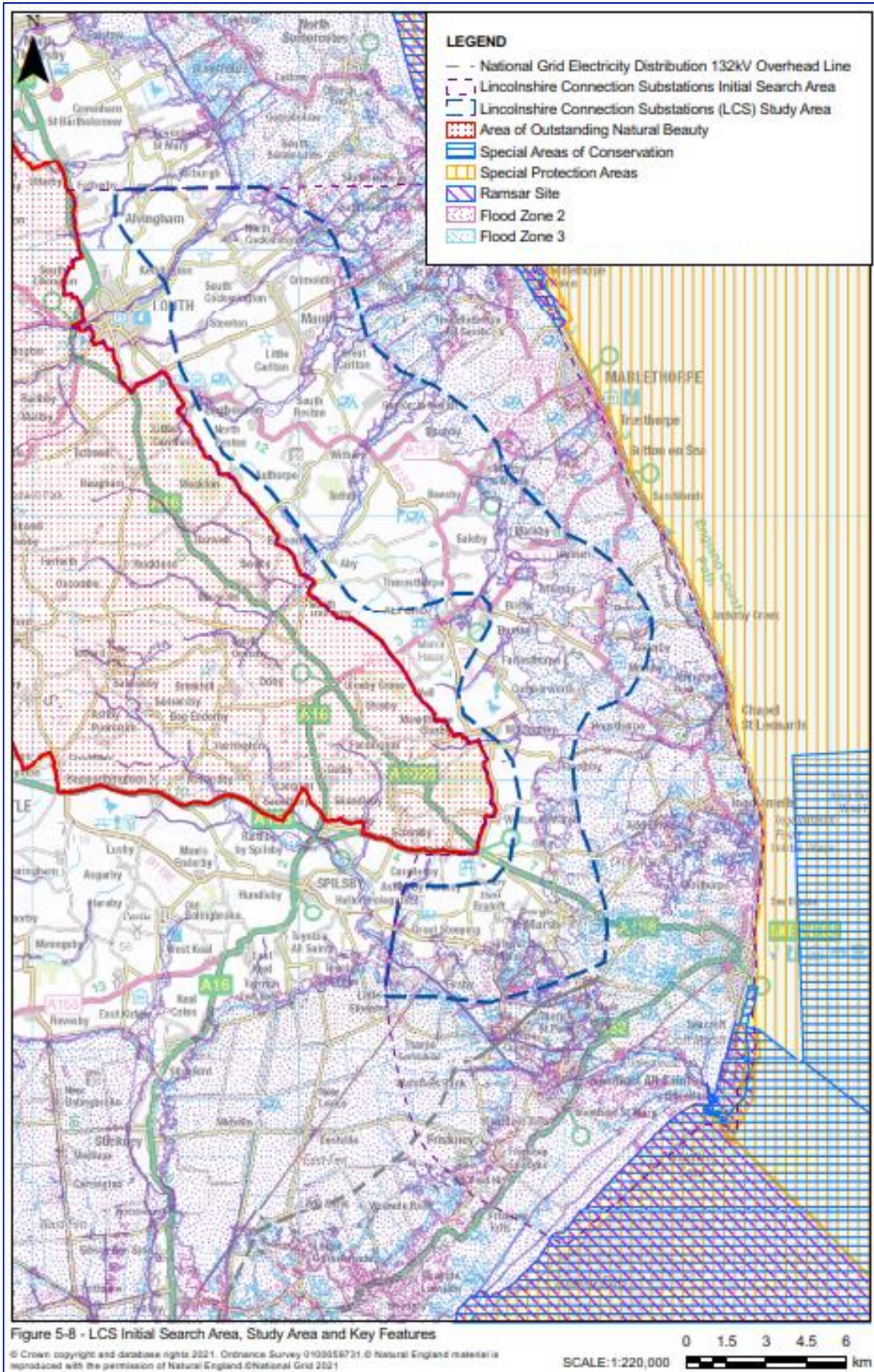
SCALE: 1:90,000

0 0.5 1 1.5 2 km

## New Lincolnshire Connection Substations

- 5.2.33 The broad strategic zone for the two (as detailed in **Paragraph 1.1.3**) new LCS (see **Paragraph 5.2.3**) is located between South Cockerington in the north to the Lincolnshire coast south of Wainfleet All Saints. It extends inland to the edge of the AONB, covering a large area of the Lincolnshire coast and hinterland.
- 5.2.34 The definition of the study area for the LCS (LCS-A and LCS-B) was a two-phase process, which is outlined below. The broad strategic zone was taken as the initial search area from which to begin the process of defining the study area for the LCS based on the key drivers identified within **Paragraph 4.5.5** and in balancing NGET's duties.
- 5.2.35 For the first phase, using this initial search area, a high-level desk-based review was undertaken of the major areas of highest amenity, main centres of population and major technical constraints. The major areas of highest amenity identified included the AONB; Humber Estuary SAC, SPA and Ramsar Site; Greater Wash SPA; The Wash SPA and Ramsar Site; Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC; Gibraltar Point SPA and Ramsar, The Wash and North Norfolk Coast SAC and the Inner Dowsing, Race Bank and North Ridge SAC. The main centres of population identified included Louth, Skegness, Burgh le Marsh and Mablethorpe. The major technical constraint at this scale identified was the large extent of Flood Zone 3 along the Lincolnshire coast.
- 5.2.36 For the second phase, following the high-level review, the initial search area was subject to a review and refinement process to exclude as far as reasonably practicable these identified major areas of highest amenity, main centres of population and technical constraints. The search area was amended as follows:
- To avoid the populated area of Louth and Alford in the west;
  - To avoid the AONB in the west;
  - To avoid the populated area of Skegness in the south-east;
  - To avoid the areas completely covered by Flood Zone 3 along the Lincolnshire coast (which will also avoid coastal settlement located in Flood Zone 3 areas); and
  - To avoid the NSN and Ramsar sites along the Lincolnshire coast to the east and south.
- 5.2.37 The outcome of this was the defined LCS Study Area, as shown in **Figure 5-8**, sufficient to encompass an area within which the identification and assessment of potential siting zones could be completed, allowing for the application of the principles of the Horlock Rules detailed within **Chapter 3** in line with the Project Need case and NGET's statutory duties and obligations.

Figure 5-8 – LCS Initial Search Area, Study Area and Key Features



## New Weston Marsh Substation

- 5.2.38 The definition of the study area for the new Weston Marsh substation involved a three-phase process taking into consideration the key drivers for the location of the new Weston Marsh substation (as described in **Paragraph 4.5.5**).
- 5.2.39 For the first phase, an initial search area of 5 km was identified, from the Spalding Tee-Point (that connects the two existing 400 kV 4ZM and 2WS overhead lines). An initial search area of 5 km was considered likely to yield suitable locations for siting while addressing the key drivers. Increasing the distance further from the Spalding Tee-Point was discounted as this would increase the required reconfiguration of existing transmission lines (distance to the new substation). This increase in distance would increase the geographical spread of development and be likely to increase the scale of environmental and socio-economic impacts, costs and the duration of construction. The initial search area is shown in **Figure 5-9**.
- 5.2.40 For the second phase, following identification of the initial search area a high-level desk-based review was undertaken to identify the major areas of highest amenity, main centres of population and major technical constraints or interactions. Those identified for the new Weston Marsh substation include:
- Centres of population at Spalding, Surfleet, Fosdyke, Moulton Seas End, Saracen's Head, Whaplode, Moulton and Weston;
  - The existing 400 kV overhead lines; one which runs between the Spalding Tee-Point and Spalding (2WS), and one which runs between Sleaford and the existing Walpole substation (4ZM);
  - Flood Zone 3 covering the entire initial search area and the wider area;
  - River Welland and River Glen Main Rivers, WFD Waterbodies and dense drainage network;
  - Scheduled Monument at Wykeham Farm (*Wykeham Chapel: a moated monastic grange and retreat house*);
  - Grade II listed buildings located along the B1357, at Fosdyke, Saracen's Head, Weston and in proximity to the River Welland; and
  - Outer Dowsing OWF search areas for onshore substations<sup>35</sup>.
- 5.2.41 Discussions were progressed with Outer Dowsing OWF to collaborate on substation site identification search areas for onshore substations.
- 5.2.42 For the third phase, the initial search area was subject to a review and refinement process which sought to avoid the identified constraints where practicable and reduce the amount of connection infrastructure required. The initial search area for the new Weston Marsh substation was amended as follows:
- To avoid identified centres of population, the River Welland, River Glen, and the Grade II listed buildings in proximity to the River Welland; and
  - To focus on areas in closer proximity to the existing 400 kV overhead lines (4ZM and 2WS).

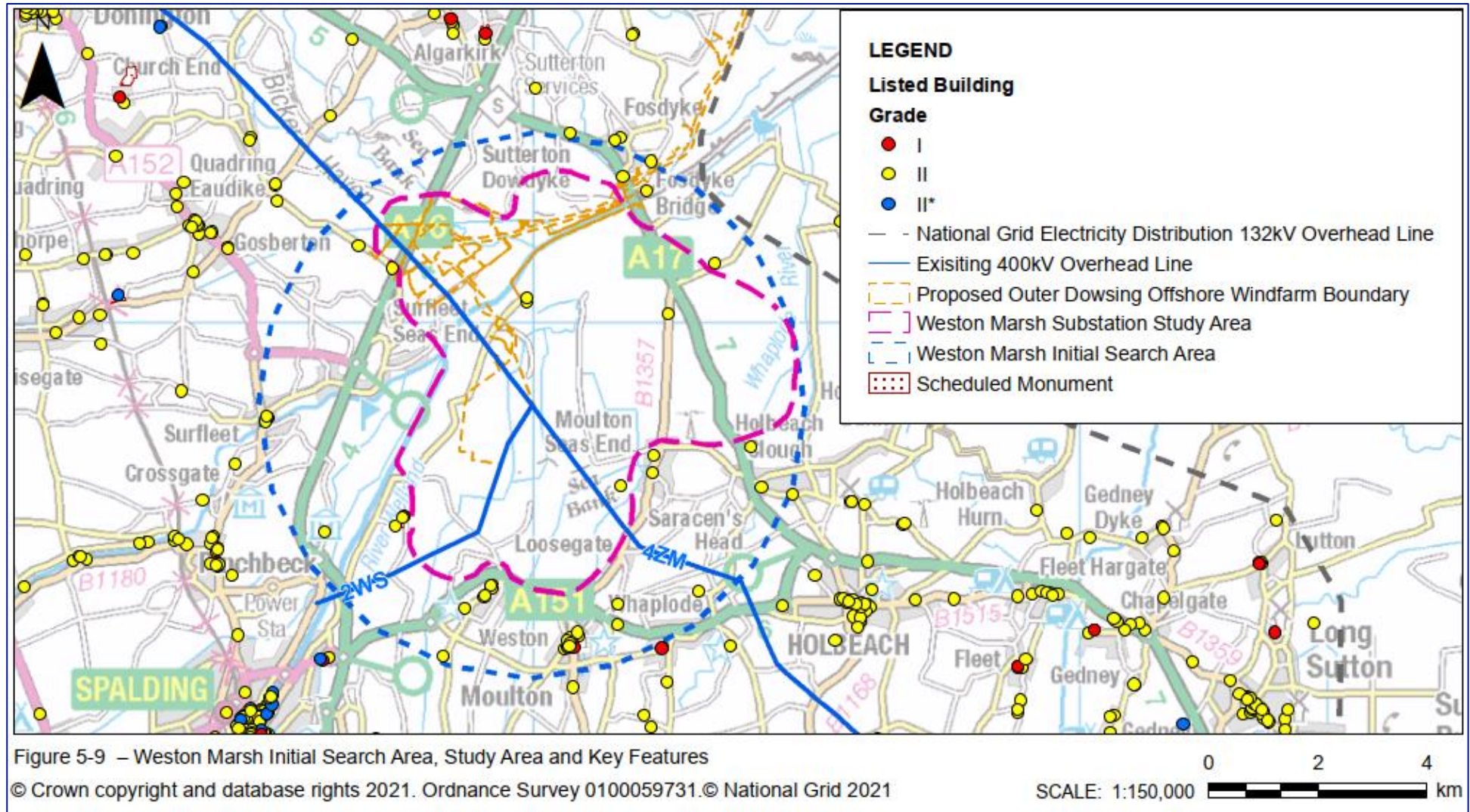
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<sup>35</sup> As shown in the Outer Dowsing Offshore Wind Farm Autumn 2023 Consultation documents. Available at: <https://www.outerdowsing.com/outer-dowsing-offshore-wind-autumn-consultation/> Accessed on 20/10/2023.

5.2.43 The study area for the new Weston Marsh substation (the 'Weston Marsh Study Area') following this final phase is shown in **Figure 5-9**.



Figure 5-9 – Weston Marsh Initial Search Area, Study Area and Key Features



## New Walpole Substation

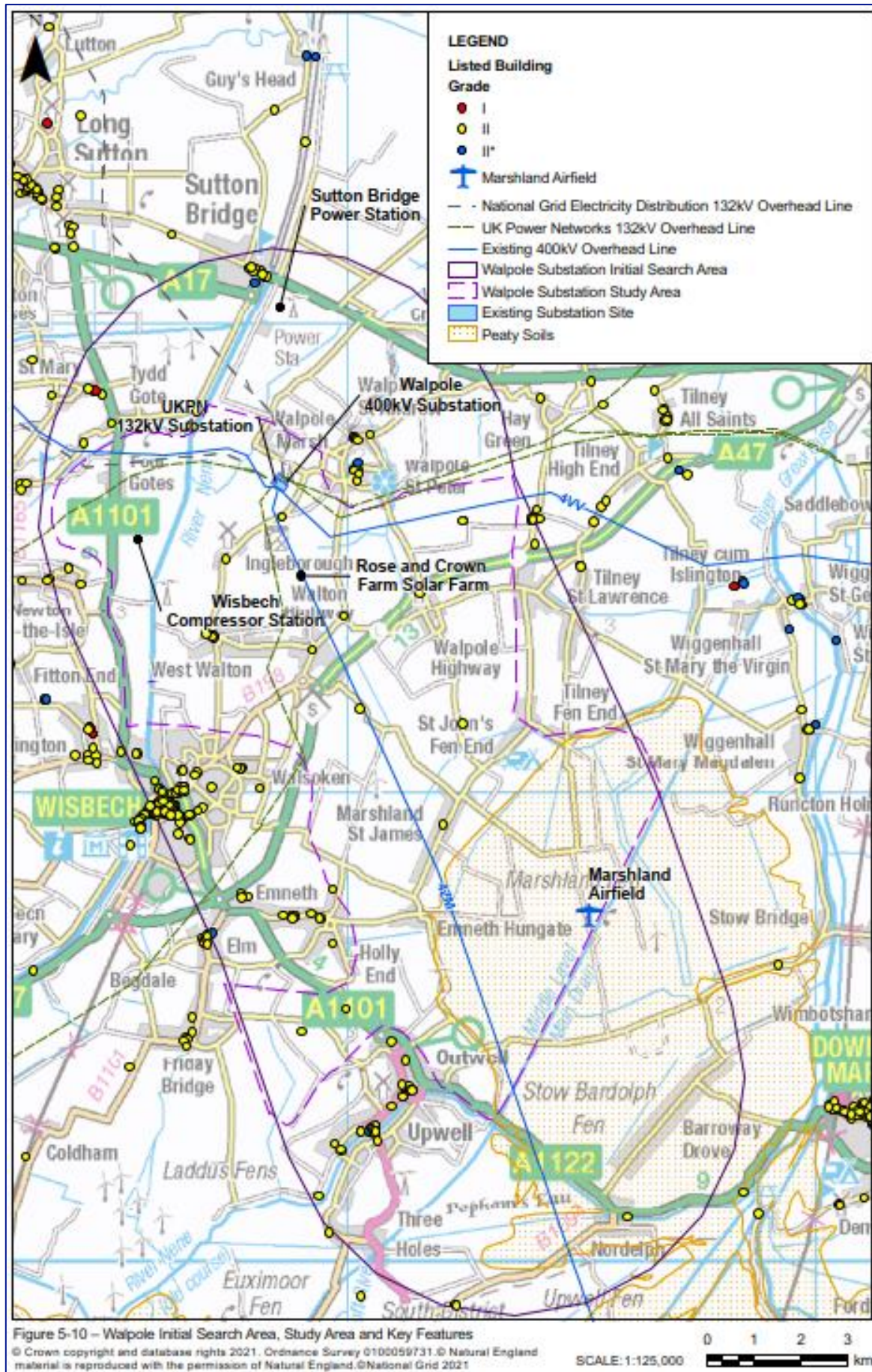
- 5.2.44 The definition of the study area for the new Walpole substation involved a three-phase process taking into consideration the key drivers for the location of the new Walpole substation (as described in **Paragraph 4.5.5**).
- 5.2.45 For the first phase, an initial search area of 5 km was identified, from the existing 400 kV 4ZM overhead line between the existing Walpole substation and the Middle Level Main Drain. An initial search area of 5 km was considered likely to yield suitable locations for siting while addressing the key drivers. Increasing the distance further south or east was discounted as this would increase the length of the proposed transmission connections for the proposed transmission connection from the new Weston Marsh substation and for the EGL 3 and EGL 4 projects. Increasing the distances north and west, further from the existing 400 kV 4ZM overhead line between Burwell and Walpole, was discounted as this would increase the length of diversions of the existing 400 kV 4ZM transmission line. This increase in distance would increase the geographical spread of development and be likely to increase the scale of environmental and socio-economic impacts, costs and the duration of construction. The initial search area is shown in **Figure 5-10**.
- 5.2.46 For the second phase, following identification of the initial search area a high-level desk-based review was undertaken to identify the major areas of highest amenity, main centres of population and major technical constraints. Those identified for the new Walpole substation include:
- Centres of population at Upwell, Outwell, Emneth, Wisbech, St John's Highway, Newton, Walpole St Peter, Walpole St Andrew, Tydd Gote, Sutton Bridge and Walpole Cross Keys;
  - The existing 400 kV overhead lines; one that runs between Sleaford and the existing Walpole substation (4ZM), one that runs between Burwell and the existing Walpole substation (4ZM) and one that runs between Norwich and the existing Walpole substation (4VV);
  - The existing NGET 400 kV Walpole substation and existing UKPN 132 kV Walpole substation;
  - The existing 132 kV overhead lines which route into the existing UKPN 132 kV Walpole substation from the north, south, east and west;
  - The existing Sutton Bridge Power Station, Rose and Crown Farm Solar Farm, Wisbech Compressor Station and sewage treatment plants (adjacent to the River Nene);
  - Flood Zone 3 covering almost the entire initial search area;
  - River Nene (Main River and WFD Waterbody), North Level Main Drain and Middle Level Main Drain WFD Waterbodies;
  - Peaty Soils;
  - Marshland Airfield; and
  - Grade I, II and II\* listed buildings scattered throughout the initial search area.
- 5.2.47 For the third phase, the initial search area was subject to a review and refinement process which sought to avoid the identified constraints where practicable and seek to

reduce the amount of connection infrastructure required. The initial search area for the new Walpole substation was amended as follows:

- To avoid identified centres of population (where possible), the Sutton Bridge Power Station, the Middle Level Main Drain; and
- To focus on areas in closer proximity to the existing 400 kV overhead lines.

5.2.48 The study area for the new Walpole substation (the 'Walpole Study Area') following this final phase is shown in **Figure 5-10**.

Figure 5-10 – Walpole Initial Search Area, Study Area and Key Features



## 5.3 Description of the Study Areas

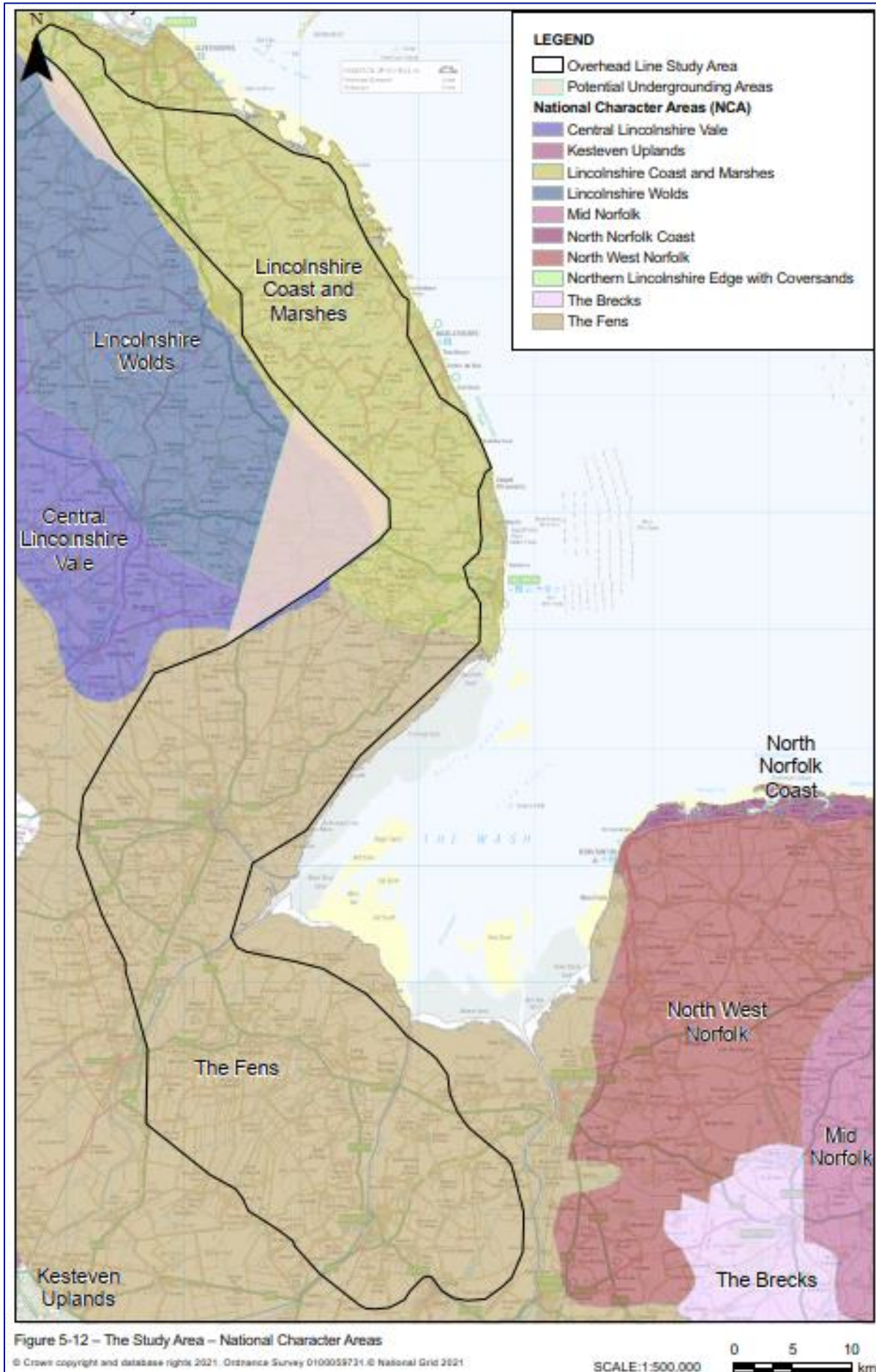
5.3.1 As the Grimsby West Study Area, Weston Marsh Study Area, LCS Study Area, Walpole Study Area and Overhead Line Study Area overlap, the baselines of all study areas are summarised together below. These combined areas are referred to as ‘the Study Area,’ shown in **Figure 5-11**, which can be considered in three parts: the northern extent, the central extent and the southern extent. Reference to the adjacent annex study area is made where applicable.

Figure 5-11 – The Study Area



- 5.3.2 The northern extent of the Study Area is bounded by the village of Great Coates in the north and the A158 to the south, and is located between the AONB in the west and the settlements of Grimsby and Skegness to the east. This section is located primarily within the district of East Lindsey, with areas of the north and north-west within the districts of North East Lincolnshire and West Lindsey. The northern extent primarily comprises the low-lying coastal plain landscape of the Lincolnshire Coast and Marshes National Character Area (NCA). The location of the NCAs is shown in **Figure 5-12**. Existing electricity transmission and distribution infrastructure include the existing Grimsby West 400 kV substation and the 4KG 400 kV overhead line which connects to it, and the Grimsby West NPG 132 kV substation and connecting NPG 132 kV overhead lines. The road network of the northern extent comprises the A46, A16, A18, A1031, A157, A1104, A1111, A52, A1028 and A158 connecting Grimsby, Louth, Skegness and Boston. The Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC, Greater Wash SPA; Inner Dowsing, Race Bank and North Ridge SAC, and Humber Estuary Ramsar, SAC and SPA are located along the Lincolnshire coast to the east.
- 5.3.3 The central extent of the Study Area is bounded by the A158 in the north and the River Welland to the south, and is located between the settlements of Donnington, Heckington and Halton Holegate in the west and The Wash SPA and Ramsar site, and The Wash and Norfolk Coast SAC to the east. This section is located primarily within the districts of East Lindsey and Boston, with areas to the south and west extending into South Holland and North Kesteven. The central extent primarily comprises the distinctive, historic, and human influenced wetland landscape of The Fens NCA. Existing electricity transmission and distribution infrastructure include two NGED 132 kV substations (north of Croft and south of Boston) and the connecting NGED 132 kV overhead lines. The road network of the central extent comprises the A52, A16, A1121, A17, A1137 and A1138 connecting Skegness, Boston and Spalding. Gibraltar Point Ramsar site and SPA, and Inner Dowsing, Race Bank and North Ridge SAC also lie along the Lincolnshire coast to the east.
- 5.3.4 The southern extent of the Study Area is bounded by the River Welland and The Wash SPA and Ramsar site, and The Wash and Norfolk Coast SAC in the north and Walpole to the south. It is located between Spalding in the west and the villages of Walpole Cross Keys and Walpole Highway to the east. This section is located within the district of South Holland, with areas to the south-east extending into Fenland and Kings Lynn & West Norfolk. The southern extent primarily comprises the distinctive, historic, and human influenced wetland landscape of The Fens NCA. Existing electricity transmission and distribution infrastructure include the existing 4ZM 400 kV overhead line connecting to the existing Bicker Fen 400 kV substation and continuing to meet the existing 2WS overhead line north-east of Spalding. There are also connecting NGED and UKPN 132 kV overhead lines that route across the southern extent of the Study Area. The road network of the southern extent comprises the A17, A1151 and A1101 connecting Boston, Spalding and Wisbech.

Figure 5-12 – The Study Area – National Character Areas



## 5.4 Scope Environmental Topics and Data Gathering (Step 2)

- 5.4.1 To identify connection options which best satisfy NGET's statutory duties and obligations and meet the Project objectives identified in the Strategic Proposal Stage (Stage 1), it is necessary to understand the distribution of environmental and technical constraints (push factors) and opportunities (pull factors) within the Study Area. Data to inform this was gathered for the Study Area, as well as for the immediately surrounding areas for those topic areas where it was considered that there was potential for adverse impacts on a feature outside the Study Area boundary (for example, impacts on the setting of the AONB or impacts on migrating wildfowl from a designated site). The extent of this data gathering was based on the professional judgement of the Project environmental and engineering specialists, considering relevant environmental legislation, policy and best practice. Specific mitigation and enhancement measures will be developed as part of the EIA in line with NPS EN-5 (Paragraph 2.9.22).
- 5.4.2 Features representing potential constraints to development were categorised as either 'seek to avoid' or 'seek to minimise' to, respectively, either avoid or minimise impacts whilst achieving the Project objectives for each of the technology options (overhead lines, undergrounding and substations). Features were categorised based on the level of constraint that the relevant environmental specialist considered them to represent based on professional judgement and relevant environmental legislation, policy and best practice. The sensitivity of particular sites and features relevant to the Project will be continually reviewed as the Project progresses in response to consultation feedback and further site-based assessment.
- 5.4.3 A list of the data obtained, to inform the onwards steps, is listed in Table 5-1, for overhead lines, Table 5-2 for undergrounding and Table 5-3 for substations.
- 5.4.4 Buffers were also included for some features representing constraints, where it was considered that potentially significant indirect impacts could occur from beyond the asset itself, for example impacts on the setting of a listed building, to avoid or minimise that impact. In addition, buffers have been added to residential properties as all things being equal, avoidance of direct oversail of residential properties during routeing of new infrastructure is the preferred approach. The extent of the buffers was based upon the professional judgement of the relevant project team subject matter expert, taking into account relevant legislation, policy and best practice. The buffers were not intended to be areas where new infrastructure must be avoided but instead are areas where new infrastructure should be minimised. The buffers are shown in **Table 5-1** for overhead lines, **Table 5-2** for undergrounding and **Table 5-3** for substations.
- 5.4.5 As well as potential constraints to the Project, the mapping exercise also identified features that might offer potential opportunities and therefore promote the inclusion of certain areas within preliminary corridors. The principal opportunities were associated with the potential to route parallel in proximity (referred to as 'close parallel') to existing 400 kV overhead lines, and thus restrict the geographic extent of environmental impacts associated with such infrastructure in line with NPS EN-5 (Paragraph 2.13.16). Further discussion of the close parallel opportunity is provided in **Paragraphs 5.6.24 and 5.6.32**.



Table 5-1 – Data Gathering Features (Overhead Line)

Sub-topic	Constraint Name	Buffer
Air Quality	Residential Properties	25 m
	Education Establishments (such as schools and colleges)	
	Buildings (other than residential properties e.g. retail, industrial estates)	
	Air Quality Management Area (AQMA)	
Ecology	Ancient Woodland	50 m
	Ramsar	500 m and 2 km
	Special Area of Conservation (SAC)	500 m
	Special Protection Area (SPA)	500 m, 1 km and 5 km
	Site of Special Scientific Interest (SSSI)	500 m
	Important Bird Area	500 m and 2 km
	National Nature Reserve	
	Local Nature Reserve (LNR)	
	RSPB Reserves	250 m

Sub-topic	Constraint Name	Buffer
	Priority Habitat Inventory	
	Traditional Orchard	
	National Forest Inventory Woodland	
Economic Activity	Business parks / Retail and shopping centres / Industrial estates	
	Best Most Versatile (BMV) agricultural land (Agricultural Land Classification (ALC) Grades 1, 2, 3)	
	Solar Farms	
	Wind farms and wind turbines	
	Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large Scale Housing or Infrastructure application registered with the relevant Local Authority)	
	National Trust Land	
	Aggregates and Mineral Resource Areas	
	Local Plan Allocations	
	Mineral Safeguarding Areas	

Sub-topic	Constraint Name	Buffer
Geology and Soils	Peaty Soils	
	Geological Sites of Special Scientific Interest	500 m
	Local Geodiversity Sites	
	Available Brownfield Land Sites	
	Aggregates and Mineral Resource Areas	
	Landfill sites	
Historic Environment	Scheduled Monuments	250 m
	Listed Buildings	250 m
	Registered Parks and Gardens	250 m
	Conservation Areas	
Landscape Area of Outstanding Natural Beauty and Visual (AONB)	National Trust Properties & Inalienable Land	
	Area of Outstanding Natural Beauty (AONB)	2 km
	National Cycle Network	
	Residential settlements and individual dwellings	25 m
	Viewpoints	

Sub-topic	Constraint Name	Buffer
	Recreational Areas	
	Outdoor recreational facilities including golf courses, canals and caravan parks	
	Local Landscape Designations	
Aviation and Defence	Licensed Airfield / Aerodrome	500 m
	Unlicensed Airfield / Aerodrome	
	Ministry of Defence properties (including military airfields)	500 m
	Civil Aviation Authority Airports or Aerodromes	1 km
Noise and Vibration	Residential properties	25 m
	Education establishments (e.g., Schools and Colleges)	
	Health care facilities (e.g., hospitals, hospices, clinics)	
	Places of worship	
Traffic and Transport	Rail Stations	
	Rail Network	
	National Cycle Network	

Sub-topic	Constraint Name	Buffer
	Cycle Routes (Sustrans National)	
Water	Statutory Main Rivers	
	Water Framework Directive (WFD) surface waters	
	Flood Zones 2 & 3 excluding 'Areas Benefitting from Flood Defences'	
	Groundwater Dependent Terrestrial Ecosystems	
	Groundwater Source Protection Zones – Inner/Zone 1	
	Internal Drainage Board Drains	

Table 5-2 – Data Gathering Features (Undergrounding)

Sub-topic	Constraint Name	Buffer	Sub-topic	Constraint Name	Buffer
Air Quality	Residential Properties	25 m		Traditional Orchard	
	Education Establishments (such as schools and colleges)			National Forest Inventory Woodland	
	Buildings (other than residential properties e.g. retail, industrial estates)		Economic Activity	Business parks / Retail and shopping centres / Industrial estates	
	Air Quality Management Areas (AQMAs)			BMV agricultural land (ALC Grades 1, 2, 3)	
		Solar Farms			
		Wind farms and wind turbines			
Ecology	Ancient Woodland	50 m		Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large Scale Housing or Infrastructure application registered with the relevant Local Authority)	
	National Nature Reserves			National Trust Land	
	Ramsar	500 m		Aggregates and Mineral Resource Areas	
	Special Area of Conservation (SAC)	500 m		Mineral Safeguarding Areas	
	Special Protection Area (SPA)	500 m and 1 km		Local Plan Allocations	
	Site of Special Scientific Interest (SSSI)	500 m			
	Important Bird Area	500 m			
	Local Nature Reserves (LNR)				
	Royal Society for the Protection of Birds (RSPB) Reserves	250 m	Geology and Soils	Peaty Soils	
	Priority Habitat Inventory			Geological Sites of Special Scientific Interest	

Sub-topic	Constraint Name	Buffer
	Local Geodiversity Sites	
	Available Brownfield Land Sites	
	Aggregates and Mineral Resource Areas	
	Landfill sites	
Historic Environment	Scheduled Monuments	250 m
	Listed Buildings	
	Registered Parks and Gardens	
	Conservation Areas	
	National Trust Properties & Inalienable Land	
Landscape and Visual	Area of Outstanding Natural Beauty (AONB)	2 km
	National Cycle Network	
	Residential settlements and individual dwellings	25 m
	Viewpoints	
	Recreational Areas	
		Outdoor recreational facilities including golf courses, canals and caravan parks

Sub-topic	Constraint Name	Buffer
	Local Landscape Designations	
Aviation and Defence	Licensed Airfield / Aerodrome	500 m
	Unlicensed Airfield / Aerodrome	
	Ministry of Defence properties (including military airfields)	500 m
	Civil Aviation Authority Airports or Aerodromes	500 m
Noise and Vibration	Residential properties	25 m
	Education establishments (e.g., Schools and Colleges)	
	Health care facilities (e.g., hospitals, hospices, clinics)	
	Places of worship	
Traffic and Transport	Rail Stations	
	Rail Network	
	National Cycle Network	
	Cycle Routes (Sustrans National)	
Water	Statutory Main Rivers	
	Water Framework Directive (WFD) surface waters	

Sub-topic	Constraint Name	Buffer
	Flood Zones 2 & 3 excluding 'Areas Benefitting from Flood Defences'	
	Groundwater Dependent Terrestrial Ecosystems	
	Groundwater Source Protection Zones – Inner/Zone 1	
	Internal Drainage Board Drains	

Table 5-3 – Data Gathering Features (Substations)

Sub-topic	Constraint Name	Buffer	Sub-topic	Constraint Name	Buffer
Air Quality	Residential Properties	25 m		Priority Habitat Inventory	
	Education Establishments (such as schools and colleges)			Traditional Orchard	
	Buildings (other than residential properties e.g. retail, industrial estates)			National Forest Inventory Woodland	
	Air Quality Management Areas (AQMAs)		Economic Activity	Business parks / Retail and shopping centres / Industrial estates	
Ecology	Ancient Woodland	50 m		BMV agricultural land (ALC Grades 1, 2, 3)	
	National Nature Reserves			Solar Farms	
	Ramsar	500 m and 2 km		Wind farms and wind turbines	
	Special Area of Conservation (SAC)	500 m		Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large Scale Housing or Infrastructure application registered with the relevant Local Authority)	
	Special Protection Area (SPA)	500 m and 1 km		National Trust Land	
	Site of Special Scientific Interest (SSSI)	500 m		Aggregates and Mineral Resource Areas	
	Important Bird Area	500 m and 2 km		Local Plan Allocations	
	Local Nature Reserves (LNR)			Geology and Soils	Peaty Soils
	Royal Society for the Protection of Birds (RSPB) Reserves	250 m			Geological Sites of Special Scientific Interest

Sub-topic	Constraint Name	Buffer
	Local Geodiversity Sites	
	Available Brownfield Land Sites	
	Aggregates and Mineral Resource Areas	
	Landfill sites	
Historic Environment	Scheduled Monuments	250 m
	Listed Buildings	250 m
	Registered Parks and Gardens	250 m
	Conservation Areas	
	National Trust Properties & Inalienable Land	
Landscape and Visual	Area of Outstanding Natural Beauty (AONB)	2 km
	National Cycle Network	
	Residential settlements and individual dwellings	25 m
	Viewpoints	
	Recreational Areas	
	Outdoor recreational facilities including golf courses, canals and caravan parks	

Sub-topic	Constraint Name	Buffer
	Local Landscape Designations	
Aviation and Defence	Licensed Airfield / Aerodrome	500 m
	Unlicensed Airfield / Aerodrome	
	Ministry of Defence properties (including military airfields)	500 m
	Civil Aviation Authority Airports or Aerodromes	500 m
Noise and Vibration	Residential properties	25 m
	Education establishments (e.g., Schools and Colleges)	
	Health care facilities (e.g., hospitals, hospices, clinics)	
	Places of worship	
Traffic and Transport	Rail Stations	
	Rail Network	
	National Cycle Network	
	Cycle Routes (Sustrans National)	
Water	Statutory Main Rivers	
	Water Framework Directive (WFD) surface waters	



Sub-topic	Constraint Name	Buffer
	Flood Zones 2 & 3 excluding 'Areas Benefitting from Flood Defences'	
	Groundwater Dependent Terrestrial Ecosystems	
	Groundwater Source Protection Zones – Inner/Zone 1	
	Internal Drainage Board Drains	

## 5.5 Ascribe a weight to, confirm and ‘Heat Map’ Features (Step 3)

- 5.5.1 Data gathered for features representing potential constraints to development was attributed a sensitivity weighting as described in **Chapter 4**. Sensitivity weightings were attributed by the relevant landscape and environmental specialist based on professional judgement, considering relevant environmental legislation, policy and best practice and agreed with the project team. The data, once classified, was then used to create ‘heat maps’ showing the relative importance of the different features. This assisted in providing a visual representation of the relevant constraints for the Project across the Project Study Area and informed the identification of early corridors, siting zones and siting areas.
- 5.5.2 The heat maps were then reviewed by the project team to ensure that the sensitivity weightings applied were appropriate in terms of their relative importance in decision-making for the type of infrastructure proposed, and to check whether there were features that were so extensive that they would affect all corridors or siting zones or siting areas and thus not help in distinguishing between options. Following this review several amendments were made, including:
- Removal of BMV<sup>36</sup> Agricultural Land from the heat maps as the entirety of the Study Area is covered by this feature and therefore it would not be a differentiating factor in the identification and assessment of corridors, siting zones and siting areas;
  - Removal of Flood Zone 2 and Flood Zone 3 from the overhead line heat map as the areas between Burgh le Marsh and Wisbech, and a large portion of the area between Grimsby and Walpole, were covered by them, such that they would not be a differentiating factor in the identification of corridors; and
  - Reduction in the sensitivity weightings for Priority Habitat Inventory and Peaty Soils data for the overhead line heat map. This is necessary due to the granularity of these Natural England datasets which are interpreted from other data sets and sources (for example OS mapping, aerial imagery and BGS 1:50,000 mapping) at a larger geographical scale. In addition, there is potential for these areas to be over sailed, and hence not to be directly affected, by an overhead line.
- 5.5.3 The review identified the need for several additional datasets for which data was collated into the GIS and added to the heat mapping. This included:
- Residential density, derived from OS AddressBase residential property data;
  - Planning policy land allocations, set out in relevant development plans and digitised by GIS specialists; and
  - Local airfields, data derived from OpenStreetMap and checked against aerial imagery and online searches.
- 5.5.4 The heat maps were reviewed again following these changes and approved for the identification of early corridors for overhead lines and undergrounding, and substation

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<sup>36</sup> ‘Best Most Versatile’ land, which is defined as Agricultural Land Classification (ALC) Grades 1, 2 and 3a agricultural land and is recognised as the most productive and versatile land. The ALC system for grading agricultural land quality is provided in England & Wales (MAFF 1988) – see Appendix 1.

siting zones and siting areas. The heatmaps for each technology type for the Project are shown in **Figure 5-13**, **Figure 5-14** and **Figure 5-15**.

Figure 5-13 – Overhead Line Heatmap

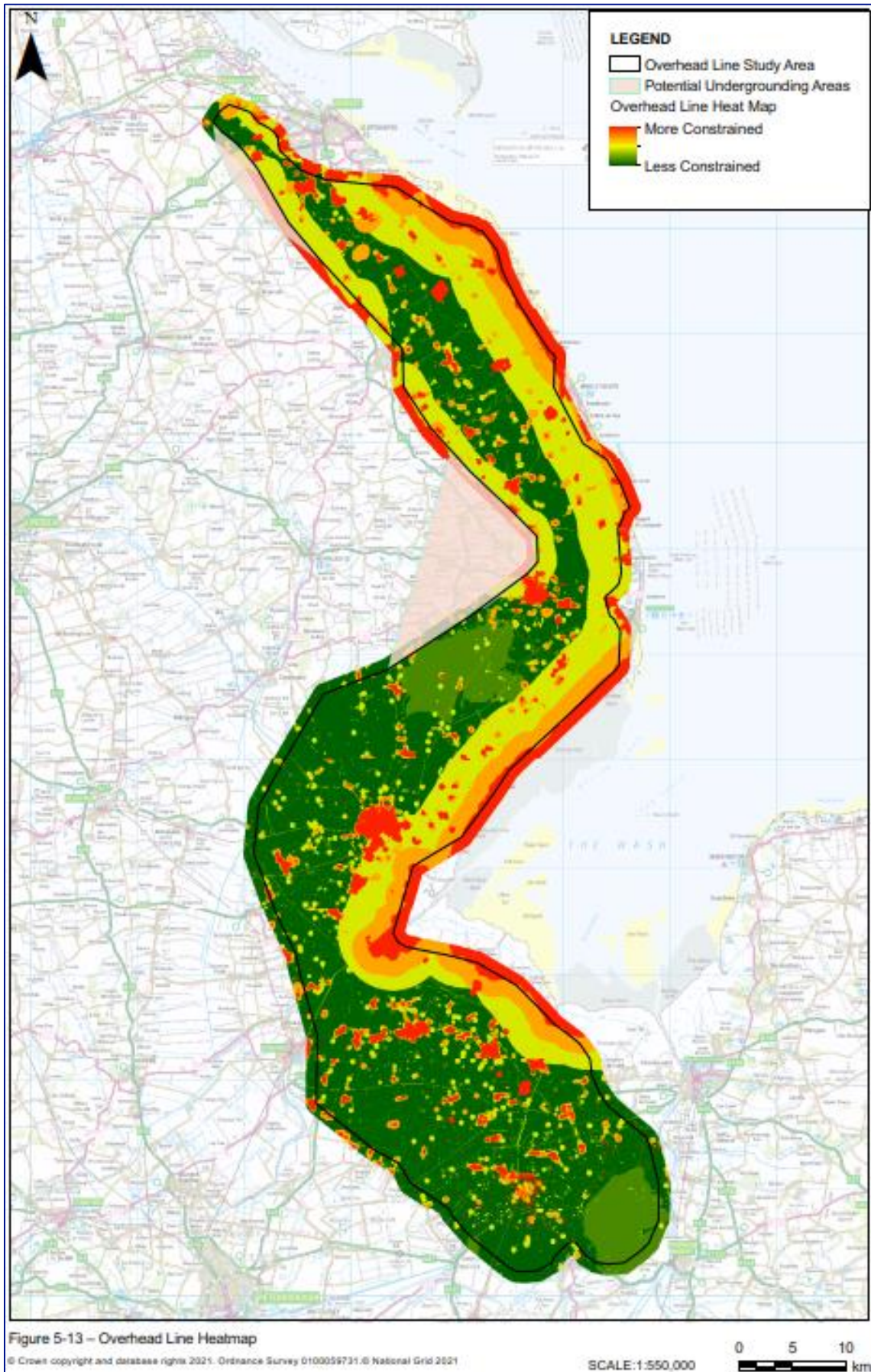


Figure 5-14 – Substations Heatmap

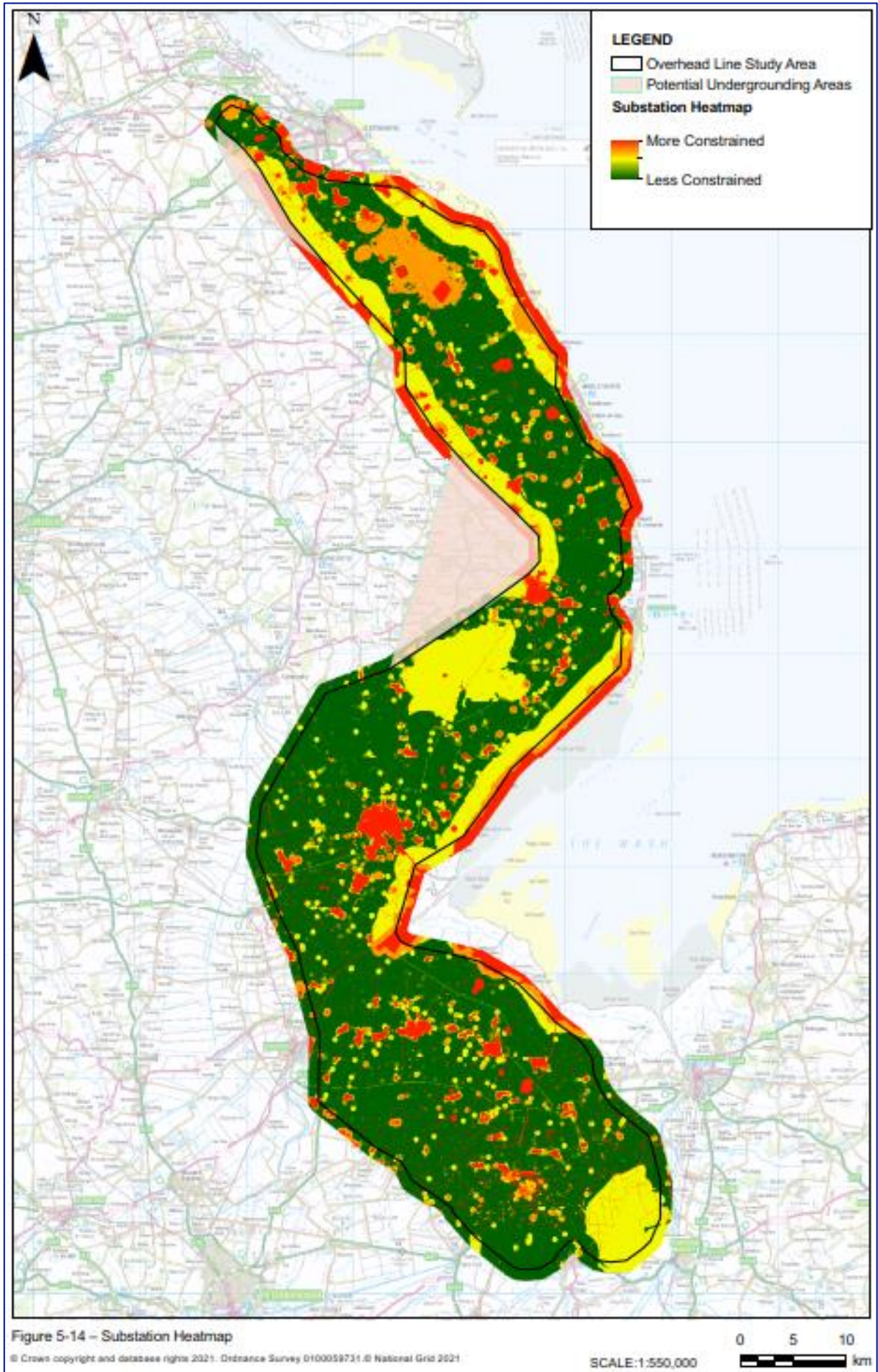
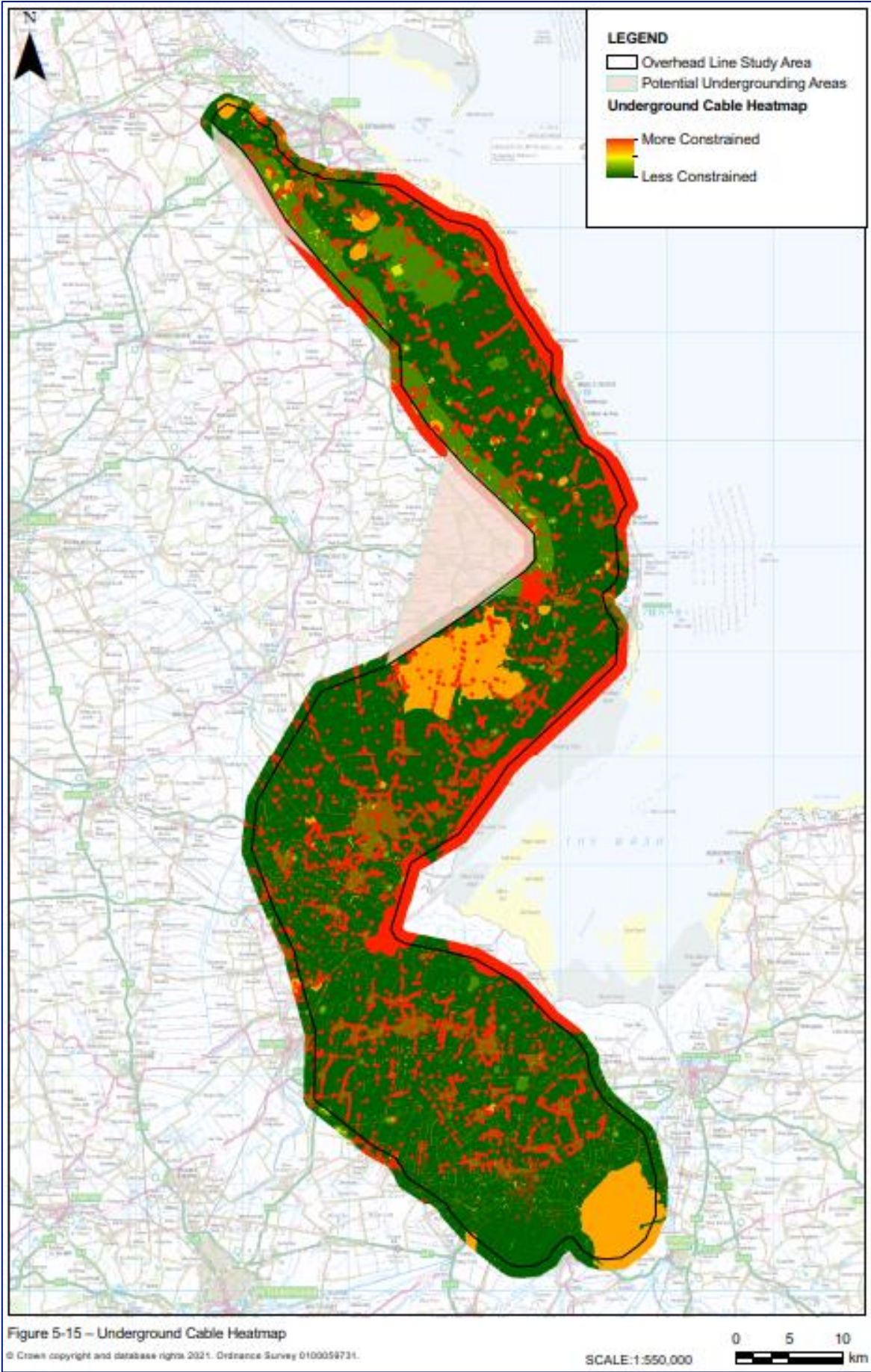


Figure 5-15 – Underground Cable Heatmap



## 5.6 Identifying and Defining Siting Zones, Siting Areas and Corridors (Steps 4 to 6)

5.6.1 The heat maps derived for each of the Project components informed the identification of options for preliminary corridors, siting zones and siting areas within the Study Area.

### Overhead Lines (Steps 4 to 6)

5.6.2 Following the development of the heat maps at Step 3, early corridors were developed between the potential connection points by landscape specialists working with others as appropriate. The early corridors were identified by applying professional judgement, and their knowledge of routeing considerations, in particular the Holford Rules, as outlined in **Chapter 3**. This was to ensure that the corridors identified were technically feasible whilst minimising the potential for adverse impacts on the environment, including elements and nuances that cannot be digitised (e.g., Holford Rules 3 to 7, see below).

5.6.3 The GIS analysis using heat maps was used as a starting point to identify corridors that aimed to:

- Entirely avoid the largest areas of highest amenity and largest settlements;
- Avoid smaller areas of higher amenity and smaller clusters of houses as far as possible;
- Avoid smaller areas of technical constraint as far as possible;
- Allow for enough space to accommodate reasonable lengths of straight alignment at later stages of the Project, in accordance with Holford Rule 3;
- Be broad enough to allow for smaller areas of high amenity and residential properties within the corridor to be avoided at the detailed design stage;
- Likewise, be broad enough for constraints not apparent at this stage (i.e., information arising from non-statutory consultation, not currently known to NGET) to be avoided at the detailed design stage; and
- Provide options to connect from one corridor to another so that constrained sections of an otherwise suitable corridor can be bypassed.

5.6.4 The consideration of the Holford Rules in the development of the early corridors was led by landscape specialists because the underlying aim of the rules is, in effect, to guide the design of overhead lines to have the least possible landscape and visual impacts whilst avoiding important constraints. Rules 1 and 2 address the areas of high amenity (i.e., environmental constraints). Rule 1 applies at a broader scale, primarily in setting the Study Area. Rule 2 considers amenity areas at a smaller scale and therefore was the main driver in developing the heat maps, the GIS analysis and is critical in developing corridors. Rule 3 considers the effect of 'angle' pylons and the visual impacts that may be caused by an overhead line with frequent changes of direction. Rules 4 and 5 consider ways to 'best fit' an overhead line in the landscape to reduce the degree to which it may be visible. Rule 6 considers wirescape and Rule 7 considers the approaches to urban areas.

5.6.5 The landscape of the Study Area is generally very flat and open, with long views and, as such, Rules 4 and 5 which primarily refer to topography are less relevant and harder to accommodate. The development of the preliminary corridors was therefore driven by

Rules 2 and 3, with technical and socio-economic considerations feeding in alongside environmental constraints. The development of preliminary corridors aimed to ensure that areas of constraint are either excluded or where included in the corridor can be avoided in detailed design whilst avoiding unnecessary changes of direction. Rules 4 and 5 were mainly considered in relation to areas of existing woodland. Rule 6 was considered in the area west of Skegness (in relation to the existing NPG 132 kV overhead line) and south-east of Bicker (in relation to existing 132 kV (NGED and UKPN) and 400 kV 4ZM and 2WS overhead lines). Rule 7 was considered in the more built-up northernmost and southernmost parts of the Study Area.

- 5.6.6 Furthermore, the Holford Rules supplementary notes consider routeing close to residential areas, and state that this should be avoided as far as possible on grounds of general amenity. NGET's preferred approach is to avoid direct oversail of residential properties during routeing of new infrastructure as far as practicable. Therefore residential properties were excluded from the corridors where practicable, as described in **Section 5.6.9**.
- 5.6.7 As well as potential constraints to development, the mapping exercise also identified opportunities to promote the inclusion of certain areas within the corridors. The principal opportunities were associated with the potential to route parallel with and close to the existing 400 kV 4ZM overhead line (referred to as 'close parallel', as detailed in **Chapter 4**), and thus restrict the geographic extent of environmental and socio-economic impacts associated with such infrastructure. These opportunities, where relevant, were considered in the development of the corridors.
- 5.6.8 The identified corridors were then subject to a back-check and review and further analysis by the project team.
- 5.6.9 The review considered information gathered from the environment and technical site visits undertaken (ground-truthing key issues and pinch-points identified during the desk studies) and further design and construction issues subsequently identified by the technical teams. Suggested amendments to the corridors were implemented where they were consistent with environmental considerations. The changes implemented include:
- Addition of a corridor from Grimsby West to the west of North Thoresby which is located within the AONB. This was added taking into consideration the distribution of constraints between the A46 and Tetney/North Thorseby causing several pinch-points. Inclusion of this corridor as an underground cable corridor to avoid these pinch-points as it would route into and partially through the AONB in line with NPS EN-5.
  - Cutting out sections of corridors where clusters of residential properties were present.
  - Expansion of corridors north of Barnoldby le Beck and Waltham to reflect the potentially larger area to cross the existing NPG 132 kV overhead line and the potential to oversail proposed solar farms/extensions.
  - Addition of a corridor west of Tothill Wood to reflect the relatively unconstrained nature of this area and avoid potential setting impacts on a group of scheduled monuments north-east and east of Tothill Wood.
  - Removal of a small corridor south of *Butterbump round barrow cemetery* Scheduled Monument, to avoid potential impacts on the setting of this monument with already large corridors located west and east of this scheduled monument.



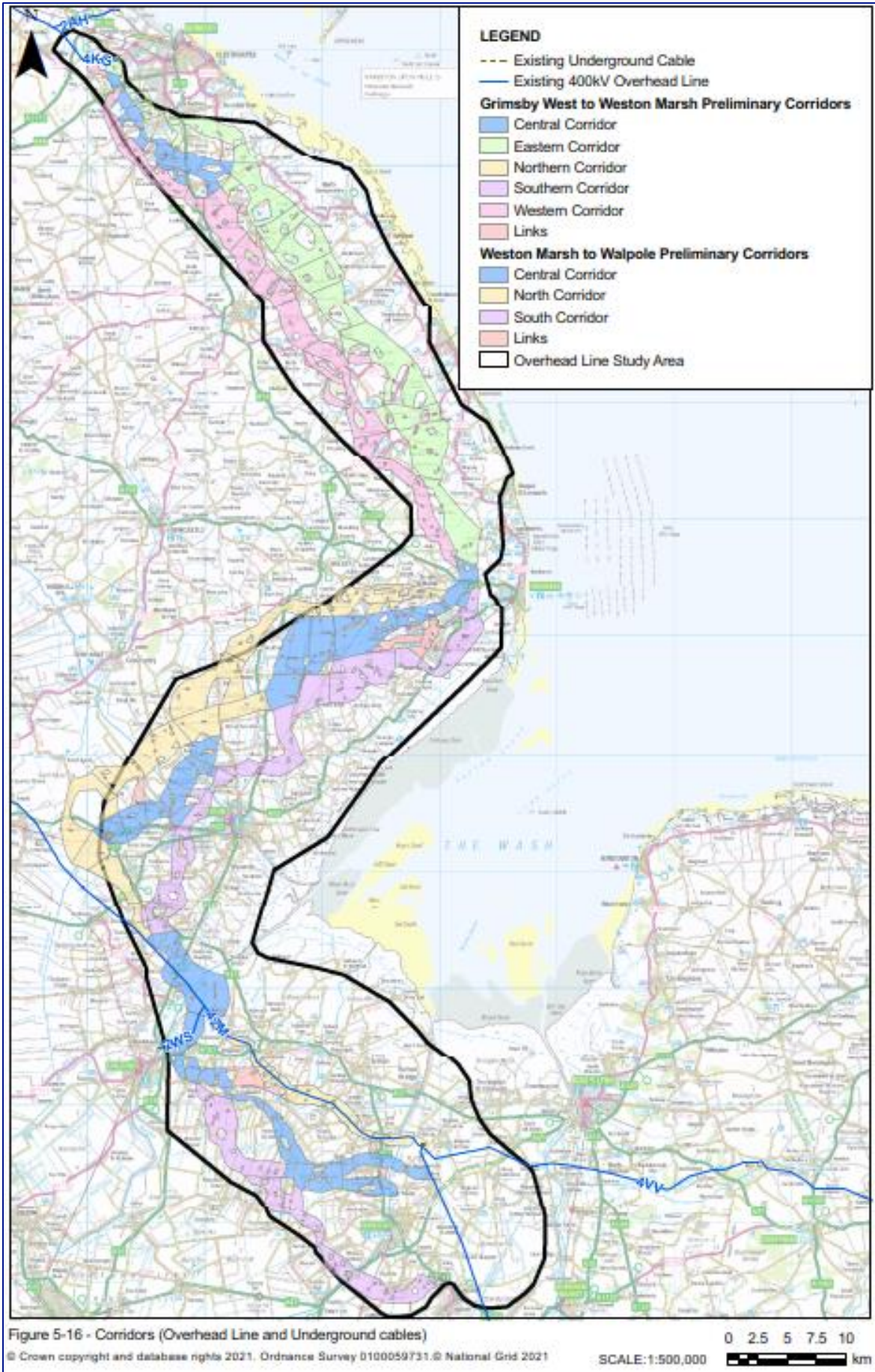
- Removal of a small corridor immediately east of Orby due to its narrow nature, and due to the presence of residential properties and National Trust land.
- Removal of a small corridor between the existing 400 kV 4ZM overhead line and Quadring Eaudike to remove an unnecessary dual crossing of the existing overhead line.
- Removal of a corridor north of the existing 400 kV 4ZM overhead line and the A17 between the Spalding Tee-Point and the existing Walpole substation. This corridor was removed due to the requirement to route near and cross over five existing 132 kV or 400 kV overhead lines, which increases the technical complexity and the potential for a wirescape. It also removed a requirement for multiple pipeline crossings, the proximity of the preliminary corridor to The Wash SPA and Ramsar site, RAF Holbeach Air Weapons Range, MoD high priority military low flying area and Wingland Airfield.
- Expansion of corridors west of Weston to reflect the potentially larger area to cross the A151 and potentially route adjacent to the existing 400 kV 4ZM overhead line.
- Addition of a corridor east of Whaplode St Catherine and Holbeach St John's. This was added to reduce potential interference with Fenland Airfield and to provide an option to reduce overall length of an overhead line of other corridors by approximately 2 km.

5.6.10 In addition, an exercise was undertaken to check the extent of potential constraints on both larger scale OS mapping and aerial photography.

5.6.11 The process of developing the preliminary overhead line corridors confirmed the position taken at Step 1, that a preliminary underground cable corridor within the northern 'annex study area' west of Barnoldby le Beck should be considered as an alternative to avoid pinch-points between the A46 and the Tetney/North Thoresby area. The southern annex study area west of Burgh le Marsh was considered not to be required as on review a corridor between Burgh le Marsh and Skegness was identified which was technically feasible and environmentally acceptable. It was considered that should an underground cable corridor be taken forward in the northern annex study area that it may be beneficial to utilise underground cables from the Grimsby West substation. Therefore, underground cable options for the corridors between Grimsby West and the annex study area were also developed.

5.6.12 The corridors identified for Options Appraisal are presented in **Figure 5-16**.

Figure 5-16 – Corridors (Overhead Line and Underground cables)



## Preliminary Corridors

- 5.6.13 The corridor identification exercise identified a network of potential corridors and links. To allow for clear, comparative analysis, these were structured and named. Between Grimsby West and Burgh le Marsh there are Western, Eastern and Central corridors, with 13 links. Between Burgh le Marsh and Weston Marsh there are Northern, Southern and Central corridors with 14 links. Between Weston Marsh and Walpole there are Northern, Southern and Central corridors with three links. The complexity of the network of corridors is such that no one corridor provides a complete end-to-end solution: hence the sections and links which allow parts of different corridors to emerge as a preference and be linked to form a complete end-to-end solution.
- 5.6.14 An underground cable corridor was identified between Grimsby West and North Thoresby, running into the edge of the AONB west of Barnoldby le Beck. This was introduced to provide routing flexibility to the south of Grimsby West and an alternative technical solution if required, recognising the narrowness of the Eastern and Central corridors in the Waltham area and the proximity of the Western overhead line corridor to the AONB.
- 5.6.15 South of North Thoresby, the corridors are sufficiently broad to allow flexibility in overhead line routing, and are further from the AONB. As such the presumption to route overhead as required by government guidance prevails, and no underground cable corridors were identified in these areas.
- 5.6.16 As noted above, because complex, overlapping permutations of preliminary corridors were identified, they were divided into discrete parts called 'sections,' so that each individual section could be appraised without duplication. Following Options Appraisal, the corridor sections emerging as the optimum choices are combined to form an end-to-end corridor.
- 5.6.17 The individual sections of the corridor are referenced with a prefix and section number, as follows:
- Western Corridor options have the prefix "W" e.g., western option section 1 is known as section W1;
  - Eastern Corridor options have the prefix "E" e.g., eastern option section 1 is known as section E1;
  - Central Corridor options have the prefix "C" e.g., central option section 1 is known as section C1;
  - Southern Corridor options have the prefix "S" e.g., southern option section 1 is known as section S1; and
  - Northern Corridor options have the prefix "N" e.g., northern option section 1 is known as section N1.
- 5.6.18 The links are named according to the Section they join, e.g. E4-C4 provides a link from section E4 of the Eastern Corridor to section C4 to the Central Corridor. Sections of the underground cable corridor are denoted by the addition of "U" to the naming convention. For example, the western underground cable option in section 1 is known as Option W1U.
- 5.6.19 An overview of the corridors and their associated sections are shown on **Figure 5-16**, and are described below.

- 5.6.20 The identified corridors between Grimsby West and Burgh le Marsh form a complex permutation of options through the middle of the Study Area, set back from the AONB to the west and from the coastal settlements and the NSN and Ramsar sites to the east. The separation of the corridors was primarily driven by the pattern of settlement. Groupings of constraints, and in some instances, individual constraints were avoided and cut-out of the corridors leading to the creation of 'cut-outs' within corridors.
- 5.6.21 Two corridors (Western Corridor, starting at W1, and Eastern Corridor, starting at E1) run from the Grimsby West Zone, either side of two wind turbines, to a pinch-point between Laceby and the edge of the Grimsby/Cleethorpes built-up area, where they merge into one (Central Corridor at C1) until the A56. South of the A46 the corridors separate into three (Western (at W2), Eastern (at E2) and Central (at C2) corridors) as far as Fulstow Top, where the Central Corridor splits to join the Eastern and Western corridors. From Fulstow Top to the pinch-point between Skegness and Burgh le Marsh there are then two corridors, Eastern and Western. At this pinch-point between Skegness and Burgh le Marsh these two merge into one Central Corridor (at section C7).
- 5.6.22 Broadly speaking, from the pinch-point, the one Central Corridor, splits into three (Northern, starting at N1, Central, starting at C8, and Southern, starting at S1) to avoid residential areas. Groupings of constraints, and in some instances, individual constraints were avoided and cut-out of the corridors leading to the creation of cut-outs within corridors. The three corridors predominantly route south-west towards Stickney where the Central Corridor merges with the Northern and Southern corridors. These form a broad complex permutation of options through the middle of the Study Area, set back from the edge of the AONB and populated areas to the north and from the coastal settlements and the NSN and Ramsar sites along the Lincolnshire coast to the south. Between Stickney and Frithville the two corridors continue to route west (sections N5 through N7 and S6) before the Central Corridor returns between the Northern and Southern corridors (Section C14). The three corridors route south-west until Swineshead where the Central Corridor merges with the Northern Corridor. Between Swineshead and Sutterton only the Northern and Southern corridors are present and route south towards Weston Marsh. At Sutterton, these merge into one broad corridor (Central Corridor) to the Weston Marsh siting zones.
- 5.6.23 From Weston Marsh siting zones, the broad Central Corridor splits into three corridors to Walpole from sections C21A and C21B. Groupings of constraints, and in some instances, individual constraints were avoided and cut-out of the corridors leading to the creation of cut-outs within corridors. The broad Central Corridor at Weston Marsh initially splits out into two corridors (Northern and Central) to avoid the areas of Weston and Moulton (skirting to the east and west, respectively), before the Central Corridor splits further into two corridors (Central and Southern) to avoid Fenland Airfield at Section C24. These form a complex permutation of options through the middle of the Overhead Line Study Area, set back from the NSN and Ramsar sites along the Lincolnshire coast to the north-east. From Weston Marsh, the Northern Corridor continues south-east from a pinch-point to the west of Holbech across to the Rive Nene, avoiding Sutton St James and Tydd St Giles. To the south-east of the Airfield, the Central and Southern Corridors converge around Sutton St Edmund before the Central Corridor continues East to Newton and the north of Wisbech and the Southern Corridor continues south-west, ending to the south of Wisbech.

## Appraising 'Close Parallel' Opportunities

### Opportunities with a Close Parallel Alignment

- 5.6.24 In general terms, a close parallel route may have the potential to reduce the overall extent of environmental impacts arising from a project by intensifying the degree of impact on receptors already affected by existing overhead lines, rather than resulting in impacts to areas not affected by existing infrastructure.
- 5.6.25 Whilst the efficacy of close paralleling in reducing environmental impacts would be strongly influenced by local factors (e.g., topography, settlement pattern, woodland cover etc.), the optimum level of benefit is likely to result from lines that, as stated in Holford Rule 6, are planned with pylon types, spans and conductors forming a coherent appearance i.e. where pylons on the different circuits are located directly side by side with very similar span distances and therefore are likely to be less intrusive in side on views, with conductors as a result also being in a similar side by side arrangement. In most circumstances, this is likely to be more achievable the closer the overhead lines are to each other.
- 5.6.26 The minimum distance between lines is determined by technical constraints, safety constraints and ground conditions and would typically be 85 m. The maximum distance at which the benefits of close paralleling might be achieved depends on local factors which are described in more detail below.

### Challenges with a Close Parallel Alignment

- 5.6.27 As mentioned above, the benefit of a close parallel alignment is realised when the pylon types, spans and conductors form a coherent appearance. This is difficult to achieve, as the appearance of the infrastructure can change depending on the direction and level it is being viewed from. It is not always feasible to site pylons adjacent to each other if there are constraints present alongside the existing pylon, and this can also result in an inconsistent span length and pylon heights for the overhead line.
- 5.6.28 There are technical challenges associated with construction of a close parallel alignment, including difficulties with achieving the required offset from the existing overhead line and access where the existing overhead line is already within a constrained working area.
- 5.6.29 In some locations, where constraining features impede a close parallel alignment, there may be a need to cross the existing overhead line. In these circumstances, subject to engineering preference as well as detailed landscape and visual impact assessment, a line swap over, overhead line duck-under or cable duck-under would be required (an example of which is shown in **Figure 5-17**), increasing technical complexity and required permanent infrastructure. As such it can be challenging to accommodate these interactions with existing overhead line assets within proximity to such constraining features. For instance, existing overhead lines may need to be re-routed or require temporary diversions to accommodate a line swap over. In considering whether to take a close parallel route between Weston Marsh and Walpole one option would involve close paralleling the existing 4ZM 400 kV overhead line. A close parallel alignment may also impact on upon residential property and may require permanent acquisition, temporary acquisition of direct oversail of such properties.

Figure 5-17 – Examples of an Overhead Line Duck Under



### Defining Close Parallel Opportunities

5.6.30 Existing 400 kV overhead lines within the Study Area suitable for close parallel need to have pylons of a height and spacing that can likely be matched by the Project. Those identified comprise:

- The existing 400 kV 4ZM overhead line which routes between Bicker Fen and Walpole.
- The existing 400 kV 2WS overhead line which routes from the Spalding substation to the Spalding Tee-Point with the 400 kV 4ZM overhead line.

5.6.31 The process in defining a close parallel corridor needs to be more detailed than, and differs from, that used to define the corridors because it requires the identification of potential alignments rather than just corridors to better understand the technical

complexity, costs, viability and in-combination impacts. There is therefore a more detailed level of technical work required to determine potential feasibility.

- 5.6.32 For the existing 400 kV 4ZM overhead line between Weston Marsh and Walpole, potential close parallel preliminary engineering alignments were identified at Step 5 to inform the subsequent options appraisal of corridors at Step 7 to ensure technical constraints, such as crossings of existing overhead lines, were considered.

## Substation Siting Zones and Siting Areas

### New Grimsby West Substation

#### New Grimsby West Substation - Steps 4 and 5

- 5.6.33 Upon review, due to the size of the Grimsby West Study Area it was considered that it effectively constituted a siting zone. Therefore, it was considered appropriate to instead identify potential siting areas within this siting zone (herein referred to as the 'Grimsby West Zone'). The identification of potential Grimsby West siting areas was undertaken taking into consideration the required land take, distribution of environmental, socio-economic and technical constraints, and the Holford and Horlock Rules as detailed below.
- 5.6.34 As outlined in **Chapter 2**, an AIS substation (larger than a GIS substation) for the new Grimsby West substation could extend to approximately 600 m by 200 m (approximately 12 ha) dependent upon the number of connections required. Based on this broad technical parameter, landscape specialists, using GIS mapping software and working with other members of the project team, identified potential siting areas within the Grimsby West Zone. The siting areas identified were sufficient in size for siting of the new Grimsby West substation and to allow for any required micro-siting at subsequent stages such that, as far as reasonably possible, they met the following criteria:
- Avoid sites of high amenity, cultural or environmental value;
  - Avoid sites close to larger settlements (where reasonably possible);
  - Seek to identify an area where the effect on local features (such as mature hedgerows and tree belts) is as low as reasonably practicable;
  - Avoid areas that risk affecting surface or ground water sources, and sites at risk of flooding (where reasonably possible);
  - Seek areas where local screening (e.g. woodlands) could be used to reduce the degree of intrusion; and
  - Seek areas with sufficient space around to allow for mitigation planting and/or landform.
- 5.6.35 In addition, the following issues which may lead to additional environmental effects were considered:
- Access: where possible seek areas in proximity to A-roads or B-roads or potential to develop access, for large indivisible loads, to minimise the risk of off-site effects from road improvements; and
  - Connections (see **Figure 2-9**): consider the likely overhead line or underground cable connection approaches to siting areas, and the potential effects of these

(noting that these must be weighed in the balance when selecting a preferred option). These include new connections and potential modifications required to the existing electricity transmission and distribution infrastructure (existing 400 kV 4ZM overhead line and existing Grimsby West NGET 400 kV and NPG 132 kV substations).

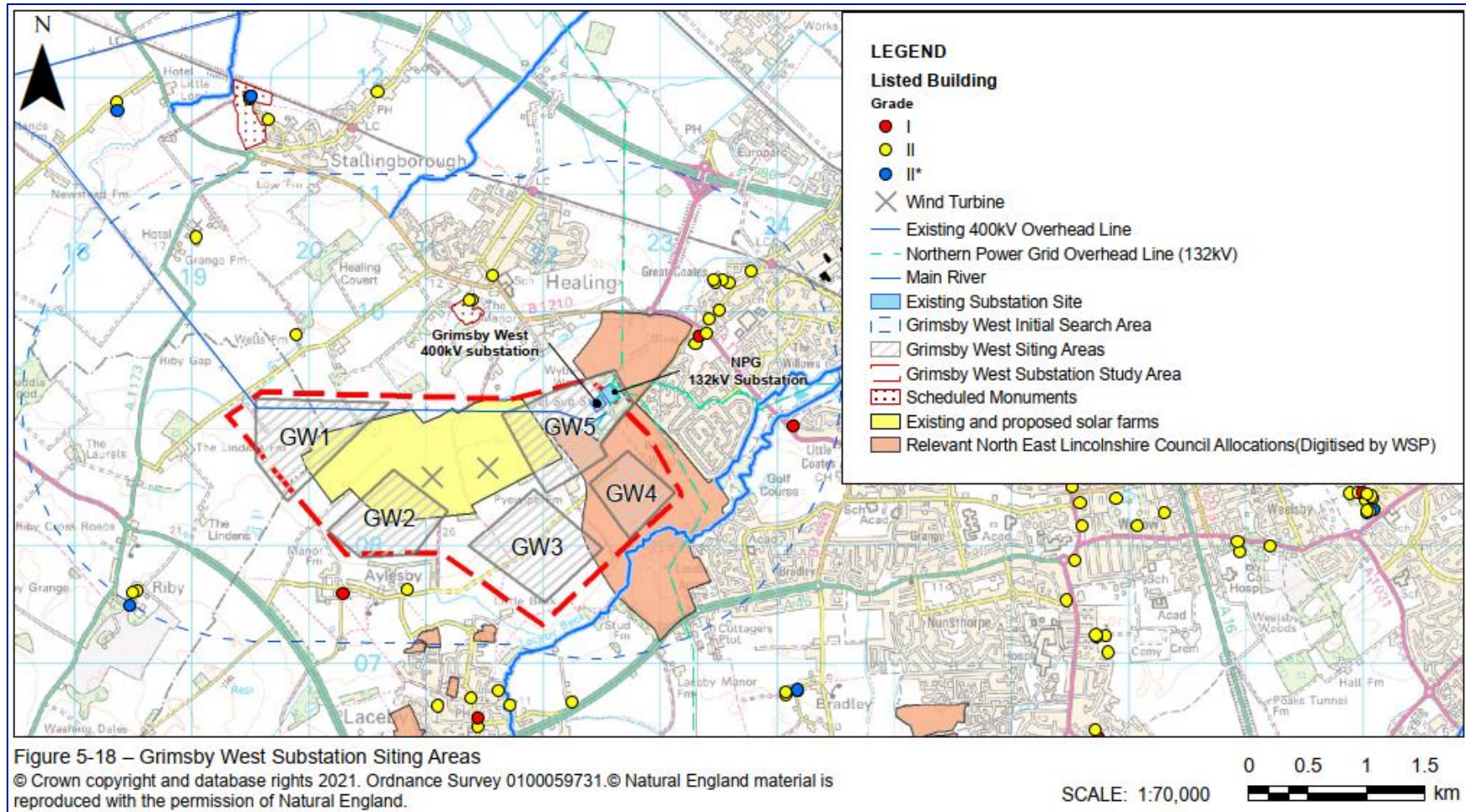
- 5.6.36 The presence of brownfield land was considered as NGET seek areas of previously developed land ahead of greenfield sites where possible, particularly to reduce effects on ground conditions and the water environment. However, no areas of vacant or available brownfield land were identified within the Grimsby West Zone.
- 5.6.37 The definition of the Grimsby West Zone has avoided most environmental features. Therefore, the identification of potential siting areas was driven by proximity to existing transmission infrastructure and the presence of existing wind turbines, the proposed Aura Power Solar Farm, the residential property at Pyewipe Farm and blocks of woodland. Taking these into consideration, five siting areas were identified, from west to east these are:
- Siting area GW1 – an area, approximately 800 m by 1,200 m, located north-west of Aylesby and existing wind turbines which encompasses the existing 400 kV 4KG overhead line to the north;
  - Siting area GW2 – an area, approximately 800 m by 600 m, located immediately north of Aylesby and south of existing wind turbines;
  - Siting area GW3 – an area, approximately 800 m by 700 m, located east of Aylesby and north-east of Laceby, Aylesby Road travels through the centre;
  - Siting area GW4 – an area, approximately 600 m by 500 m, located west of Wybers Wood and immediately north of Laceby Beck, Aylesby Road travels through the north-west; and
  - Siting area GW5 – an area, approximately 900 m by 600 m, located west of Wybers Wood which encompasses the existing 400 kV overhead line, and NGET and NPG substations at Grimsby West.

#### New Grimsby West Substation - Step 6

- 5.6.38 The identified siting areas were then subject to a back-check and review and further analysis by the project team. The review considered information gathered from the environment and technical site visits (ground-truthing key issues during the desk studies) and further design and construction issues identified by the technical teams. The review resulted in the removal of siting area GW4 as it was identified that the siting area was wholly covered by a local plan housing allocation for the Grimsby West Urban Extension (GWUE).
- 5.6.39 The other identified siting areas for Grimsby West taken forward to Options Appraisal are shown on **Figure 5-18**.



Figure 5-18 – Grimsby West Siting Areas and Key Environmental Features



## Lincolnshire Connection Substations

### Lincolnshire Connection Substations – Step 4 and 5

- 5.6.40 The identification of potential siting zones for the LCS (LCS-A and LCS-B), was undertaken, taking into consideration the required land take of each new LCS and other customer or planned transmission connection infrastructure distribution of environmental, socio-economic and technical constraints, and the Holford and Horlock Rules as detailed below and described within **Chapter 2**.
- 5.6.41 LCS-A and LCS-B will be new points on the network where connections for customers and other transmission links can be made, and therefore will act as an attractor to customers and their required infrastructure for a connection to the network. As detailed in **Chapter 2**, a new 400 kV transmission line will connect the new Grimsby West substation to LCS-A, LCS-A to LCS-B, and LCS-B to the new Walpole substation via a new substation at Weston Marsh. This will form four separate sections of 400 kV transmission line that will constitute a continuous 400 kV route from Grimsby West to Walpole, connecting LCS-A, LCS-B and Weston Marsh to each other and to the wider 400 kV transmission network. This customer and other planned transmission infrastructure does not form part of the Project and separate consents will be required by these projects for substations or converter stations and cables for their projects connecting to LCS-A and LCS-B. Although their project infrastructure does not form part of the Project, as each LCS will likely act as an attractor the capacity to accommodate this (customer and other planned transmission) infrastructure in the vicinity of LCS-A and LCS-B has been given consideration when identifying potential siting zones.
- 5.6.42 As detailed in **Chapter 2**, the exact configuration of the connections to each of LCS-A and LCS-B is still subject to change. Therefore, for the purposes of the current stage of the Project, to seek a coordinated approach (in line with NPS EN-5 Paragraph 2.13.16), and to inform the siting work, a reasonable worst-case assumption has been made for the customer infrastructure (including temporary and permanent works) connecting at LCS-A and LCS-B. It is assumed that approximately 60 ha of customer substation or converter station infrastructure could connect at LCS-A and approximately 60 ha at LCS-B (120 ha for LCS-A and LCS-B combined). This infrastructure is assumed to be located within approximately 4 km of LCS-A and LCS-B, although this will be subject to other developers' own siting work and the decisions, they will make on location preferences.
- 5.6.43 As detailed in **Chapter 2**, it is anticipated that each new AIS LCS could extend approximately 700 m by 200 m (approximately 14 ha) dependent upon the confirmed configuration of the number of connections required. Each new LCS, would also require permanent access together with peripheral landscaping, drainage, and other related works.
- 5.6.44 In addition to LCS-A, LCS-B and substation or converter station infrastructure for other projects, connections between the infrastructure, permanent accesses, drainage, landscaping and mitigation would be required for this associated infrastructure. The area which would be required for these aspects is assumed to be approximately 25% of the combined areas of LCS-A, LCS-B and substation or converter station (for customer and other planned transmission projects) infrastructure. For the purposes of the current stage of the Project and to inform the siting work, it is assumed that an area of approximately 19 ha is required for LCS-A and approximately 19 ha at LCS-B for these additional works (38 ha for both LCS-A and LCS-B combined).

- 5.6.45 For the purposes of siting, siting zones have been identified to accommodate the reasonable worst-case (in terms of surface area) of required infrastructure at each of LCS-A and LCS-B taking into consideration other factors detailed in **Paragraph 5.6.44**. This was undertaken to ensure good sites, large enough to accommodate the infrastructure for either LCS-A or LCS-B, but not large enough to accommodate both LCS-A and LCS-B, were not missed. However, it should be noted that the following detailed design, one of LCS-A or LCS-B sites will have a smaller area overall once the configuration of incoming connections is confirmed through ongoing system design work.
- 5.6.46 The identification of potential siting zones sought to identify relatively unconstrained areas of at least 93 ha, which accounts for:
- siting of either LCS-A or LCS-B (approximately 14 ha);
  - siting of associated LCS-A or LCS-B customer and other planned transmission infrastructure (approximately 60 ha); and
  - spacing between each of the individual infrastructure elements to account for factors such as making land unviable for agricultural use or other previous uses following completion of construction, by connections between infrastructure, orientation of connections and infrastructure, permanent accesses and likely drainage (approximately 19 ha).
- 5.6.47 Preliminary examination of the heat maps and the GIS datasets identified a long-list of 19 relatively unconstrained areas within the LCS Study Area of at least 93 ha. These were identified to assist the environmental specialists in identifying preliminary siting zones. Environmental specialists undertook a high-level appraisal to gauge the level of environmental sensitivity likely to be associated with each area. This analysis took account of factors including:
- the presence of any potentially valuable landscape features;
  - the presence of sites of high amenity, cultural or environmental value;
  - the proximity of adjacent settlements and residential properties and, where relevant, listed buildings;
  - the availability of existing local screening features (e.g., woodland) to reduce the degree of visual intrusion;
  - the presence of sensitive surface or ground water sources, and sites at risk of flooding;
  - the broad nature of adjacent roads to minimise the risk of off-site effects from road improvements; and
  - the scope for mitigation planting and/or landform.
- 5.6.48 Consideration was also given to the potential length of connections (see **Figure 2-10**) to the LCS from potential landfall areas, based upon historical and publicly available information from other projects in the area and both onshore and offshore studies conducted by third parties. In order to seek a coordinated approach in line with NPS EN-5 (Paragraph 2.13.16).
- 5.6.49 The presence of brownfield land was considered as NGET seek areas of previously developed land ahead of greenfield sites where possible, particularly to reduce effects on ground conditions and the water environment. However, despite informal

consultation with the relevant local council on potential sites, no areas of vacant or available brownfield land suitable for the required infrastructure parameters were identified within the LCS Study Area.

5.6.50 Review of the 19 relatively unconstrained areas identified that some were contiguous and some very close to each other. Where this was the case, the relatively unconstrained were grouped, resulting in 10 LCS siting zones in total for consideration at Options Appraisal. From north to south these are:

- Siting zone LCS1 – an area, approximately 2 km by 2 km, located north-east of South Cockerington and generally east of (partially overlapping) North Cockerington.
- Siting zone LCS2 - an area, approximately 2.9 km by 2 km, located east of Grimoldby and Manby, it encompasses the B1200 which routes east to west across the siting zone.
- Siting zone LCS3 - an area, approximately 2.5 km by 1.9 km, located east of Great Carlton and north of Gayton le Marsh.
- Siting zone LCS4 – an area, approximately 1.6 km by 1.4 km, located south of Little Carlton, south-west of Great Carlton, north-east of Castle Carlton and north of South Reston.
- Siting zone LCS5 - an area, approximately 2 km by 1.1 km, located south-west of Woodthorpe, north-west of Galley Hill and north of Greenfield Wood/Mother Wood.
- Siting zone LCS6 - an area, approximately 2.7 km by 2.1 km, located south of Beesby, north of Thoresthorpe and immediately east of Saleby (Saleby is encompassed within the siting zone), it encompasses the A1120 which routes along the western edge of the siting zone.
- Siting zone LCS7 – an area, approximately 3.3 km by 2 km, located south of Galley Hill, west of Saleby, north of Tothby (encompassed within the siting zone) and Alford) and east of Greenfield Wood/Mothers Wood, it encompasses the A1120 which routes along the eastern edge of the siting zone.
- Siting zone LCS8 - an area, approximately 3.6 km by 2.6 km, located south of Markby, encompasses Asserby, east of Huttoft and north of Thurlby, it encompasses the A1111 which routes north to south along the western edge of the siting zone.
- Siting zone LCS9 - an area, approximately 2.4 km by 1.5 km, located south of Alford, east of Farlethorpe and west of Mawthorpe, it encompasses the B1196 which routes north to south long the western edge of the siting zone.
- Siting zone LCS10 – an area, approximately 3.1 km by 2.1 km, located south-east of Willoughby, encompasses Sloothby, north of Boothby and east of Welton Low Wood.

#### Lincolnshire Connection Substations – Step 6

5.6.51 Following site visits, two additional siting zones were identified, and a change to siting zone LCS7 was deemed necessary:

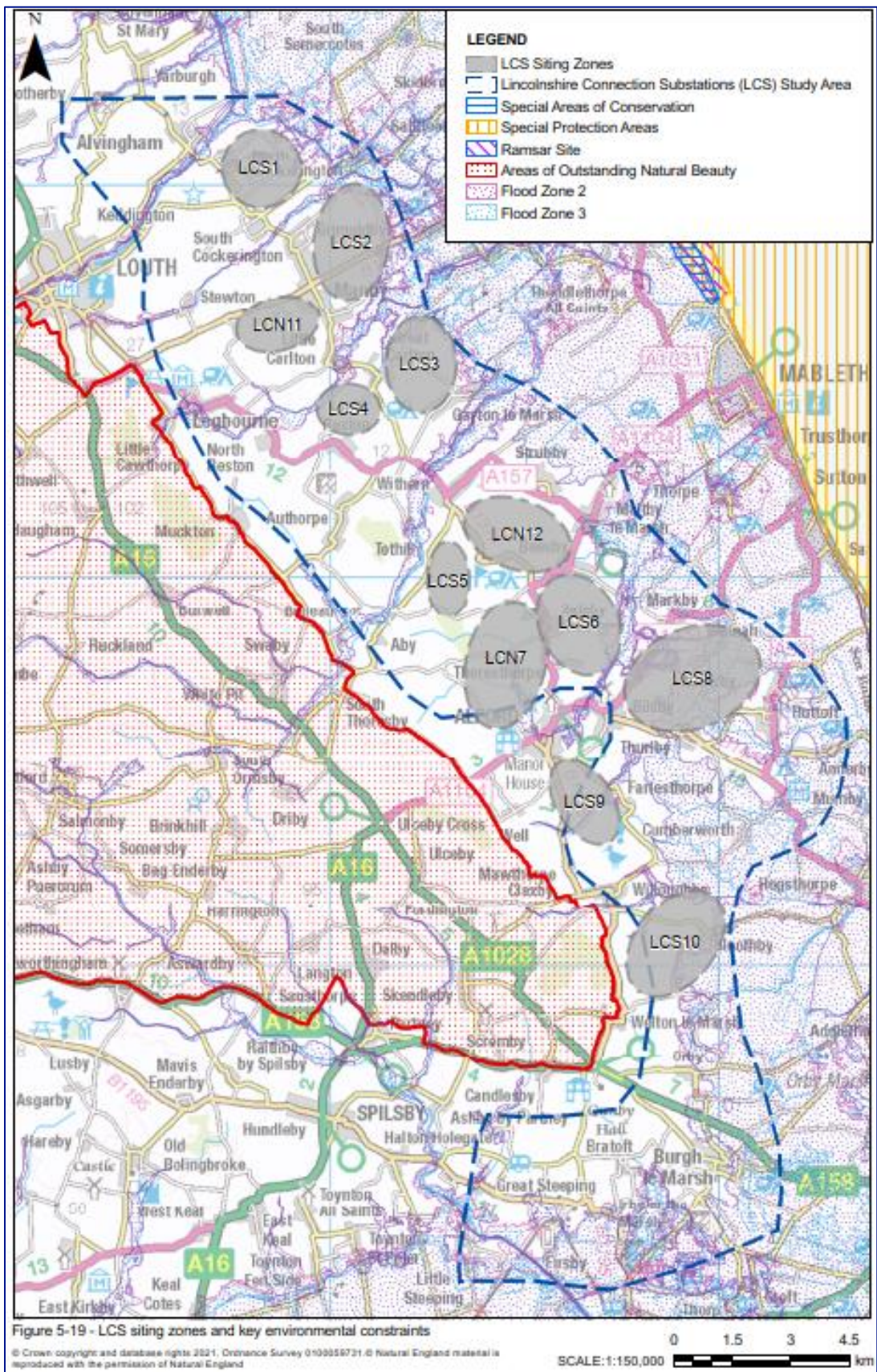
- Addition of siting zone LCS11 - an area, approximately 2.2 km by 1.4 km, located directly west of Manby and north-east of Little Carlton, it encompasses Manby Showground and the B1200 routes from west to east along the northern edge of the siting zone.

- Addition of siting zone LCS12 - an area, approximately 2.8 km by 1.7 km, located south-west of Strubby, south-west of Maltby le Marsh, north-west of Beesby, north-east of Woodthorpe, it encompasses the B1373 which routes south-east to north-west in the west of the siting zone.
- Amendments to the shape of siting zone LCS7 to encompass a relatively unconstrained area further north towards Galley Hill.

5.6.52 These additional LCS siting zones alongside the LCS siting zones LCS1 to LCS10 were taken forward for Options Appraisal. These LCS siting zones are shown in **Figure 5-19**.

5.6.53 It is noted that although some of the LCS siting zones contain settlements (e.g. LCS1 partially overlaps with North Cockerington) these areas are assumed to be excluded as part of the Options Appraisal.

Figure 5-19 – LCS Siting Zones and Key Environmental Features



## New Weston Marsh Substation

### New Weston Marsh Substation – Steps 4 and 5

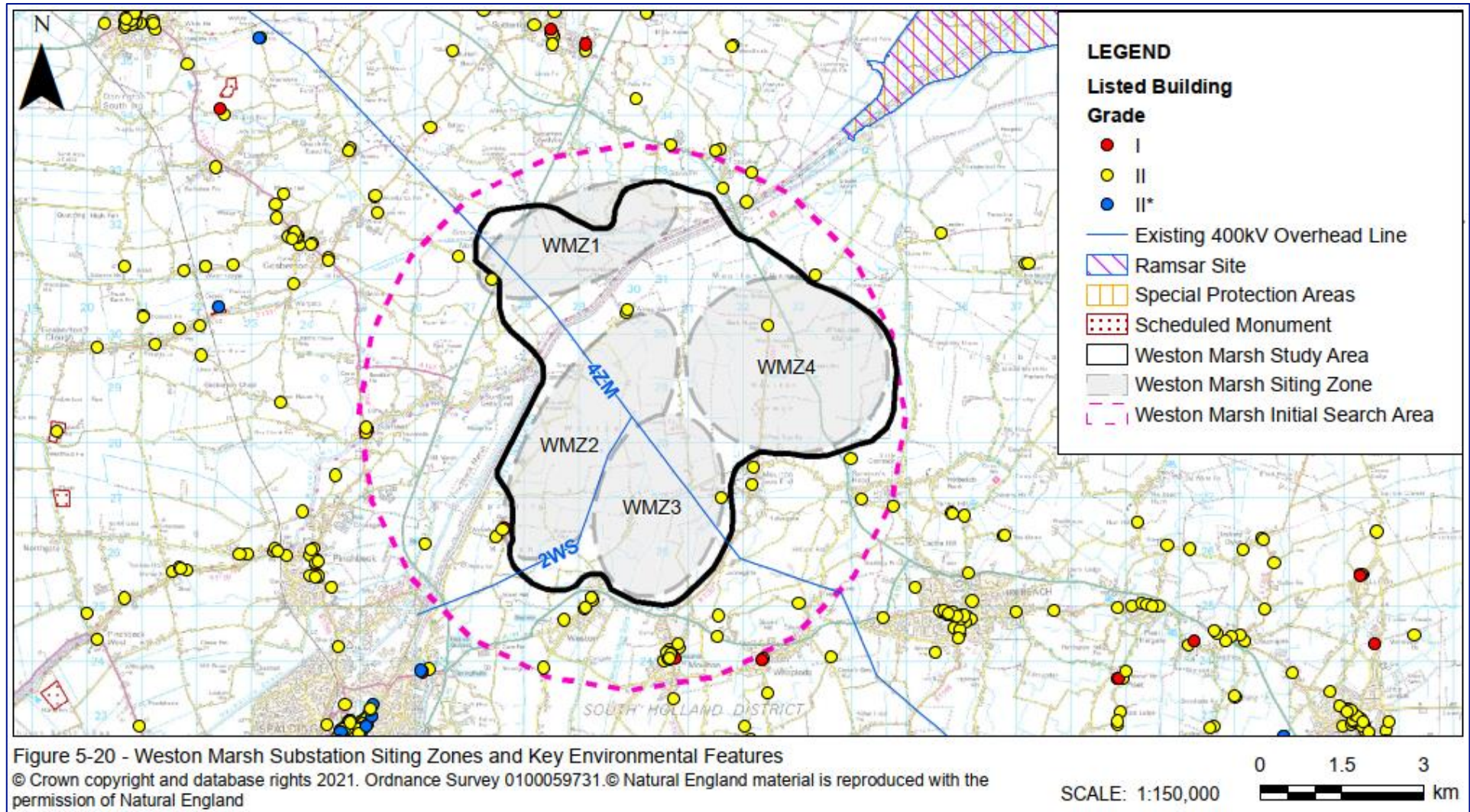
- 5.6.54 The identification of potential Weston Marsh siting zones took into consideration the required land take, distribution of environmental, socio-economic and technical constraints, and the Holford and Horlock Rules as detailed below.
- 5.6.55 As outlined in **Chapter 2**, an AIS substation at Weston Marsh could extend to approximately 700 m by 200 m (approximately 14 ha) dependent upon the number of connections required. Based on this broad technical parameter, landscape specialists, using GIS and working with the project team, identified potential siting zones within the Weston Marsh Study Area. The siting zones identified were sufficient in size for siting of the new Weston Marsh substation and to allow for any required micro-siting at subsequent stages such that, as far as reasonably possible, they met the following criteria:
- Avoid sites of high amenity, cultural or environmental value;
  - Avoid sites close to larger settlements (where reasonably possible);
  - Seek to identify an area where the effect on local features (such as mature hedgerows and tree belts) is as low as reasonably practicable;
  - Avoid areas that risk affecting surface or ground water sources (where reasonably possible); and
  - Seek areas where local screening (e.g. woodlands) could be used to reduce the degree of intrusion;
  - Seek areas with sufficient space around to allow for mitigation planting and/or landform.
- 5.6.56 In addition, the following issues which may lead to additional environmental effects were considered:
- Access: where possible seek areas in proximity to A-roads or B-roads or potential to develop access, for large indivisible loads, to minimise the risk of off-site effects from road improvements; and
  - Connections (see **Figure 2-12**): consider the likely overhead line or underground cable connection approaches, and the potential effects of these (noting that these must be weighed in the balance when selecting a preferred option). These include new connections and potential modifications required to the existing electricity transmission infrastructure (existing 400 kV 4ZM and 2WS overhead lines).
- 5.6.57 The presence of brownfield land was considered as NGET seek areas of previously developed land ahead of greenfield sites where possible, particularly to reduce effects on ground conditions and the water environment. However, no areas of vacant or available brownfield land were identified within the Weston Marsh Study Area.
- 5.6.58 The definition of the Weston Marsh Study Area already avoided many of the features identified at Step 1. Therefore, the identification of potential siting zones was driven by the presence of scattered residential properties, blocks of woodland, a dense drainage network, and proximity to the Spalding Tee-Point as detailed within **Chapter 2**. Taking these factors into consideration four siting zones were identified. From west to east these are:

- Siting zone WMZ1 - an area, approximately 3.8 km by 1.7 km, located north of the River Welland. The Risegate Eau waterbody travels through the siting zone from north-west to south-east, and the A16 and existing 400 kV 4ZM overhead line travel through the western extent of the siting zone;
- Siting zone WMZ2 – an area, approximately 5.2 km by 2.1 km, located east of the River Welland (which is at the western extent of the siting zone) and at the Spalding Tee-Point. The existing 400 kV 4ZM and 2WS overhead lines travel through centre and east (respectively) of the siting zone;
- Siting zone WMZ3 – an area, approximately 3.4 km by 2.3 km, located adjacent to the Spalding Tee-Point. The existing 400 kV 4ZM overhead line travels through the centre of the siting zone and the existing 400 kV 2WS overhead line is adjacent to the east of the siting zone; and
- Siting zone WMZ4 – an area, approximately 3.2 km by 3.7 km, located north-east of the Spalding Tee-Point. The B1357 and A17 route through the centre of the siting zone from north to south.

5.6.59 The identified siting zones for the new Weston Marsh substation are shown on **Figure 5-20**.



Figure 5-20 – Weston Marsh Siting Zones and Key Environmental Features



## New Weston Marsh Substation – Step 6

- 5.6.60 Following site visits no changes were deemed necessary to the identified preliminary siting zones at Weston Marsh. These siting zones were then taken forward to Options Appraisal.

## New Walpole Substation

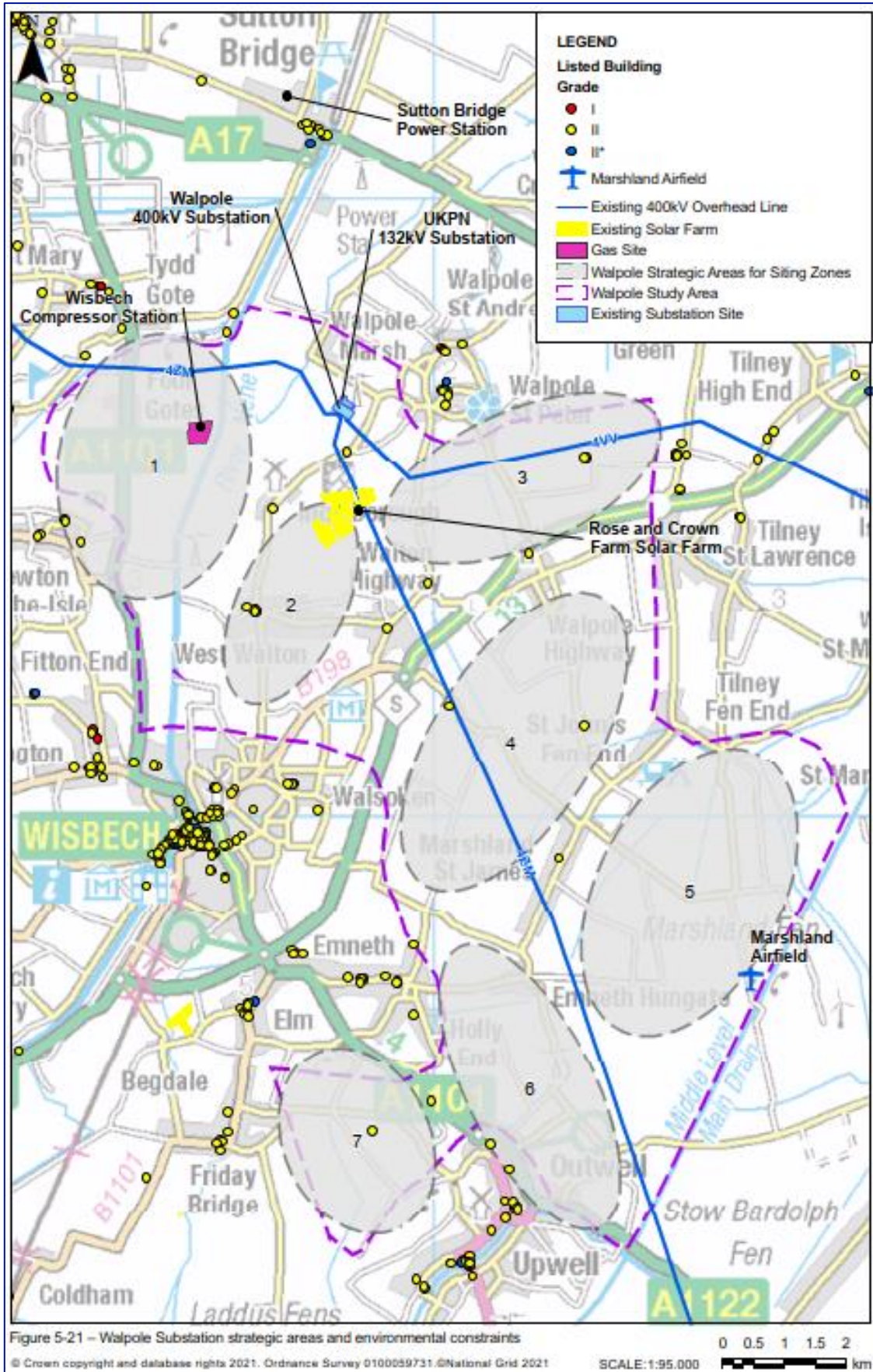
### New Walpole Substation – Steps 4 and 5

- 5.6.61 The identification of potential Walpole siting zones took into consideration the required land take, distribution of environmental, socio-economic and technical constraints, and the Holford and Horlock Rules as detailed below.
- 5.6.62 As detailed in **Chapter 2**, the new Walpole substation will be a new point on the network where connections can be made, and therefore will act as an attractor for connections to the network. The planned transmission connection infrastructure (EGL 3 and EGL 4 projects) does not form part of the Project and separate consents will be required by each project for substations or converter stations and cables for their project/s connecting to the new Walpole substation. Although this connection infrastructure does not form part of the Project, as the new Walpole substation acts as an attractor and in seeking a coordinated approach (in line with NPS EN-5 Paragraph 2.13.16), the capacity to accommodate this infrastructure in the vicinity of the new Walpole substation has been given consideration.
- 5.6.63 As detailed in **Chapter 2**, the additional connection infrastructure (alongside the new Walpole 400 kV substation) required in proximity to the new Walpole substation comprises the EGL 3 and EGL 4 projects. It is assumed that approximately 20 ha of infrastructure for converter stations is required in proximity to the new Walpole substation.
- 5.6.64 As detailed in **Chapter 2**, it is anticipated that the new AIS Walpole substation could extend approximately 800 m by 200 m (approximately 16 ha) dependent upon the number of connections required. The new Walpole substation would also require permanent access together with peripheral landscaping, drainage, and other related works.
- 5.6.65 In addition to the new Walpole substation, EGL 3 and EGL 4 converter station infrastructure, connections between the infrastructure, permanent accesses, drainage, landscaping and mitigation would be required. The area which would be required for these aspects is assumed to be approximately 25% of combined areas of the new Walpole substation, EGL 3 and EGL 4 converter station infrastructure. For the purposes of the current stage of the Project and to inform the siting work, it is assumed that an area of approximately 9 ha is required.
- 5.6.66 For the purposes of siting, siting zones have been identified to accommodate the reasonable worst-case of required infrastructure for the new Walpole substation, EGL 3 and EGL 4 infrastructure taking into consideration other factors detailed in **Paragraph 5.6.65**.
- 5.6.67 The identification of potential siting zones sought to identify relatively unconstrained areas of at least 45 ha which accounts for:
- siting of the new Walpole substation (approximately 16 ha);

- siting of EGL 3 and EGL 4 infrastructure (approximately 20 ha); and
- spacing between each of the individual infrastructure elements to account for factors such as sterilised land by connections between infrastructure, orientation of connections and infrastructure, permanent accesses and likely drainage (approximately 9 ha).

5.6.68 Preliminary examination of the heat maps and the GIS datasets identified a long-list of over 50 relatively unconstrained areas of at least 45 ha. Review of these areas identified that some were contiguous and some very close to each other. Where this was the case, they were grouped into seven strategic areas, see **Figure 5-21**, to assist the environmental specialists in identifying preliminary Walpole siting zones.

Figure 5-21 – Walpole Strategic Areas and Key Environmental Features



5.6.69 Environmental specialists and the FEED Contractor undertook a high-level appraisal to gauge the level of environmental sensitivity and technical complexity likely to be associated with each area. This comparative appraisal is presented in **Table 5-4**. The high-level appraisal took account of factors including:

- A. Opportunities to limit the length of 400 kV overhead line required to achieve the required connections;
- B. Opportunities to limit the length of underground cable required to achieve the EGL 3 and EGL 4 project connections;
- C. Proximity to the A-road and B-road networks;
- D. Opportunities to site outside of Flood Zone 2 and Flood Zone 3;
- E. Opportunities to limit crossings of existing above ground infrastructure (e.g. railways, roads and overhead lines) to achieve the required connections; and
- F. Opportunities to limit crossings of existing underground infrastructure (e.g. cables and pipelines) and watercourses to achieve the required connections.

Table 5-4 – Walpole Strategic Area –Comparative Appraisal

<b>Opportunity</b>	<b>Comparative Appraisal</b>
<b>Opportunity A</b>	<p>The locations of Strategic Areas 1, 2, and 3 to the north and north-west of the Study Area would allow the opportunity to limit the length of the overhead line connections from Weston Marsh.</p> <p>Those Strategic Areas located further south and east (Strategic Areas 4 to 7) would likely result in longer overhead line connections from Weston Marsh and therefore do not meet this opportunity. Those Strategic Areas which would likely lead to the longest overhead line connections from Weston Marsh are Strategic Areas 5 and 6.</p>
<b>Opportunity B</b>	<p>The locations of Strategic Areas 1, 2, and 3 to the north and north-west of the Study Area would allow the opportunity to limit the length of the underground cable connections from the Lincolnshire coastline to the north of Skegness (it is assumed that the EGL 3 and EGL 4 projects will make landfall between Grimsby and Skegness).</p> <p>Those Strategic Areas located further south and east (Strategic Areas 4 to 7) would likely result in longer overhead line connections from Weston Marsh and therefore do not meet this opportunity. Those Strategic Areas which would likely lead to the longest underground cable connections.</p>
<b>Opportunity C</b>	<p>Strategic Areas 1, 3, 6 and 7 are located on, or directly adjacent to an A-road or B-road and therefore would allow the opportunity to limit the length of new permanent and/or temporary road construction. Strategic Areas 2, 4 and 5 are not located on, or directly adjacent to an A-road or B-road. Strategic Area 5 is located furthest from an A-road or B-road.</p>
<b>Opportunity D</b>	<p>All Strategic Areas, except for Strategic Area 7, are situated within areas of Flood Zone 2 and 3. Therefore only Strategic Area 7 offers the opportunity to site outside of Flood Zone 2 and 3.</p>
<b>Opportunity E</b>	<p>All Strategic Areas would require crossing of an existing 132 kV overhead line. Strategic Areas 1 and 2 are likely to require the least crossings of</p>

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<b>Opportunity</b>	<b>Comparative Appraisal</b>
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existing above ground infrastructure. Strategic Areas 6 and 7 are likely to require additional crossings compared to Strategic Areas 1 and 2 (crossings of additional A-roads and B-roads and an additional 132 kV overhead line). Strategic Areas 3, 4 and 5 are likely to require the most crossings, including additional A-roads, B-roads, 132 kV overhead lines and the existing 400 kV 4ZM (between Burwell to Walpole) overhead line.

<b>Opportunity F</b>	<p>There are existing pipelines (primarily oil and gas) in the wider area which may require multiple crossings for Strategic Areas 3, 4 and 5.</p> <p>Strategic Area 1, subject to detailed routeing, may not require crossing existing pipelines. Strategic Areas 2, 6 and 7 would offer the opportunity to limit the number of existing pipeline crossings.</p> <p>All Strategic Areas require crossing North Level Main drain and all Strategic Areas except for Strategic Area 1 would require crossing the River Nene. The Strategic Areas to the south and east (4, 5, 6 and 7) will increase the number of drain and watercourse crossings as additional lengths of infrastructure will be required.</p>
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5.6.70 The outcome of this work identified that Strategic Area 1, Strategic Area 2 and Strategic Area 7 offered comparatively better opportunities than the other Strategic Areas and would be the focus of the siting work for the new Walpole substation. Although they are in Flood Zone 3, Strategic Areas 1 and 2 offer the opportunity to limit the length of 400 kV overhead line, underground cable (both of which would likely be routeing south-east from the north-west), crossings of existing above ground infrastructure, existing underground infrastructure and watercourses when compared to the other strategic areas. Strategic Area 7, although likely to be comparatively longer than most other strategic areas offered the opportunity to site outside of Flood Zone 2 and Flood Zone 3.

5.6.71 Within the Strategic Areas taken forward following high-level appraisal detailed above, a preliminary examination of the heat maps and the GIS datasets identified a list of nine relatively unconstrained areas of at least 45 ha. These were identified to assist the environmental specialists in identifying preliminary siting zones. Environmental specialists undertook a further high-level appraisal to gauge the level of environmental sensitivity likely to be associated with each area. This analysis sought to identify siting zones such that, as far as reasonably possible, they met the following criteria:

- Avoid sites of high amenity, cultural or environmental value;
- Avoid sites close to larger settlements (where reasonably possible);
- Seek to identify an area where the effect on local features (such as mature hedgerows and tree belts) is as low as reasonably practicable;
- Avoid areas that risk affecting surface or ground water sources, and sites at risk of flooding (where reasonably possible);
- Seek areas where local screening (e.g. woodlands) could be used to reduce the degree of intrusion; and
- Seek areas with sufficient space around to allow for mitigation planting and/or landform.

- 5.6.72 In addition, consideration was given to the broad nature of adjacent roads to minimise the risk of off-site effects from road improvements and to the presence of brownfield land. No areas of vacant or available brownfield land suitable for the required infrastructure parameters were identified within the Walpole Study Area.
- 5.6.73 The identified nine relatively unconstrained areas were identified as potential siting zones and taken forward to Step 6.

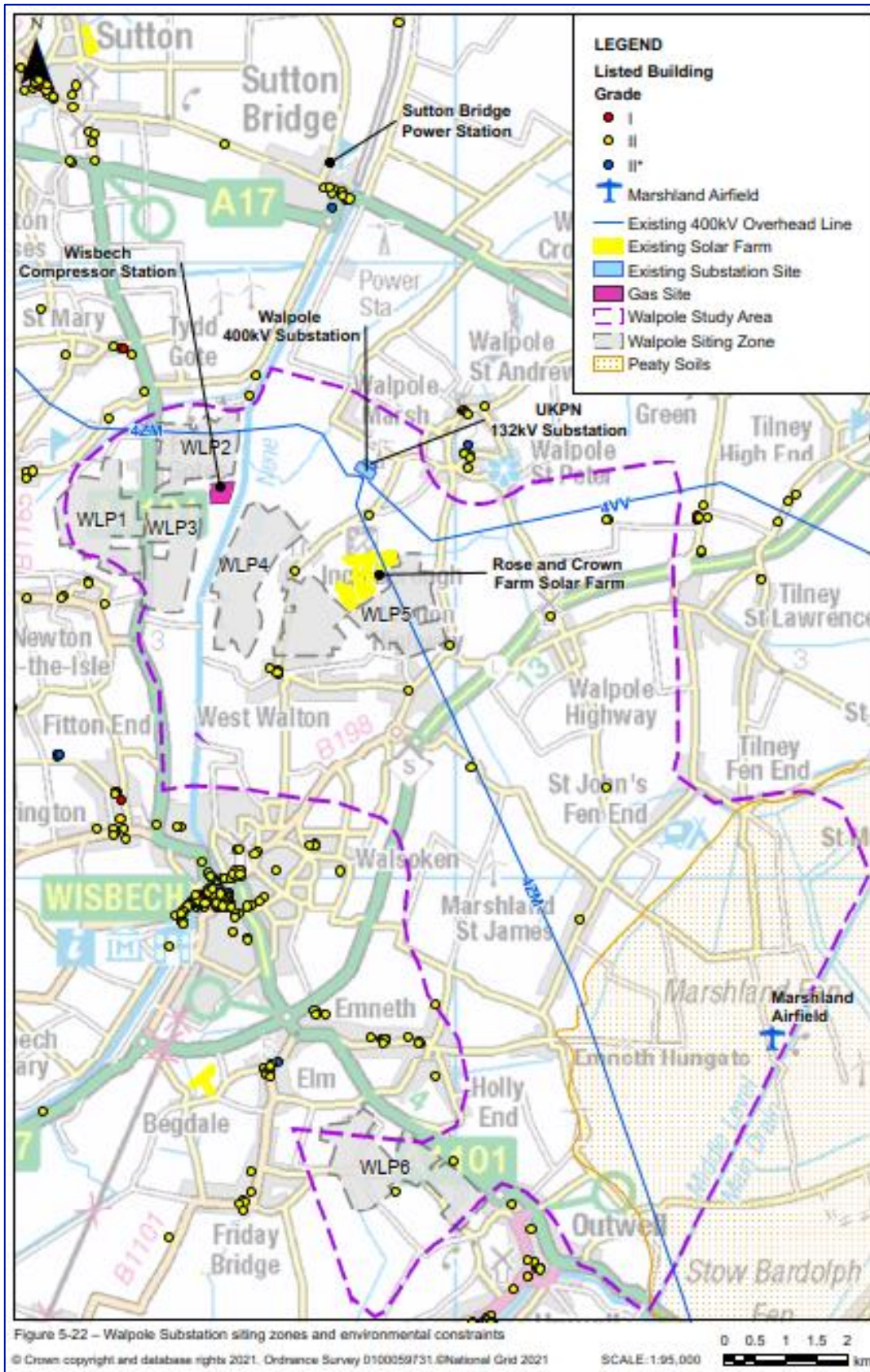
#### New Walpole Substation – Step 6

- 5.6.74 The identified nine relatively unconstrained areas were then subject to a review and further analysis by the project team. The review considered information gathered from the environment and technical site visits (ground-truthing key issues during the desk studies) and further design and construction issues identified by the technical teams. The review resulted in the removal of two areas and amendment to two areas these comprise:
- removal of a siting zone located immediately south-west of Walpole Marsh due to the significant technical complexity of siting, and routeing into, the siting with four existing 132 kV or 400 kV overhead lines present;
  - removal of a siting zone located south-west of West Walton due to the potential significant adverse landscape and visual effects resulting from diversions of the existing 400 kV 4ZM overhead line (which would likely require either encircling West Walton or addition of two new overhead lines south of West Walton and Walton Highway; and
  - Grouping of two identified areas located immediately south of the existing Rose and Crown Farm Solar Farm.
- 5.6.75 Following this review, the identified siting zones for the new Walpole substation for consideration at Options Appraisal, as shown on **Figure 5-22**, were taken forward for appraisal.
- 5.6.76 From north to south the siting zones are:
- Siting zone WLP1 – an area within strategic area one, approximately 1.8 km by 1.4 km, located west of the A1101, south-east of the North Level Main Drain and north of Newton.
  - Siting zone WLP2 - an area within strategic area one, approximately 1.3 km by 1.1 km, located west of the River Nene, east of the A1101, north-west of the Wisbech Compressor Station and south-west of Foul Anchor.
  - Siting zone WLP3 - an area within strategic area one, approximately 1.7 km by 0.9 km, located west of the River Nene, east of the A1101 and Newton, north-west of the Wisbech Compressor Station and south-west of Foul Anchor.
  - Siting zone WLP4 – an area within strategic area two, approximately 2.5 km by 0.9 km, located east of the River Nene, south-east of the existing Walpole substation and north-west of West Walton.
  - Siting zone WLP5 - an area within strategic area two, approximately 2.7 km by 1.5 km, located directly south of the Rose and Crown Farm solar farm, north of Walton Highway and West Walton, the existing 400 kV 4ZM between Burwell and Walpole routes north south through the centre of the siting zone.

- Siting zone WLP6 - an area within strategic area seven, approximately 2.5 km by 1.6 km, located south-west of Emneth, north-east of Outwell and east of Friday Bridge.



Figure 5-22 – Walpole Siting Zones and Key Environmental Features



## 5.7 Mitigation of impacts through avoidance

5.7.1 The Study Area, corridors, siting zones and siting areas defined through the above process are effectively the first two stages of an iterative process looking at features which represent constraints at an increasingly smaller scale. They were designed to comply with Holford Rules 1 and 2 and Horlock Rule 2, avoiding the major areas of highest amenity value altogether, where practicable, and allowing room within the corridors to avoid smaller areas of high amenity value by local deviation. This approach seeks to minimise environmental impacts from the outset. The main constraints which influenced the formation of the corridors, siting zones and siting areas and whether they have been avoided by this process, are listed in **Table 5-5**.

Table 5-5 – Major Features Representing Constraints within the Study Area

Topic	Constraint Type and Name	Avoided by Corridors, Siting Zones, and Siting Areas
Ecology	Site of Special Scientific Interest (SSSI): Tetney Blow Wells, Muckton Wood SSSI, Sea Bank Clay Pits, Willoughby Meadow, Bratoft Meadows, The Wash	Avoided
	Ancient woodland (12)	Avoided (8), partially within corridors (three - small portions of Tothill/Claythorpe Woods, Hornby/Mother Woods, and Rigsby Wood) and partially within Siting Zones (1 - Withern Wood)
Economic Activity	Wind Farms (14)	Avoided (12), partially within corridors (2 - Gayton Le Marsh Wind Farm and Hollies Wind Farm)
	Solar Farms (17)	Avoided (13), partially within corridors (4 - The Hollies Solar Park – Skegness, Laceby Solar Farm, Yarbrugh Grove Farm, and Rose and Crown Farm Solar Farm)
	Golf Courses (16)	Avoided (12), partially within corridors (3 - Waltham Windmill Golf Club, Tydd St Giles Golf and Country Club, and Tetney Golf Club), and partially within Siting Zones (1 - Woodthorpe hall 18 Hole Affiliated Golf Course)
	Nationally Significant Infrastructure Project (5)	Avoided (2), partially within corridors and siting zones/areas (3– Viking CCS NSIP and Outer Dowsing OWF)

Topic	Constraint Type and Name	Avoided by Corridors, Siting Zones, and Siting Areas
Historic Environment	Registered Park and Gardens (3)	Avoided
	Conservation Area (24)	Avoided
	Scheduled Monuments (78)	Avoided (71), partially within corridors (1 – Round barrow cemetery with outlying barrow to the west of Tetney and north of Waithe Beck), within corridors (3 - Churchyard cross - St Mary's churchyard, Churchyard cross – St Andrew's churchyard, and Churchyard cross – Old Church), within corridors and Siting Zones (1 - North Cockerington Hall moated site) and within Siting Zones (2 – Castle Hill: a motte castle 250 m east of Hanby Hall Farm, and Churchyard cross at St Margaret's churchyard Selby)
Landscape and Visual	Lincolnshire Wolds AONB	Within corridors (underground cable)
	Urban areas	Avoided
	Country Park (2)	Avoided (1), within corridors (Witham Way)
Water	Statutory Main Rivers	Within corridors and three LCS siting zones
	Flood Zones 2 and 3	Within corridors and within siting zones
	Flooding from reservoirs	Within corridors

## 5.8 Introduction to the Cost and Programme Model

### NGET's Cost Estimates

- 5.8.1 Costs have been developed by NGET's cost estimating team using consistent assumptions such that route lengths are based on a route produced from a desktop exercise that is representative of the likely constraints to routeing. The costs of applying normal industry 'best practice' mitigation measures during construction and operation are inherent within the cost base used. Costs can therefore be compared at Step 7 (Options Appraisal) on a consistent basis noting that they could be higher or lower, but consistent in relative terms. The scope of work for the new substations at Grimsby West, the LCS (LCS-A and LCS-B), Weston Marsh and Walpole are alike for all siting zones or siting areas (and their connecting corridors) and therefore the cost of this work has not been included and is not a differentiator between options.

- 5.8.2 The costs included were estimated based on prices from the financial year 2020/21 and as such would need adjustment for inflation with time. However, they provide a consistent cost point for comparison of options at this stage.

## NGET's Programme Estimates

- 5.8.3 To inform the Options Appraisal (Step 7), a logic linked activity schedule was built for each discipline based on a generic build process for overhead lines using assumptions such as pylon type, span length and pylon foundation type to standardise any unknown parameters, offering consistency across the corridors. Any variables determined by the corridors, such as construction discipline and corridor length were inputted to the schedule, producing estimates of construction duration and provision of an earliest operational date for each corridor.

## 5.9 Next Step - Options Appraisal (Step 7)

- 5.9.1 As explained in **Chapter 4**, Options Appraisal (Step 7) is a structured process by which the environmental, socio-economic, technical, cost and programme implications are identified, reported and compared. It is a tool to aid objective and justified decision making and it enables NGET to document in a transparent manner the information on which judgements have been based. Options Appraisal is therefore focussed on those sub-topics which assist in distinguishing between options.
- 5.9.2 Through the definition of study areas and preliminary options as areas that seek to comply with Holford Rules 1 and 2 (seeking to minimise environmental effects from the outset), the options identified have already avoided several features such that they no longer represent differentiating factors. The constraints initially considered but found not to be differentiating factors for the Options Appraisal include:
- MoD properties (including military airfields). None are identified with 4 km of the corridors, siting zones or siting areas.
  - RSPB Reserves. None are located within 5 km of the corridors, siting zones or siting areas.
  - National Forest Inventory Woodland. Large blocks of National Forest Inventory Woodland have been avoided through the definition of the corridors, siting zones or siting areas. Although smaller blocks of woodland are present, they can generally be avoided through careful routeing and siting.
  - BMV agricultural land (ALC Grades 1, 2, 3). BMV agricultural land is present across the defined study areas, apart from those defined as urban areas.
  - National Trust Properties and inalienable land. None are located within the corridors, siting zones or siting areas.
  - Local Landscape Designations. None are directly affected by the corridors, siting zones or siting areas.
  - Viewpoints. None are located within 2 km of the corridors, siting zones or siting areas.
  - Groundwater Dependent Terrestrial Ecosystems (GWDTE). GWDTE present within the defined study areas overlap with SSSIs.

- Traffic and transport. As the corridors all require crossing the Poacher Railway line between Burgh le Marsh and Skegness it is not considered to be a differentiating factor. In addition, as Cycle Routes (Sustrans National) stretch across the corridors and are absent from siting areas they are not considered to be a differentiating factor. Traffic and transport is considered for the LCS siting zones.
- Geology and Soils. Although landfills (historic and permitted waste sites) are present within the corridors, given their size and the space available within the corridors they can be avoided through careful routeing or can be oversailed. Landfills are absent from the siting zones and siting areas. Peaty soils are present within the corridor; however, these are not considered as a differentiating factor between Grimsby West and Burgh le Marsh as the small pockets present are within the Western Corridor (Section W14) only and can be easily avoided or oversailed. In addition, the area between Burgh le Marsh and Weston Marsh contains a large area of peaty soils which cannot be avoided or oversailed by the Northern, Southern or Central Corridors and therefore is not considered to be a differentiating factor.

5.9.3 The Options Appraisal, undertaken for each Project component, described in **Chapters 60 to 10** below include the environmental and socio-economic sub-topics and constraints shown in **Table 5-6**.

**Table 5-6– Options Appraisal Sub-Topics and Constraints**

<b>Sub-topic</b>	<b>Constraint Name</b>
Ecology	Ancient Woodland
	National Nature Reserves
	Ramsar
	SAC
	SPA
	SSSI
	Important Bird Area
	LNR
	Priority Habitat Inventory
	Traditional Orchard
Historic Environment	Scheduled Monuments
	Listed Buildings
	Registered Parks and Gardens
	Conservation Areas

Sub-topic	Constraint Name
Landscape	AONB
Visual	Residential settlements and individual dwellings
	Recreational areas
	Outdoor recreational facilities including golf courses, canals and caravan parks
Water	Statutory Main Rivers
	WFD surface waters
	IDB watercourses
	Flood Zones <sup>37</sup> 2 & 3 excluding 'Areas Benefitting from Flood Defences'
	Artificial Sources of Flooding – Reservoir
	Groundwater Source Protection Zones – Inner/Zone 1
	Drinking Water Safeguard Zones (surface water and groundwater)
Noise and Vibration	Residential areas
	Education establishments (e.g., Schools and Colleges)
	Health care facilities (e.g., hospitals, hospices, clinics)
	Places of worship
Economic Activity	Business parks / Retail and shopping centres / Industrial estates
	Solar Farms
	Wind farms and wind turbines
	Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large Scale Housing or Infrastructure application registered with the relevant Local Authority)
	Local Plan Allocations
Aviation and Defence	Licensed Airfield / Aerodrome
	Unlicensed Airfield / Aerodrome

<sup>37</sup> Other sources of flooding (such as surface water flooding) would be considered at the next step and at the Defined Proposal and Statutory Consultation (Stage 3) stage.

Sub-topic	Constraint Name
Traffic and Transport (only considered for the LCS and Walpole siting zones)	Cycle Routes (Sustrans National)

- 5.9.4 For the environmental, socio-economic and technical issues the appraisal considers the potential impacts on relevant receptors, and whether such effects could be avoided or mitigated through careful routeing or siting as the primary form of mitigation. Where impacts cannot be avoided or mitigated by careful routeing or siting, other forms of mitigation have been considered in accordance with NGET's mitigation hierarchy as detailed in **Paragraph 4.8.4**. These other forms of mitigation are described as 'other mitigation' in **Chapter 6 to Chapter 12**. The residual impacts considered in the Options Appraisal do not take account of further project-specific environmental, socio-economic or technical mitigation measures which are likely to be included as part of the EIA process undertaken at the Defined Proposal and Statutory Consultation Stage (Stage 3).
- 5.9.5 It should be noted that whilst consideration of residential properties is not included within the economic activity sub-topic appraisal, consideration of direct oversails of residential properties was considered as part of the comparative appraisals and as part of the end-to-end solution. Avoidance of direct oversail of residential properties during routeing of new infrastructure is NGET's preferred approach.
- 5.9.6 The environmental, socio-economic and technical appraisals for the corridors are described in **Chapter 6 to Chapter 8**, the appraisals for the substation siting zones and siting areas are described in **Chapter 9 to Chapter 12**, with the cost and programme implications outlined in **Chapter 14**.

# **6. Options Appraisal - Grimsby West to Burgh le Marsh**



# 6. Options Appraisal - Grimsby West to Burgh le Marsh

## 6.1 Introduction

6.1.2 This Chapter outlines the Options Appraisal (Step 7 as described in **Chapter 4**) for the corridors between Grimsby West and Burgh le Marsh which encompasses the area within which the LCS siting zones (see **Figure 6-1**) are situated. The preliminary corridors have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6). The Options Appraisal for the LCS siting zones is set out in **Chapter 10**.

6.1.3 As described in **Chapter 5**, the corridor identification exercise identified three preliminary overhead line corridors between Grimsby West and Burgh le Marsh and 13 links, these include the:

- Western Corridor – Sections of which are denoted with the prefix “W” e.g., western corridor section 1 is known as Section W1;
- Eastern Corridor – Sections of which are denoted with the prefix “E” e.g., eastern corridor section 1 is known as Section E1;
- Central Corridor – Sections of which are denoted with the prefix “C” e.g., central corridor section 1 is known as Section C1; and
- Links – Named according to the sections they join, e.g., Section E4-C4 provides a link from section 4 of the Eastern Corridor to section 4 to the Central Corridor.

6.1.4 The preliminary underground cable corridor Sections are denoted by the addition of “U” to the naming convention. For example, the western underground cable option in section 1 is known as Section W1U.

6.1.5 The corridors, and their associated sections and links are shown in increasing levels of detail on **Figure 6-2** and **Figure 6-3**. Key constraints for the preliminary Corridors between Grimsby West and Burgh le Marsh are shown on **Figure 6-4**.

Figure 6-1 – Corridors between Grimsby West and Burgh le Marsh



Figure 6-2 – Corridors between Grimsby West and Covenham St Mary

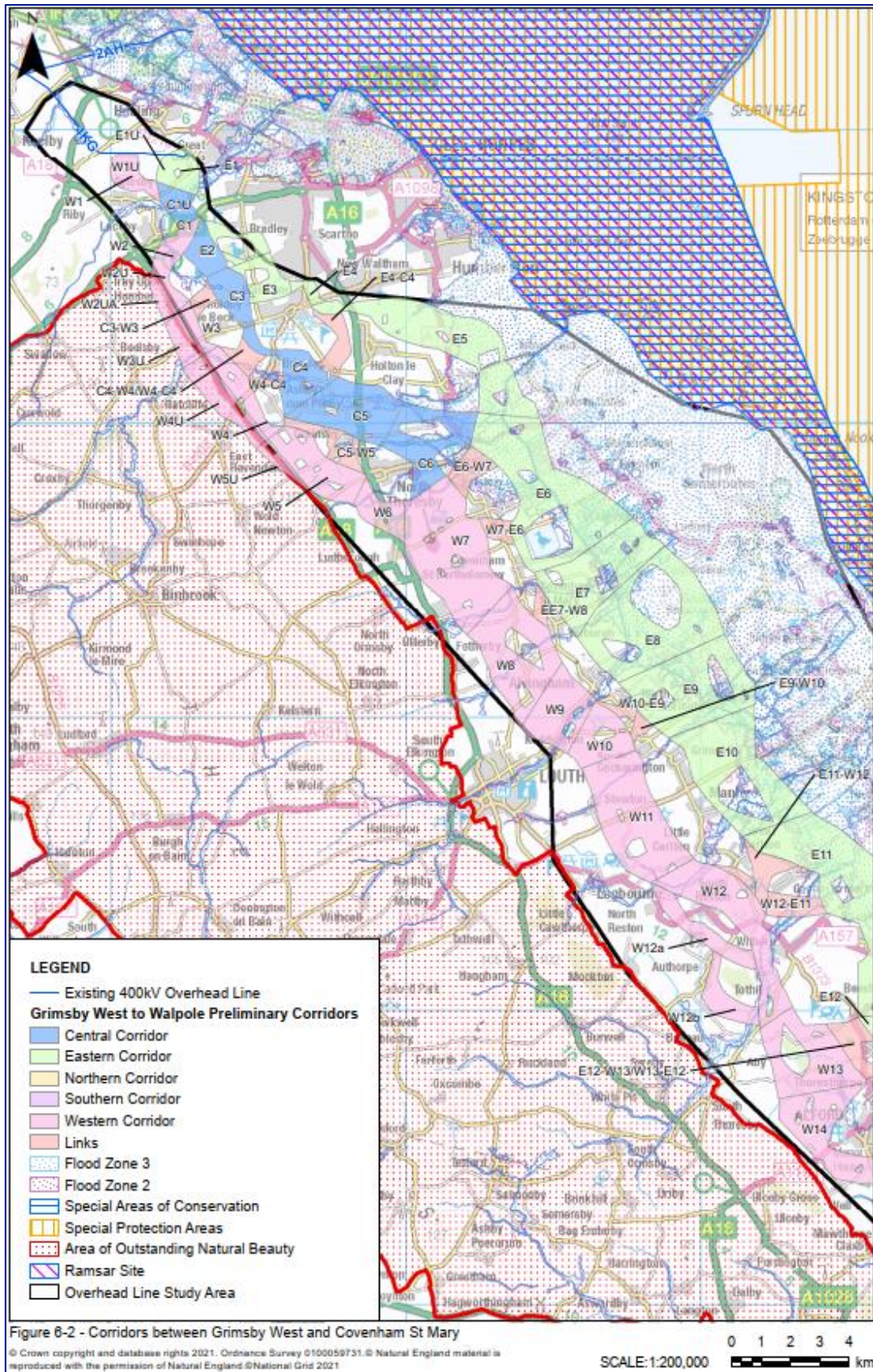


Figure 6-3 – Corridors between Covenham St Mary and Saleby

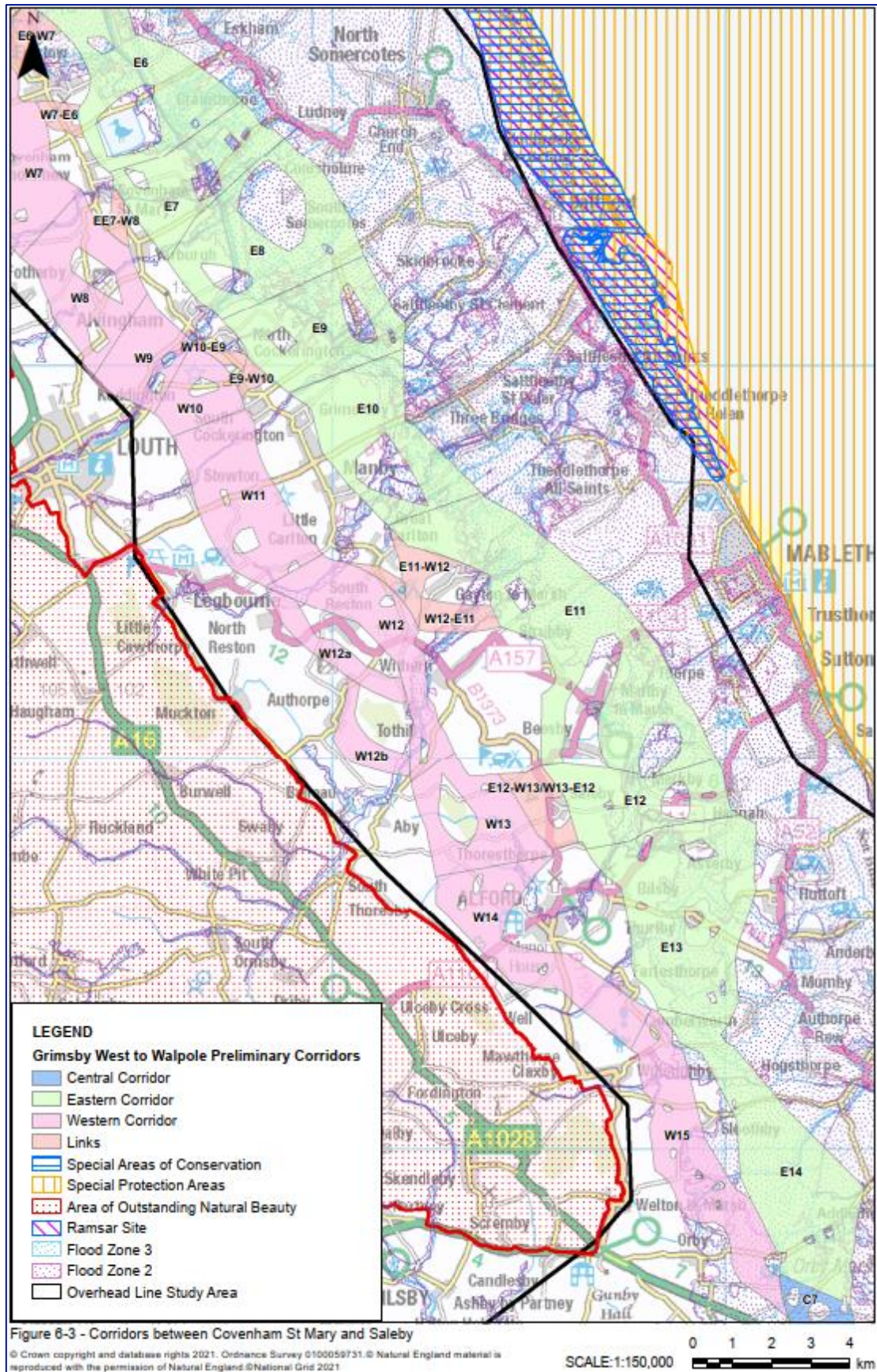


Figure 6-4 – Grimsby West to Burgh le Marsh - Key Constraints

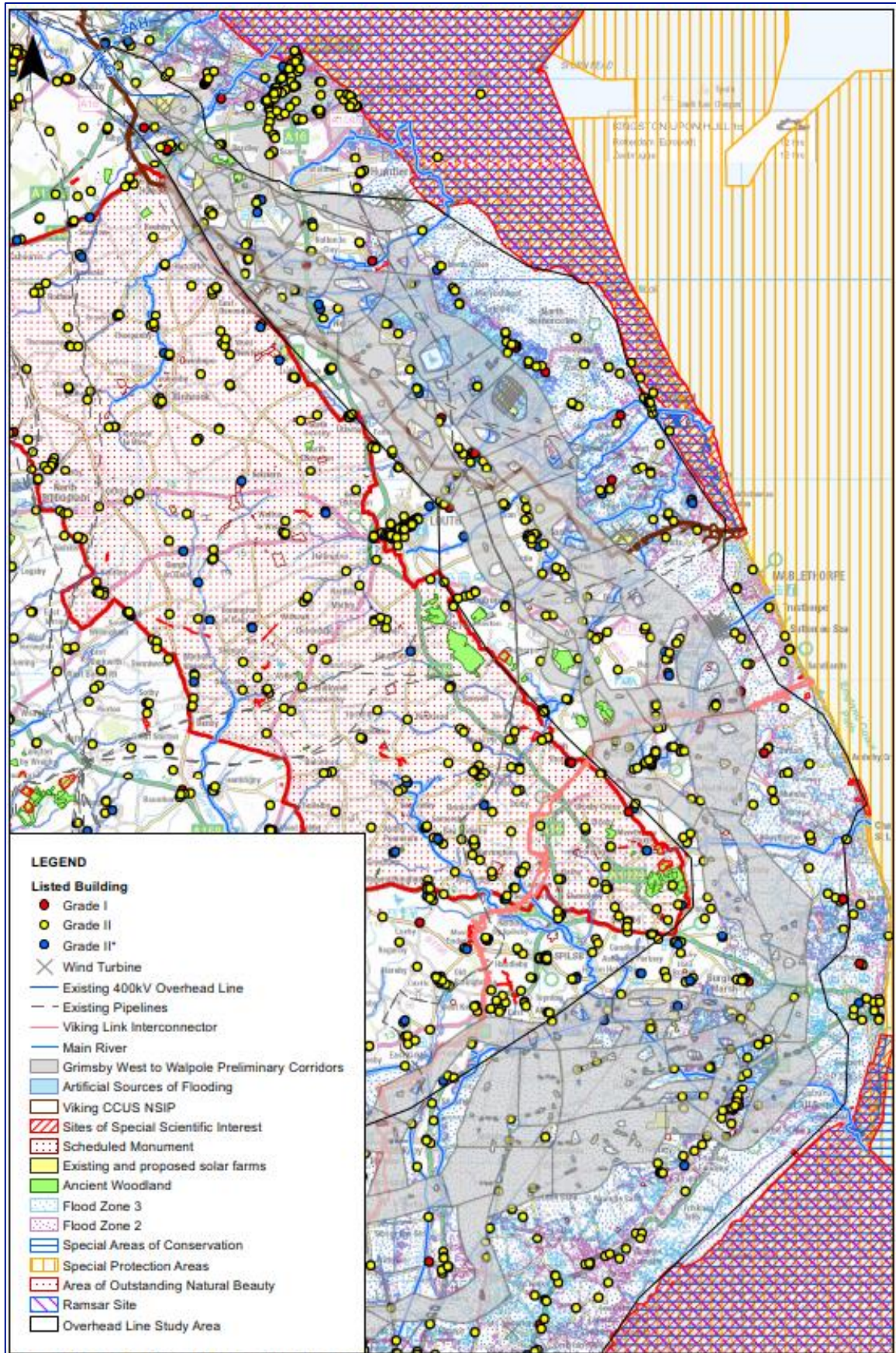


Figure 6-4 - Grimsby West to Burgh le Marsh Key Constraints

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SCALE: 1:300,000 0 2 4 6 8 km

## 6.2 Options Appraisal

6.2.1 The Options Appraisal below has considered environmental, socio-economic and technical topics for each Section and link and was informed by the data gathered as outlined in **Table 5-1** and **Table 5-2**. For the current Project stage, relevant data comprises desk study information, supplemented by a site visit to select locations, on important receptors.

### Western Corridor (Sections W1 to W15, W1U to W5U)

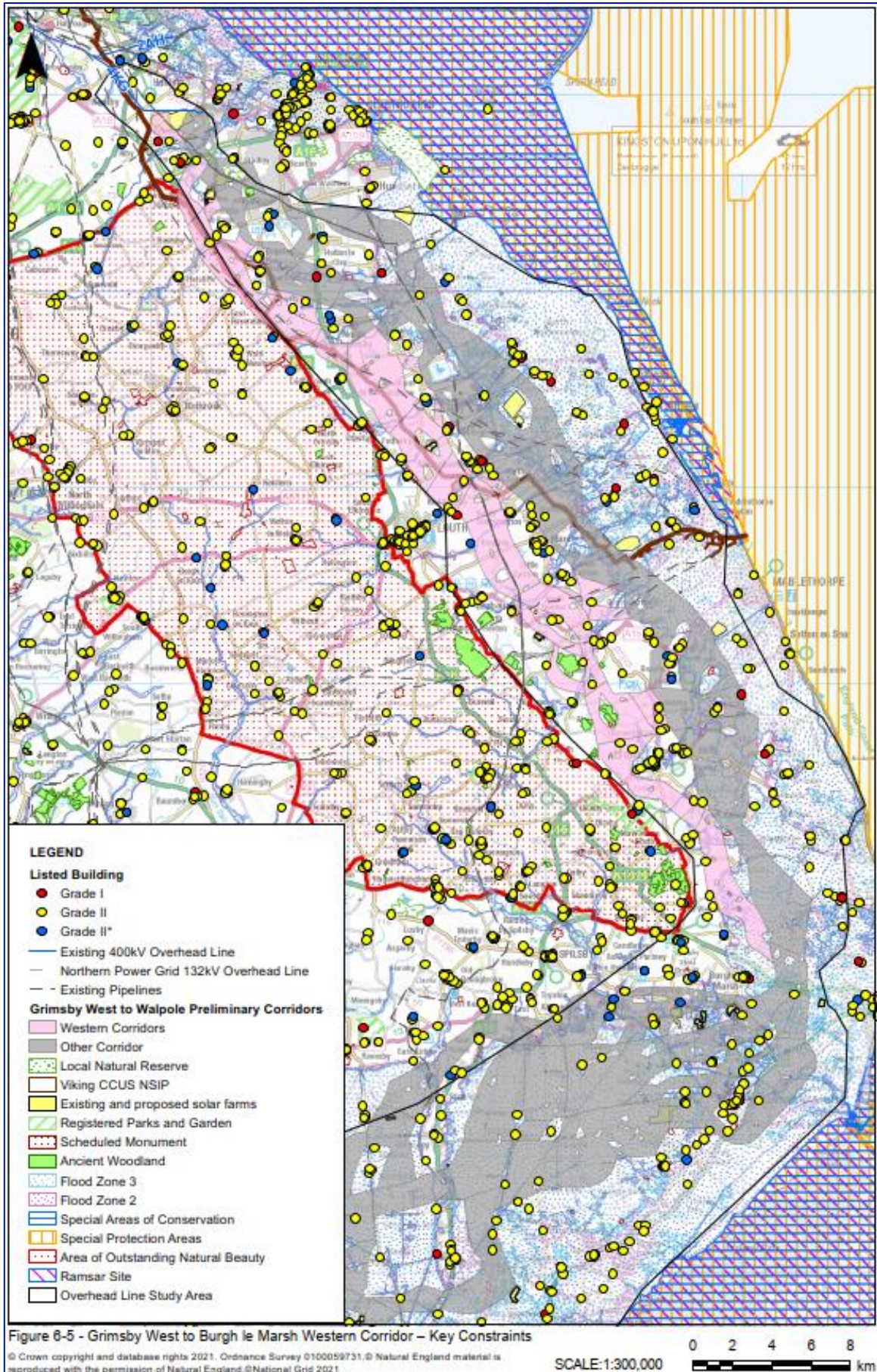
- 6.2.2 The Western Corridor (Sections prefixed with 'W') is shown in **Figure 6-5**. It starts at the 400 kV 4KG overhead line, terminating at the existing Grimsby West substation, and routes south to meet the Central Corridor (Sections C1 and C1U), before continuing west, then south-east to meet Section W6 located west of North Thoresby. Between the 400 kV 4KG overhead line and North Thoresby, two technology options are considered. Overhead line Sections (Sections W1 to W5) route along the western edge of the Overhead Line Study Area between Laceby and North Thoresby. Underground cable Sections (Sections W2U to W5U) overlap with, and route west of, the overhead line Sections as they are located within the Lincolnshire Wolds AONB ('the AONB'). Both these overhead line and underground cable sections cross a NPG 132 kV overhead line; the overhead line sections at Section W3 (between Laceby Solar farm and Hatcliffe) and the underground cable sections at Section W3U (west of Barnoldby le Beck and the A18). At Sections W5 and W5U the overhead line and underground cable sections merge as the Western Corridor routes to the east, away from the AONB. Should underground cables be utilised then sealing end compounds (SECs) would be required where there is a transition between underground cable and overhead line. The precise siting of this infrastructure would be undertaken later in the design process and prior to statutory public consultation for the Project referred to in a later stage of this report.
- 6.2.3 South of North Thoresby, the Western Corridor from Section W6 onwards is outside the boundary of the AONB and is therefore, at this stage, only considered for an overhead line solution (as per the National Policy Statement (EN-5) starting presumption described in **Section 2.3**). From here it continues south until reaching Section W12, avoiding populated areas of Ludborough and Louth to the west and a linear line of towns and villages to the east between Fulstow and Withern. The Western Corridor from Section W12 onwards continues south of Withern, avoiding smaller villages (including Woodthorpe) and environmental receptors (such as Mother Wood) before reaching Section W14 where it routes to the west of the populated area of Alford. From Section W15 the Western Corridor then continues south-east to meet the Central Corridor (Section C7) again.
- 6.2.4 The Western Corridor is located furthest west of the corridors appraised between Grimsby West and Burgh le Marsh. Notable constraints for this corridor include the AONB, NPG132 kV overhead lines, existing underground cable and pipeline infrastructure, a proposed Solar Farm by Aura Power (Aura Power Solar Farm), Laceby Solar Farm, Laceby Golf Club, the Viking Carbon Capture and Storage Pipeline NSIP application ("Viking CCS NSIP"), Grainsby Hall and Park, Willoughby Branch Line LNR, *Well Hall* Registered Park and Garden, *Willows Lock* and *Salter Fen Lock* Scheduled Monuments, the Louth Canal, Flood Zones 2 and 3, and patches of ancient woodland. These constraints are shown on **Figure 6-5**. The corridor was progressed primarily due to it providing an option to route further from the larger settled areas of Grimsby and Cleethorpes and sections of the Lincolnshire coastline

that are internationally designated for their bird interest (including the Humber Estuary SPA and Greater Wash SPA).

6.2.5 In addition to the corridor itself, there are six links between the Western corridor and either Central or Eastern corridors. These links have been provided where it would be possible to avoid constraints or pinch points associated with a particular Section by transferring from one corridor or section to another and are as follows.

- Link W4-C4, which connects the Western and Central corridors south of Brigsley.
- Link C4-W4/W4-C4, which connects the Central and Western corridors south of Barnoldby le Beck.
- Link W7-E6, which connects the Western and Eastern corridors to the south of Fulstow.
- Link W10-E9, which connects the Western and Eastern corridors to the south of North Cockerington.
- Link W12-E11, which connects the Western and Eastern corridors to the south of Great Carlton and Gayton le Marsh.
- Link E12-W13/W13-E12, which connects the Eastern and Western corridors to the south of Woodthorpe.

Figure 6-5 – Grimsby West to Burgh le Marsh Western Corridor – Key Constraints





## Environmental Factors

### Landscape and Visual

6.2.6 The Western Corridor is located within the Lincolnshire Coast and Marshes NCA (NCA 42) which is characterised by a wide coastal plain extending from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. The key landscape and visual features between Grimsby and Burgh le Marsh are the density of the population and the proximity to the AONB between Laceby and North Thoresby, and again at Alford. The AONB<sup>38</sup> is split into four Local Landscape Character Areas (LCAs), those of relevance to the Western corridor are set out below:

- LCA: Chalk Wolds (includes Laceby to Louth), key features include:
  - *“Open rolling arable farmland on a gently dipping plateau”* – enables wide open views of the landscape.
  - *“Enclosure roads (drovers roads) with wide verges and characteristic hedgerows”* – high hedgerows obscure the majority of views for road users.
  - *“Small plantation woodlands and historic beech planting”* –provides an opportunity to improve the connectivity of green infrastructure assets as part the mitigation.
- LCA: South – Eastern Claylands (Louth to Alford to north of Gunby), key features include:
  - *“Views across the Middle Marsh to the coast”* – views of the western corridor will be visible within views of the wider of corridor.
  - *“Extensive oak-ash woodland”* –provides an opportunity to improve the connectivity of green infrastructure assets as part the mitigation.
  - *“Ridge top roads and their associated archaeology”* – enables views of the wider landscape.

### Grimsby West to North Thoresby

6.2.7 The existing NGET 400 kV and NPG 132 kV Grimsby West substations are located east of the Western Corridor in Sections W1 and W1U, and a section of the 400 kV 4KG overhead line is located to the north. The presence of this existing electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. However, careful consideration of the overhead line routing is required alongside the siting of the Grimsby West substation to ensure that new overhead line entries (considered at a later stage) do not intensify impacts on landscape and visual amenity and result in the creation of a wirescape. A new overhead line in Section W1 has the potential to cause adverse impacts upon views from nearby settlements (at Aylesby, Laceby and at scattered properties) due to the wide, open nature of the landscape with long views and the proximity of the settlement. There is also the potential to adversely impact views from the AONB. However, given the reduced sensitivity of the landscape at over 2 km away (and with

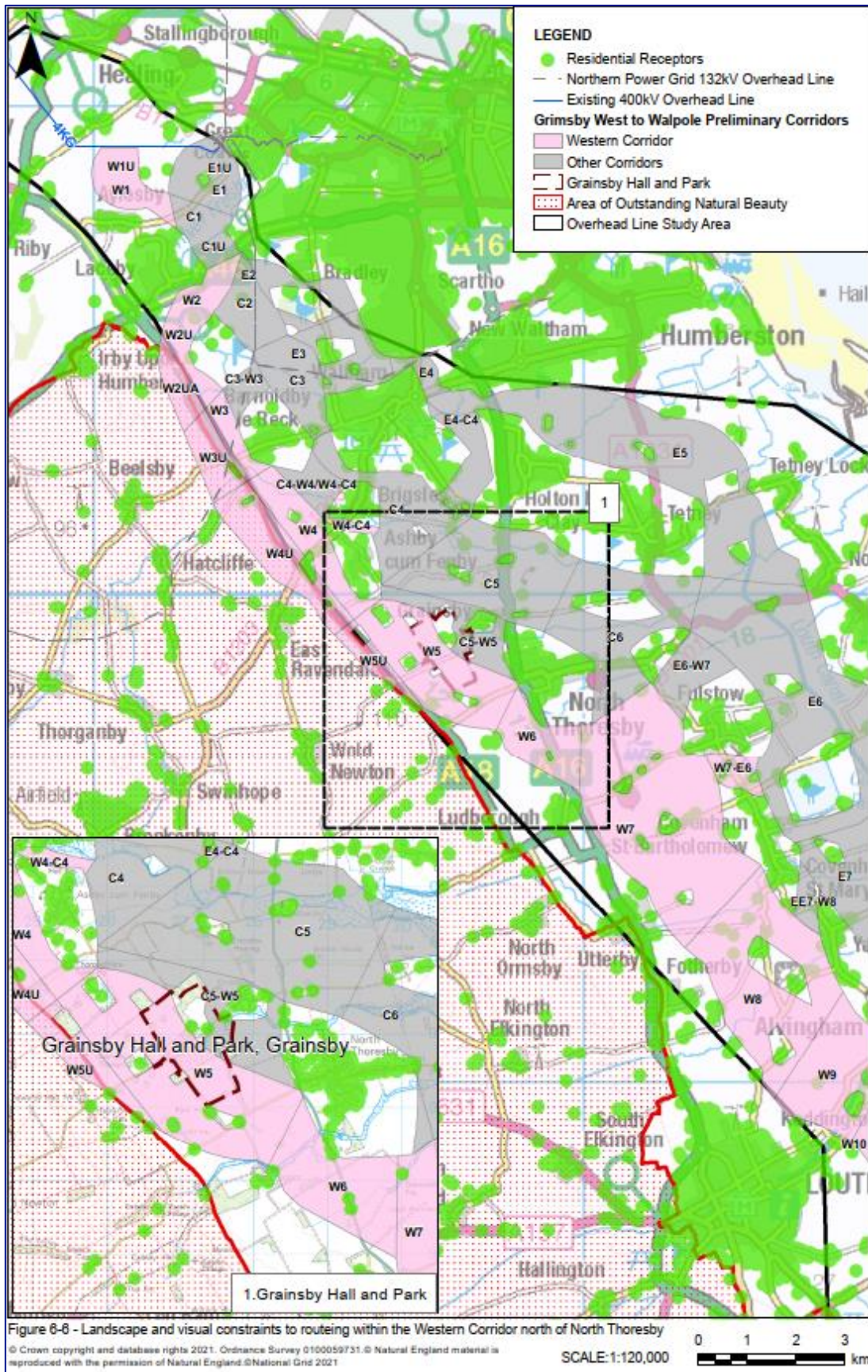
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<sup>38</sup> Lincolnshire Wolds Area of Outstanding Natural Beauty Management Plan 2018 – 2023 (The Lincolnshire Wolds Countryside Service and Lincolnshire Wolds Joint Advisory Committee (AONB Partnership)). Available online at: <https://www.lincswolds.org.uk/our-work/management-plan>

careful routeing and siting of infrastructure) significant adverse visual effects on the AONB are unlikely.

- 6.2.8 Following south between Laceby and North Thoresby (where Sections W2 to W5 and Link W4-C4 are located), the area is more densely populated than other parts of the Overhead Line Study Area and here the Western Corridor is within a kilometre of the AONB (see **Figure 6-6**). Residential visual receptors for these Sections include those situated at Aylesby, Laceby, Wybers Wood, Bradley, Nunsthorpe, Scartho, Barnoldby le Beck, Waltham, Brigsley and Holton le Clay. Other sensitive visual receptors in this area include those using numerous recreational paths such as Public Rights of Way (PRoW) and Sustrans Cycle Routes between the identified towns, villages and the AONB, and users of the Willows Caravan Park (adjacent to Section W2). In this area, the Western Corridor also passes through the enclosed designed landscape associated with Grainsby Hall and Park to the north-west of North Thoresby in Section W5, as shown in the insert to **Figure 6-6**, although the larger blocks of woodland are avoided. The introduction of a new overhead line could be incongruous in the context of the AONB; however, this potential is reduced due to the presence of the NPG 132 kV overhead line within Section W3 (making the landscape less sensitive to adverse impacts from new infrastructure). There is potential that, even with careful routeing, significant adverse visual effects on the setting of the AONB and views to/from the AONB may not be avoidable and therefore consideration of other mitigation (informed by detailed landscape and visual assessments) such as alternative pylon types or undergrounding an overhead line (as described in **Paragraph 4.8.4**, hereafter 'other mitigation') in these Sections may be considered. In addition, the presence of the NPG 132 kV overhead line within Section W3 has the potential to create a 'wirescape'.
- 6.2.9 An alternative technology considered to an overhead line in the Western Corridor is an underground cable utilising Sections W2U to W5U and is located within the AONB boundary. An underground cable in these Sections would substantially reduce the permanent impacts on the AONB, such that significant adverse impacts would only be experienced temporarily during the construction period. However, there would still be the potential for permanent impacts, predominantly associated with the presence of SECs. The severity of effects from required SECs for an underground cable would be managed through carefully siting (at a later stage) this infrastructure a sufficient distance outside of the AONB itself and by implementing landscape mitigation planting. It is considered that, without undergrounding, an overhead line in Western Corridor between Laceby and North Thorseby may not be acceptable in visual terms.

Figure 6-6 – Landscape and visual constraints to routing within the Western Corridor north of North Thoresby



## North Thoresby to Woodthorpe

- 6.2.10 Heading south-east between North Thoresby and Woodthorpe (Sections W6 to W13), the wide, open and level nature of the landscape provides considerable flexibility for the routing of an overhead line. Within these Sections the distance between the Western Corridor and the AONB increases the density of settlement becomes sparser and the pattern of settlement is linear, with a line of towns and villages located to the west and east outside of the Western Corridor South of Louth, west of section W8, to the boundary of the two AONB LCAs (chalk wolds and South-Eastern England Claylands). The density of the linear settlement between Louth and North Cockerington, along the Louth Canal, and the comparative narrowness of Sections W12A and W12B reduce the flexibility for the routing of an overhead line in these areas. The main residential visual receptors are present at North Thoresby, Louth, scattered towns, and villages predominantly to the east at Fulstow, Covenham St. Mary, Alvingham, North Cockerington, South Cockerington, Grimoldby, Manby and Withern. Other visual receptors in this area include those using numerous recreational paths such as PRoW between the identified towns, villages and the AONB, visitors to the Lincolnshire Wolds Railway (heritage railway), Woodthorpe Hall (a caravan and leisure park) and to Rushmoor Country Park.
- 6.2.11 The introduction of a new overhead line could be incongruous in the context of the AONB, especially within Section W6. However, as the Western Corridor routes further south towards Woodthorpe, distance from the AONB increases. With careful routing of the overhead line to the eastern extent of the corridor, potential adverse effects on the AONB and views to/from the AONB (a key feature of the South-Eastern Claylands LCA) could be reduced to an acceptable level without the need for use of other mitigation. Here an overhead line would be screened and/or seen in the context of the linear settlement east of the corridor and onshore windfarms towards the coast. On balance, it is envisaged that the significant adverse effects on the majority of landscape and visual receptors between North Thoresby and Woodthorpe could be reduced through careful routing, however, due to the proximity of the identified populated areas to the east and west of the corridor, some significant adverse visual effects are considered unavoidable, both on views from some residential areas and on some views from the AONB.
- 6.2.12 The Links from the Western Corridor within this area comprise Link W7-E6, Link W10-E9 and Link W12-E11. Utilising each of these links would provide a route into the Eastern Corridor. There are fewer receptors (compared to the main corridor Sections) in the vicinity of these links, primarily due to their length. The potential impacts upon the AONB from using each of these links will be very similar to the Western Corridor Sections to which they connect (i.e., Sections W7, W10 and W12 as described above). The main visual receptors for these links include the residential properties near each Link; Fulstow for Link W7-E6, North Cockerington and South Cockerington for Link W10-E9, and Great Carlton and Gayton le Marsh for Link W12-E11. Other key receptors include recreational receptors visiting Covenham Reservoir near Link W7-E6. Although the number of visual receptors near the links is comparatively fewer, they are also comparatively narrower which limits the flexibility for routing and therefore the potential to limit the scale of effects.

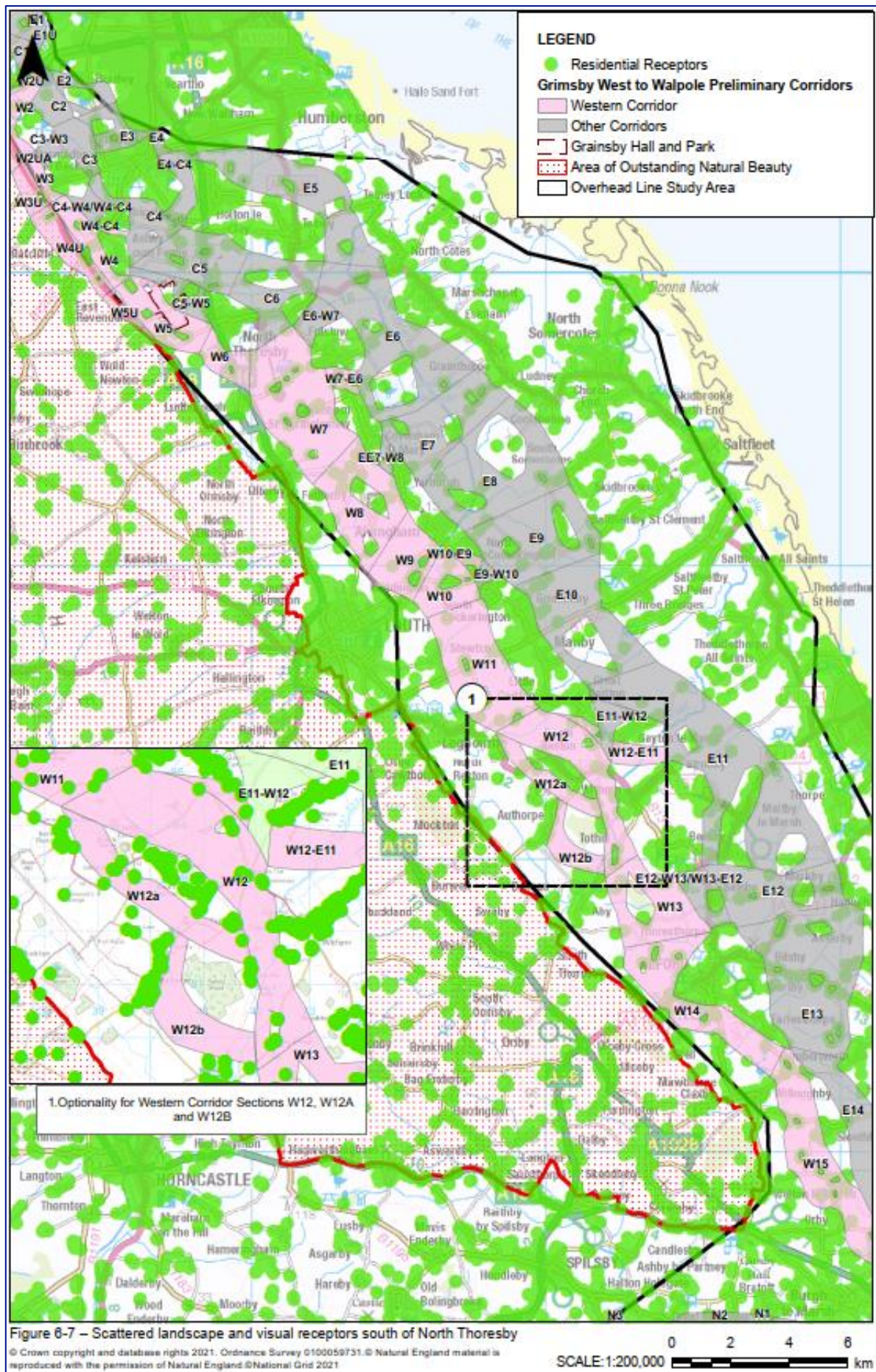
## Woodthorpe to Burgh le Marsh

- 6.2.13 To the south of Woodthorpe and heading towards Alford, Section W13 is wide, and the open and level nature of the landscape provides considerable flexibility for the routing of an overhead line. However, following Section W13, the Sections become

narrower and route closer to the AONB; Section W14 is entirely within a kilometre of the AONB where it passes west of Alford and half of Section W15 is within 2 km of the AONB. In addition to Alford, these Sections are also close to the residential areas at Saleby, Well, Farlesthorpe, Willoughby, Sloothby and scattered individual properties. Other visual receptors in this area include those using numerous footpaths between, and within, Alford and the AONB and users of Woodthorpe Hall. The introduction of a new overhead line in Sections W14 and W15 could be incongruous in the context of the AONB. There is potential that, even with careful routeing, significant adverse visual effects on the AONB and views to/from the AONB (a key feature of the South-Eastern Claylands LCA) may not be avoided and therefore consideration of other mitigation such as alternative pylon types or the undergrounding an overhead line in these Sections should be considered. Conversely, routeing away from the AONB (east) within Sections W14 and W15 will bring an overhead line closer to residential properties at Alford, Farlesthorpe, Willoughby and Sloothby. As such, it is considered that an overhead line route to the east, within Sections W14 and W15 would still require the consideration of other mitigation to reduce the level of adverse visual effects. South of Sloothby, the open and level landscape combined with a widening corridor and the presence of fewer receptors (villages of Welton le Marsh, Orby, footpath users and the AONB), provides more available space to reduce the severity of visual effects through careful routeing.

- 6.2.14 The link from the Western Corridor within this area is Link W12-E11, which connects the Western and Eastern corridors to the south of Great Carlton and Gayton le Marsh. Utilising this link would increase the distance from the AONB but would add a change of direction and route in proximity to the villages of Saleby and Thoresthorpe. Within this link it is envisaged that significant adverse effects on most landscape and visual receptors could be reduced with careful routeing. However, adverse effects on some individual receptors are considered unavoidable.

Figure 6-7 – Scattered landscape and visual receptors south of North Thoresby



## Ecology

- 6.2.15 As described in **Chapter 5**, the Western Corridor was developed to avoid designated ecological areas where possible, and there remain few designated and important ecological areas identified within and in proximity to the Western Corridor and its Links from the Western Corridor between Grimsby West and Burgh le Marsh. Those identified are appraised below.
- 6.2.16 The Western Corridor is located over 5 km from the nearest NSN (comprising SPA and SACs) and Ramsar sites; the Humber Estuary SPA, SAC, Ramsar and SSSI Sites ('Humber Estuary designated sites'). The Humber Estuary designated sites are identified for their extensive wetland and coastal habitats and support migratory and wintering waterbirds in addition to breeding populations of bittern, marsh harrier, avocet and little tern. Due to the distance of a new overhead line from the Humber Estuary designated sites, and other designated ecological sites along the Lincolnshire coastline, potential impacts are limited to pollution during construction of functionally connected habitat for both an overhead line and underground cable (where applicable) and the risk of collision, flight path disruption, injury, and mortality for vulnerable bird species, if present, for an overhead line. The potential impact on SPA, SAC and Ramsar sites will be considered in detail within a Habitat Regulations Assessment (HRA) (conducted in the absence of mitigation), as the Project development progresses. However, for the purposes of Options Appraisal, the corridors, sections and links located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routeing and standard construction measures, the Western Corridor is considered capable of being acceptable when considering the potential impacts on identified sites. Should the HRA identify adverse effects on the integrity of the NSN, the emerging preferences identified will be revisited.
- 6.2.17 Within 2 km (west and south-west) of the Western Corridor at Sections W14 and W15 are the Willoughby Meadow SSSI, Willoughby Wood SSSI and Hopland Woods SSSI, predominantly designated for their habitats (woodlands and grasslands) but which also support a range of species including breeding birds and moths. These SSSIs may be hydrologically connected to the areas within these sections and therefore may adversely impact upon them. However, there is considered sufficient space within the sections to carefully route an overhead line to the eastern extent; and, following the implementation of standard construction measures, it is considered that potential impacts upon these designated sites could be reduced.
- 6.2.18 Other important habitats identified within the Western Corridor comprise:
- Priority habitat headwater areas present within Sections W1 and W1U.
  - A traditional orchard is located adjacent to Section W5 to the north of Grainsby Lane.
  - The Tothill/Claythorpe Woods Ancient Woodland, predominantly located adjacent to Sections W12, W12A and W12B (east of Authorpe) with a small area located in Section W12B.
  - Priority habitat, coastal and floodplain grazing marsh and priority river habitat (Great Eau watercourse), present within Section W12.
  - An overhead line routeing through Sections W12 or W12A may interact with these receptors.

- Hornby/Mother Wood Ancient Woodland ('Mother Wood') and Swinn Wood Ancient Woodland are located immediately adjacent to Section W13 (between Aby and Saleby). Mother Wood Ancient Woodland is located within an area specifically excluded from Section W13 and Swinn Wood Ancient Woodland is located adjacent to the Section W13, to the west.
- The Rigsby Wood Ancient Woodland, Willoughby Branch Line LNR, and priority habitat (in the form of headwater areas) are identified in Section W14 (primarily at its connection with Section W13).
- Priority habitat headwater areas is present at the south of Section W14 which continues into Section W15, with scattered pockets of coastal and floodplain grazing marsh priority habitat are also present.
- The Willoughby Branch Line LNR crosses Section W14 south-west of Farlesthorne. The LNR is a wildlife corridor supporting a varied flora, including restharrow, hemp-agrimony, spotted-orchid, yellow-wort and great burnet. It also supports a range of fauna including butterflies and birds (such as whitethroat and other finch species, nightingale, redwings and barn owls).

6.2.19 As such, there is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the extent of the priority habitat areas within these Sections and links is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures. In addition, site observations noted that the priority habitat headwater areas currently comprise arable land and therefore adverse effects on priority habitat are not considered likely.

6.2.20 Sections W12 and W14 are the only Sections which contain important habitats (Section W12 containing coastal and floodplain grazing marsh and river habitat, and Section W14 containing the Willoughby Branch Line LNR). The potential impact upon these important habitats could be reduced through careful routeing and the implementation of standard construction mitigation measures. However, as the Willoughby Branch Line LNR crosses Section W14, there is still the potential for significant adverse effects upon this site.

### Historic Environment

6.2.21 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Western Corridor and its Links between Grimsby West and Burgh le Marsh. Those identified are appraised below.

#### Grimsby West to North Thoresby

6.2.22 Between Grimsby West and North Thoresby there are a few scattered designated heritage assets at the edge of the Western Corridor and its Links. Impacts on designated heritage assets are limited to affects upon their setting.

6.2.23 In this area, there are numerous designated heritage assets within 1 km of the Western Corridor and its links. The majority of designated heritage assets are located within the populated areas of Laceby, Barnoldby le Beck, Ashby cum Fenby and North Thoresby, see **Figure 6-8**. The most notable in proximity are:



- the *Civil War earthwork fort 350 m north-east of Walk Farm* Scheduled Monument located approximately 30 m to the west of Section W2UA and 500 m south-west of Sections W2 and W2U;
- Grade II listed buildings at *Little Laceby Farmhouse* (Sections W1 and W1U), *Manor House* and *Hatcliffe Mill* (Sections W3 and W3U) located west of Barnoldby le Beck, at *Homefield Farmhouse*, and *front gate and railings* located west of Ashby cum Fenby (Section W4) and the *Stable Block to Former Grainsby Hall* (Section W5). All of which are within 150 m from the Western Corridor (see inserts within **Figure 6-9**); and
- Three Grade II listed buildings at Brigsley, located north and south of Link W4-C4.

6.2.24 There is likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity to them. In addition, the density of designated heritage assets in this area increases the potential for buried archaeology, and therefore the potential to disturb if encountered. However due to the width of all Sections and links in this area, there is sufficient flexibility to reduce the potential significant adverse impacts through careful routeing and the implementation of standard construction measures.

#### North Thoresby to Woodthorpe

6.2.25 South of North Thoresby there are a few scattered designated heritage assets at the edge of Sections of the Western Corridor and its Links. Only Section W9 and Link W10-E9 includes designated heritage assets within their boundaries. Link W10-E9 contains the *North Cockerington Hall moated site* Scheduled Monument at its centre. Due to the narrow width of the link, there is the potential for direct impacts with the scheduled monument and therefore potentially significant residual effects, of which undergrounding or alternative pylon types is not likely to overcome. Section W9 contains two Grade II Listed locks; *Willows Lock TF 352892* and *Salter Fen Lock TF 356902* (see **Figure 6-9**). Due to the localised nature of these design locks, it is considered that direct physical impacts could be avoided, through careful routeing. Except for the scheduled monument in Link W10-E9, where direct physical impacts may be unavoidable, it is considered that potential impacts on the remaining designated heritage assets are limited to affects upon their setting.

Figure 6-8 – Key heritage assets in the vicinity of the Western Corridor between Grimsby West and North Thoresby

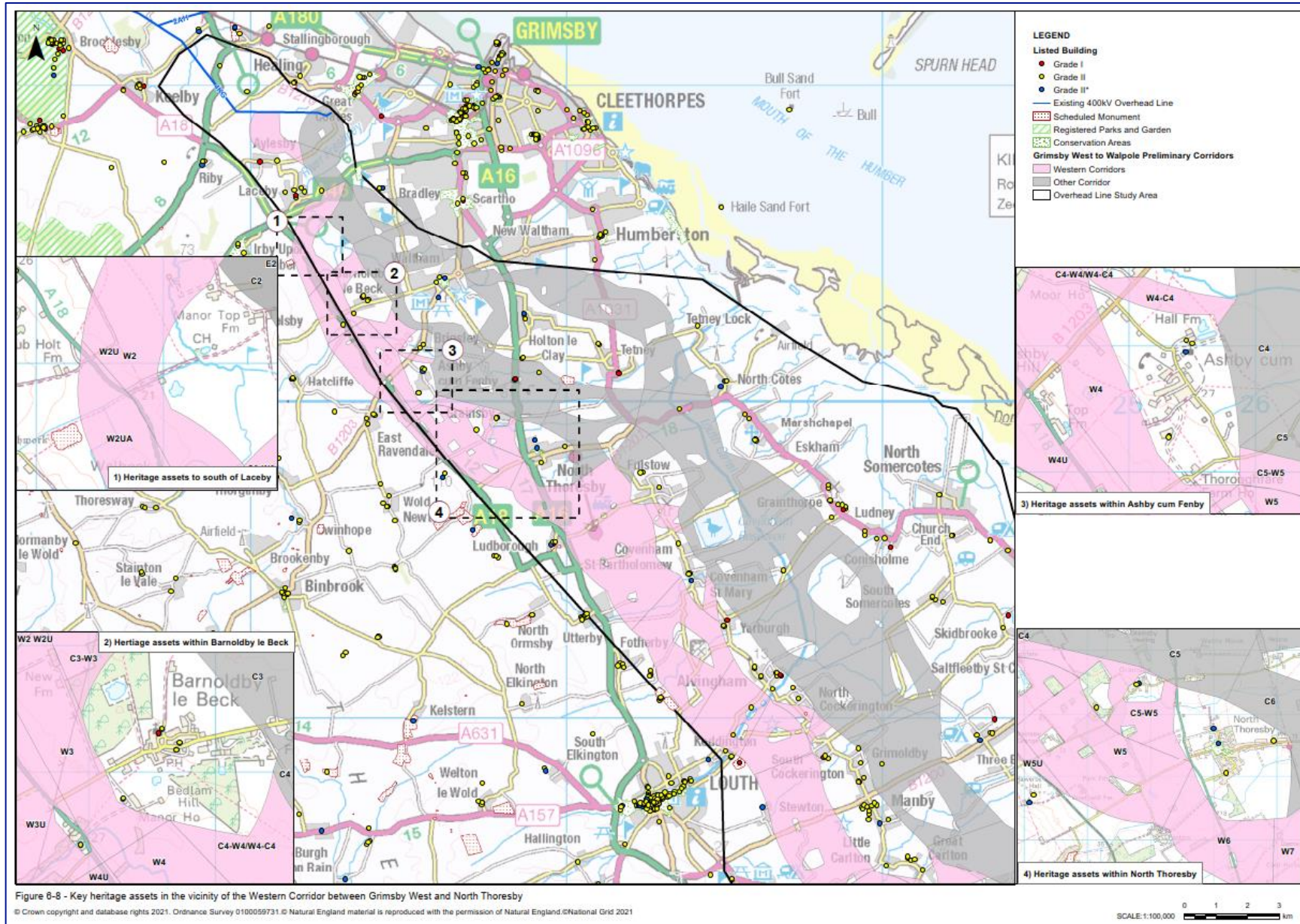


Figure 6-9 – Key heritage assets in the vicinity of the Western Corridor between North Thoresby and Burgh le Marsh

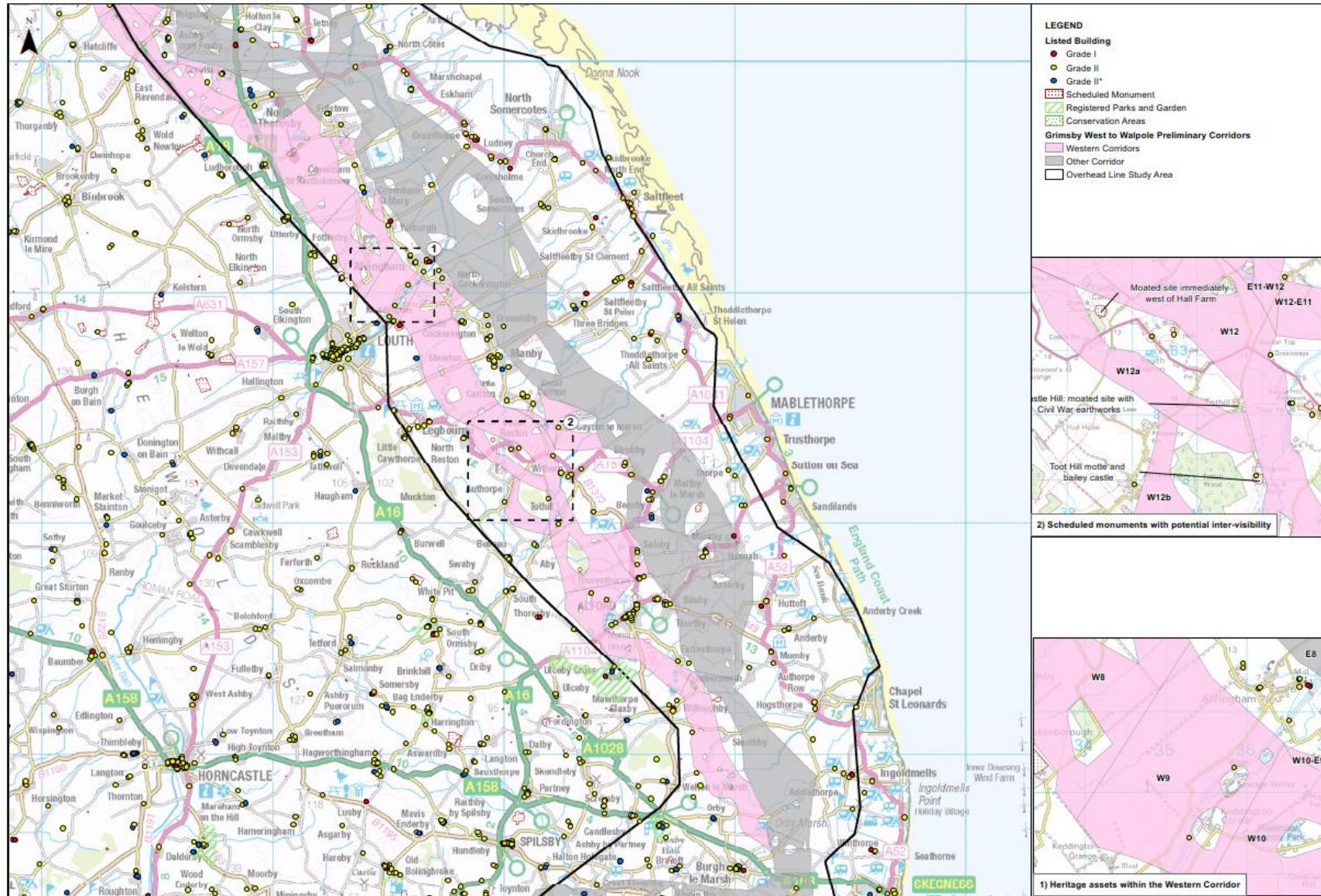


Figure 6-9 - Key heritage assets in the vicinity of the Western Corridor between North Thoresby and Burgh le Marsh  
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6.2.26 Between North Thoresby and Woodthorpe there are numerous designated heritage assets within a kilometre of the Western Corridor and its Links (see **Figure 6-9**). The most notable in proximity are:

- The *Manor moated site and fishpond complex* Scheduled Monument located approximately 200 m to the west of Section W7;
- *Deserted village* Scheduled Monument south of Little Grimsby located approximately 35 m west of Section W8;
- three Grade II listed buildings at Little Grimsby; *Gardener's Cottage And Hall Cottage, Urn At West End Of Church Of St Edith* and *Church Of St Edith*, and the Grade I listed building *Little Grimsby Hall* all located within 200 m of Section W8;
- three Grade II listed buildings south of Louth Navigation within 200 m of Section W9; *Ticklepenny Lock TF 351889, Stable Block At Abbey Farmhouse* and *Abbey Farmhouse*;
- one Grade II listed building south of Louth Navigation within Section W9; *Willows Lock TF 352892*;
- *Louth Park Abbey* Scheduled Monument and Grade I listed building *Louth Abbey Ruins* located directly adjacent to Section W10;
- *The Home Farmhouse* Grade II listed building at North Cockerington located north of Link W10-E9;
- *The Chestnut Farmhouse* Grade II listed building at Gayton le Marsh located in proximity to Link W12-E11;
- Grade II\* listed building *Church Of St Andrew* located approximately 150 m to the west of Section W11; and
- the Castle Hill Motte and Bailey Castle, Castle Carlton Scheduled Monument, Moated site immediately west of Hall Farm Scheduled Monument, Castle Hill: moated site with Civil War earthworks Scheduled Monument and Toot Hill Motte and Bailey Castle Scheduled Monument, and several associated listed buildings all located near Sections W12, W12A and W12B.

6.2.27 Sections W12, W12A and W12B have been developed to avoid the assets identified in the final bullet above, and to seek to reduce potential impacts on the setting of, and between, these assets. No obvious intervisibility between these assets was identified during site walkovers. However, due to the comparatively narrow nature of the corridor and the density of designated heritage assets in this area, it is considered that these would constrain routeing of an overhead line in these sections. Impacts could be reduced to an acceptable level by routeing through the centre of the sections, thereby retaining some distance between an overhead line and the designated heritage assets. In addition, the implementation of standard construction measures could minimise the disturbance of potential buried archaeology.

6.2.28 Except for Sections W12, W12A and W12B, for sections between North Thorseby and Woodthorpe, there is likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity to them. In addition, the density of designated heritage assets in this area increases the potential for buried archaeology, and therefore the potential to disturb if encountered. However due to the width of all Sections and links in this area, there is sufficient flexibility to

materially reduce potential adverse impacts through careful routeing and the implementation of standard construction measures.

#### Woodthorpe to Burgh le Marsh

6.2.29 South of Woodthorpe, a few scattered receptors are present at the edge, or within the areas specifically excluded from Sections W13, W14 and W15. Those most notable in proximity are:

- *Site of St Mary's Priory, Greenfield* Scheduled Monument located adjacent to Section W13;
- two Grade II Listed buildings, *Ailby House Farmhouse* and *Tothby Manor House*, located adjacent to Section W14;
- *Well Hall* Registered Park and Garden located approximately 120 m west of Section W14; and
- *Butterbump round barrow cemetery* Scheduled Monument and Grade II listed building *Hogsbeck House* both located adjacent to Section W15.

6.2.30 Due to the width of these Sections and its links, there is sufficient flexibility to reduce potential adverse impacts through careful routeing and the implementation of standard construction measures. However, within Section W14, careful routeing of an overhead line may not reduce impacts upon the setting of the *Well Hall* Registered Park and Garden (and its associated buildings) and therefore (following detailed heritage assessments) other mitigation should be considered.

### Socio-economics

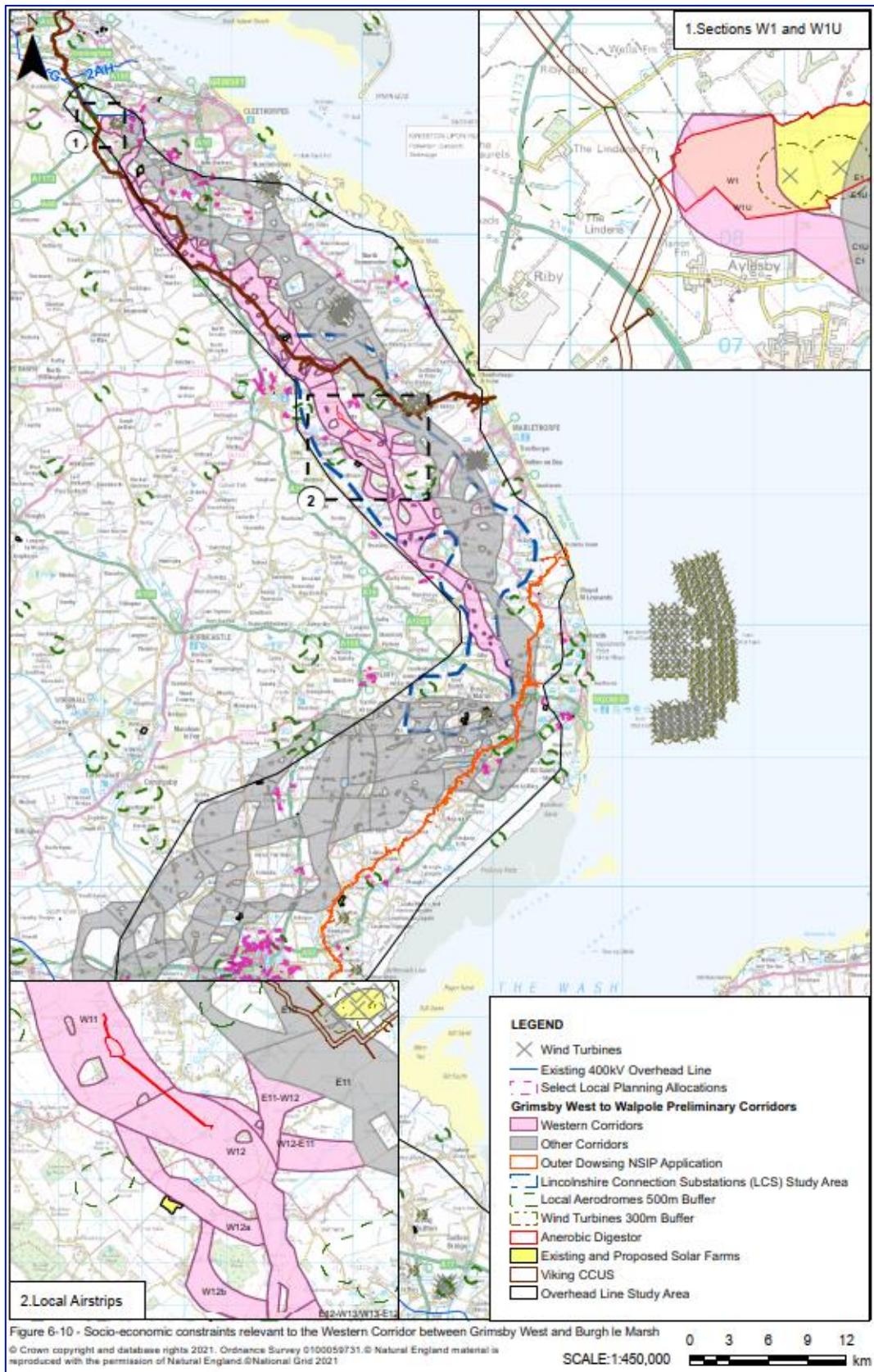
#### Grimsby West to North Thoresby

6.2.31 In proximity to Grimsby West, Sections W1 and W1U abut the Viking CCS NSIP and overlap with an approved planning application for the Aura Power Solar Farm (See **Figure 6-10**). The Viking CCS NSIP is adjacent to Sections W1 and W1U and therefore adverse effects on its operation could be avoided. The Aura Power Solar Farm covers a large swathe of Sections W1 and W1U and cannot be avoided by careful routeing. Therefore, adverse effects on the operation of the Aura Power Solar Farm are likely.

6.2.32 The Lindens Farm Airstrip is located to the west of Sections W1 and W1U, and two wind turbines are located to the east. Lindens Farm Airstrip and the wind turbine would not be adversely affected by an underground cable in Section W1U. However, an overhead line could adversely affect the operation of, or require removal of, these features. Careful routeing, by routeing an overhead line through the centre of the Section, would minimise the potential impacts upon these receptors.

6.2.33 South of Laceby, the Viking CCS NSIP currently routes south through Section W2, W2U, W2UA, W3, W3U, W4, W5 and W6 and to avoid this scheme would limit routeing flexibility. In addition, the Viking CCS NSIP currently routes through Link W4-C4 where it would considerably limit routeing flexibility. An overhead line in Sections W2 to W6 could potentially oversail the Viking CCS NSIP underground infrastructure, however an underground cable is likely to require a crossing (via a trenchless crossing or other identified method to be identified at a later stage) of this scheme in Section W2UA resulting in a direct interaction.

Figure 6-10 – Socio-economic constraints relevant to the Western Corridor between Grimsby West and Burgh le Marsh



## North Thoresby to Woodthorpe

- 6.2.34 South of North Thoresby, there are very few socio-economic features within the Western Corridor and its links. The Viking CCS NSIP continues south through Section W6, across Section W7, centrally through Section W8 and then along the eastern edge of Sections W9 and W10, as well as interacting with Link W10-E11 west of North Cockerington. However sufficient space exists within these sections and links to avoid it or oversail through careful routeing (although routeing flexibility would be limited as a result).
- 6.2.35 The Lincolnshire Wolds Railway is also located in this area, within Section W7. It could be avoided through careful routeing (at later stages) by an overhead line along the western or eastern extents of the section or, where required, it could be oversailed.
- 6.2.36 South of Louth, the Louth Airstrip is located to the west of Section W11, and the North Rest Hall Farm Airstrip and Strubby Airfield are located to the east and west of Section W12 (See **Figure 6-10**). To avoid potential impacts on these airfields, an overhead line would need to be routed to the eastern edge of Section W11, to the east in the northern half of Sections W12 and W12A and to the west in the southern half of Section W12. Woodthorpe Hall (a caravan / leisure park and golf course) is located adjacent to the Corridor and therefore potential impacts are likely to be during construction only.

## Woodthorpe to Burgh le Marsh

- 6.2.37 No other socio-economic features are identified in the rest of the Western Corridor.

### Other Considerations

- 6.2.38 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.
- 6.2.1 Residential receptors are predominantly located outside, or within areas specifically excluded from, the Western Corridor and associated Links. Within the Corridor and Links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrowness at the north of Link W4-C4 further careful investigation of infrastructure placement would be required to avoid adverse residual impacts on residential properties immediately adjacent.
- 6.2.39 There would be a requirement to cross two watercourses; Laceby Beck (within Sections W2U and W2UA) and Waithe Beck (within Section W3U in proximity to Barton Street and Hatcliffe Top historic landfills). Although implementation of standard mitigation measures during construction would limit the potential for pollution and groundwater impacts upon these features, the direct interaction increases the potential risks associated with an underground cable when compared to an overhead line in these Sections from a water perspective.
- 6.2.40 There are constraints associated with water, primarily due to the presence of the main rivers, WFD river waterbodies, IDB waterbodies and smaller watercourses, in

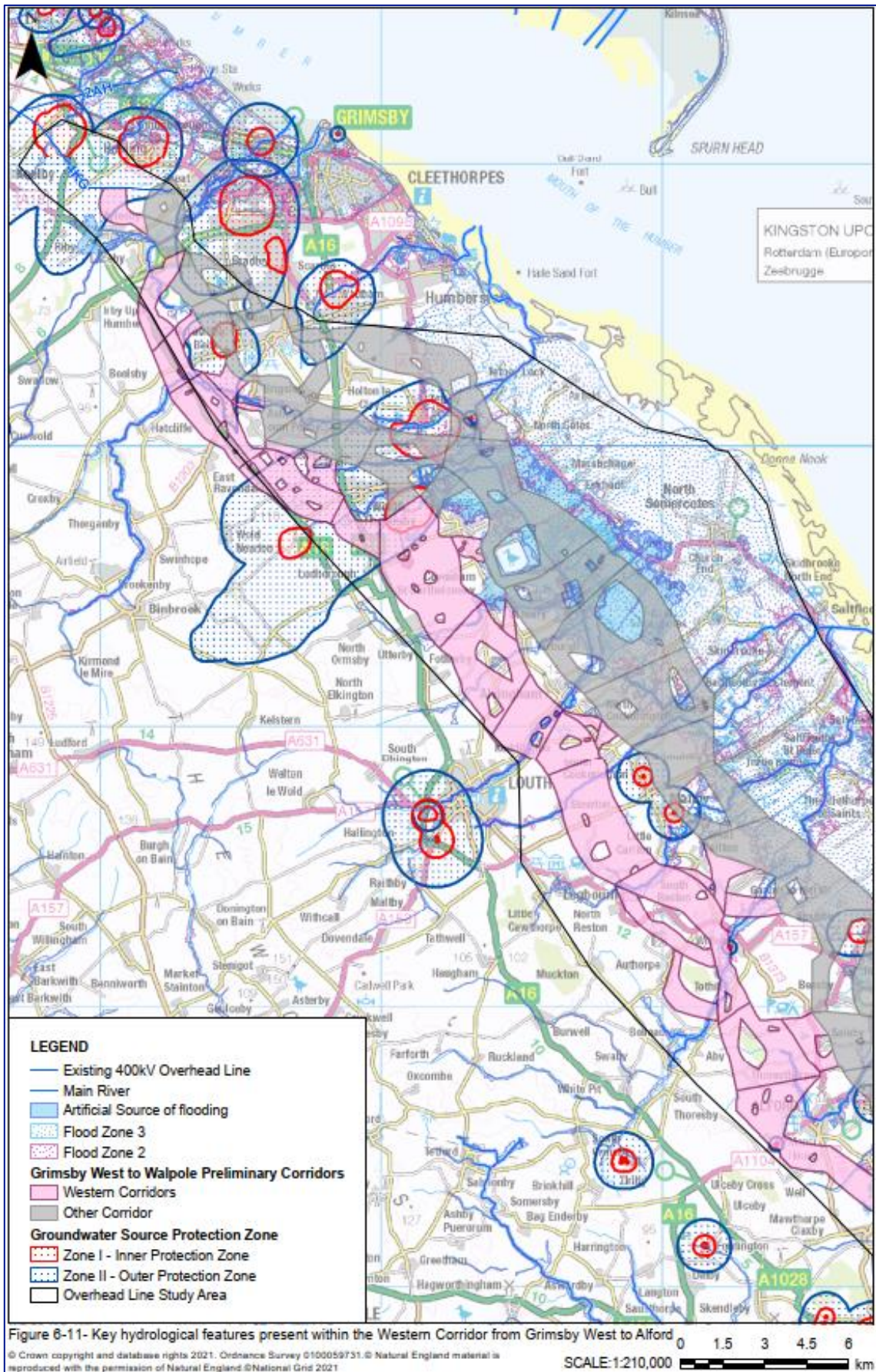
combination with Flood Zone 2 and 3<sup>39</sup> which are present across much of the Western Corridor and its links south of North Thoresby. In addition, a large area of flooding from artificial sources (as shown by data from the Environment Agency) associated with the Covenham Reservoir (which could occur because of infrastructure failure or human intervention) covers the eastern edge of Section W7 and W8. Inner groundwater source protection zones (SPZ1) are also identified within Sections W7, W12 and W14. There are no constraints which are considered to have potential adverse impacts to the extent which they would prevent routing; however, the extent of Flood Zone 2 and 3 coverage within Link W12-E11 and Section W15 (see **Figure 6-11**) means that the location of infrastructure in this area cannot be avoided and will present a constraint to construction.

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<sup>39</sup> Flood Zone 2 is land with a medium probability of flooding from rivers and/or the sea. Flood Zone 3 is land with a high probability of flooding from rivers and/or the sea.



Figure 6-11 – Key hydrological features present within the Western Corridor from Grimsby West to Alford



## Summary

6.2.41 Most of the environmental features relevant to the Western Corridor and its Links are located between the A46 and North Thoresby, within Sections W1 to W6 and Sections W1U to W5U. In this area those which exert most influence on a new overhead line are:

- the AONB (predominantly adjacent);
- the density and proximity of North Thoresby;
- the enclosed designed landscape associated with Grainsby Hall and Park;
- the Viking CCS NSIP; and
- the Aura Power Solar Farm.

6.2.42 Compared to an overhead line between the A46 and North Thoresby, there are fewer features which will significantly influence a new underground cable (in Sections W1U, W2U, W2UA, W3U and W3UA). The operation of the Viking CCS NSIP and Aura Power Solar Farm will likely be impacted, and their presence would limit the flexibility of routeing an underground cable. In addition, the potential presence of buried archaeology in proximity to the *Civil War earthwork fort* 350 m north-east of *Walk Farm* Scheduled Monument may also present a constraint, although at this stage the extent of buried archaeology is unknown. Although the AONB and the requirement to cross two watercourses will limit the flexibility of routeing within these Sections, impacts would predominantly be limited to construction.

6.2.43 South of North Thorseby (where only overhead line development is considered) there are fewer receptors within the Western Corridor and its links. Those present include watercourses, Flood Zones 2 and 3, reservoir flood areas, priority habitat and the Viking CCS NSIP. The majority of these can be avoided through careful routeing or be oversailed, limiting the potential for adverse effects.

6.2.44 When considering receptors outside the Western Corridor and its links, south of North Thoresby, these comprise scattered residential properties, recreational receptors and designated heritage assets (including the *Well Hall* Registered Park and Garden) which may be impacted alongside the AONB, visually or on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. However, most of these adverse impacts can be avoided, or reduced, through careful routeing due to the width of, and therefore flexibility within, the Western Corridor.

6.2.45 Overall, between Grimsby West and North Thorseby an underground cable would be environmentally preferred over an overhead line assuming careful siting of any SECs. Once south of North Thoresby there are fewer constraints to routeing an overhead line and a new overhead line within these Sections (which are considered for overhead line development only), except for Sections W14 and W15, would be acceptable.

## Engineering and System Factors

6.2.46 There are several constraints located throughout the Western Corridor and its links which are considered likely to reduce routeing flexibility and/or increase the technical complexity.

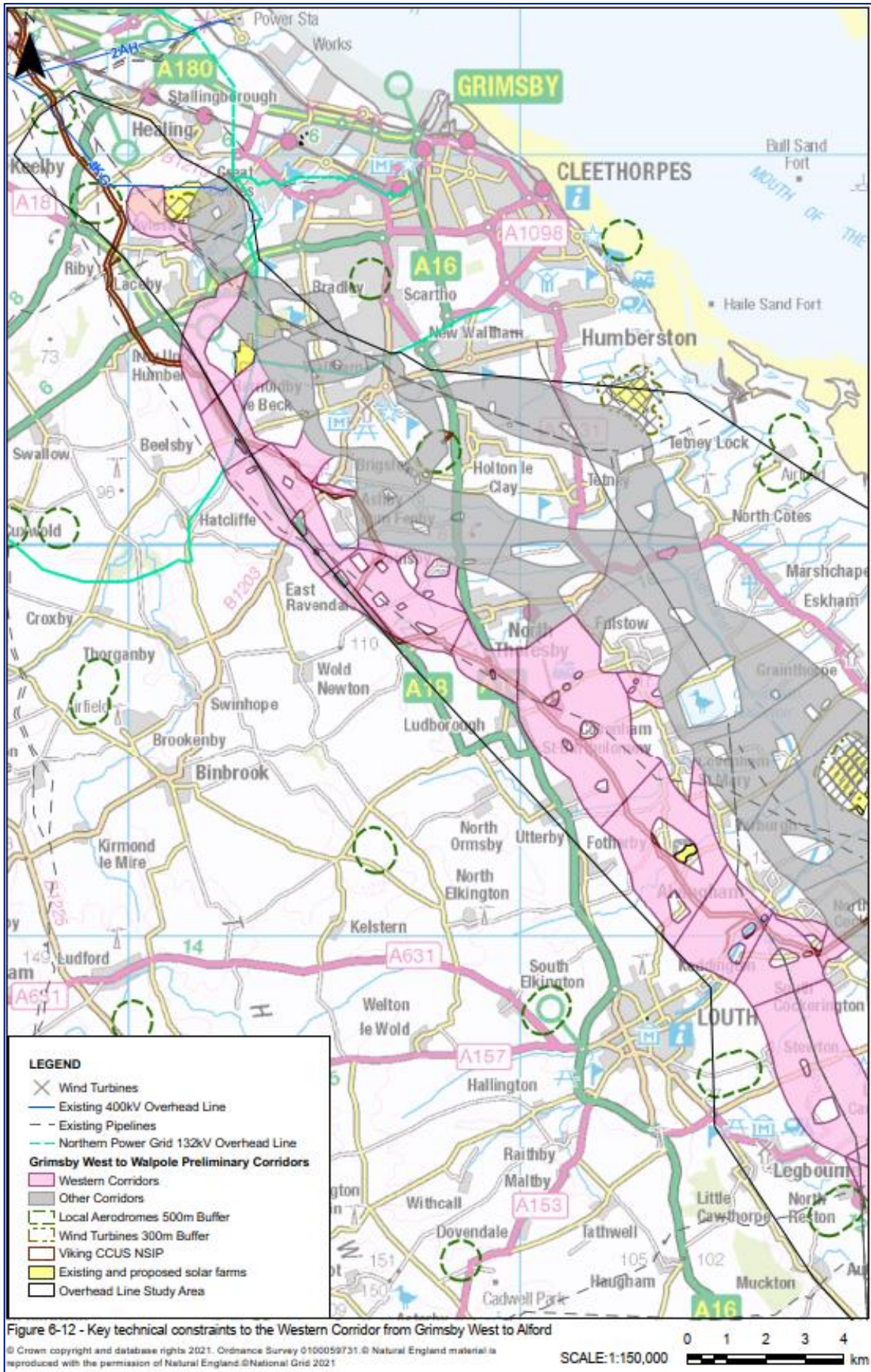
## Grimsby West to North Thoresby

6.2.47 Within Sections W1 and W1U the flexibility for routeing is considerably reduced by the Aura Power Solar Farm as, if Project infrastructure is required within the boundary of the Aura Power Solar Farm, this would have the potential to result in increased construction / delivery issues and possible access and construction limitations for the Project. Flexibility within Sections W1 and W1U is further reduced due to the presence of ConocoPhillips oil and gas pipelines ('ConocoPhillips pipelines') and the Hornsea 1 & 2 offshore windfarm underground export cables ('Hornsea cables') which route from north-west to south-east and thus restrict pylon placement. Due to the potential for induced voltages, cathodic protection studies<sup>40</sup> may be necessary if routeing in parallel to oil and gas pipelines. To achieve perpendicular crossings for an overhead line, additional and larger angle pylons may be required, and there are limited locations to achieve perpendicular crossings for an underground cable. Within Sections W1 and W1U, routeing flexibility is further reduced due to the presence of, and potential for interaction with, wind turbines located adjacent to the east of the Sections.

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<sup>40</sup> Cathodic Protection is the process of preventing corrosion via supply of a low current which protects the metal of a pipeline (turning the pipeline into a cathode). This may be required where there are sections of an overhead line in parallel with metal pipelines due to the potential for induced voltages, potentially increasing corrosion rates.

Figure 6-12 – Key technical constraints to the Western Corridor between Grimsby West and North Thoresby



- 6.2.48 Further south it is noted that Sections W2 to W5 [outside] and Sections W2U to W5U [inside] are adjacent to the boundary of the AONB. Therefore, as described above in **Paragraph 6.2.8**, may require alternative engineering solutions should an overhead line option be taken forward in this area.
- 6.2.49 Routeing within Sections W2 and W2U should consider scattered constraints including the Laceby Beck and Wellbeck Spring crossings and several rural dwellings. The A18 and A46 are present within these Sections, however, could likely be avoided through careful routeing (at later stages). Laceby Beck, and a small area of Flood Zone 2 and 3 will require crossing, however for the overhead line it is considered that these can be oversailed.
- 6.2.50 Further west within Section W2UA, there is additional complexity due to construction within the AONB and proximity to the *Civil War earthwork fort 350 m north-east of Walk Farm* Scheduled Monument. The relationship with these receptors may increase construction complexity associated with buried archaeology. The A17 and Laceby Beck would also require crossing within Section W2UA further increasing construction complexity.
- 6.2.51 Continuing south of Manor (Laceby) Golf Club within Section W3, the presence of a NPG 132 kV overhead line, the Viking CCS NSIP, existing business premises and estates which bisect the Section in the vicinity of a required crossing of Waithe Beck, considerably reduce flexibility and constrain the potential siting of infrastructure. These constraints are present within a 700 m stretch of this Section, as shown in **Figure 6-12**. For an overhead line option, the NPG 132 kV overhead line would require modification (via re-routeing, undergrounding or the requirement for a Grid Supply Point (GSP) substation<sup>41</sup>) prior to construction of the Project. The technical viability of the modification would require further assessment should this Section be taken forward.
- 6.2.52 Further west, within Section W3U, routeing an underground cable is unlikely to be complex as the corridor is adequately wide to accommodate a construction cable swathe which could avoid most constraints. A route adjacent to the west of the A18 avoids an E.ON gas pipeline (to the west of the Section) and the Viking CCS NSIP (to the east of the Section). However, a crossing of Waithe Beck would still be required.
- 6.2.2 Most of Section W4 consists of clear open fields, with sufficient space for routeing. However, scattered constraints such as small farm complexes, residential dwellings and their extended curtilages, woodland blocks, mature scattered trees and hedgerows, the requirement to cross Waithe Beck, and the presence of an E.ON gas pipeline present minor constraints to routeing. An alternative connection south of Brigsley, via Link W4-C4, is constrained due to its width and because of the Viking CCS NSIP which routes through this entire link.
- 6.2.53 South of Ashby cum Fenby, the E.ON gas pipeline routes along the length of Section W5 and therefore may require crossing twice, although it could be avoided by routeing to the eastern or western edges of Section W5. Careful routeing (at later stages), sufficient stand-off distances (specific stand-off distances subject to detailed engineering studies) and cathodic protection studies may be required. Other scattered constraints such as residential properties (as well as their extended curtilages), woodland blocks, mature scattered trees and hedgerows, and

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<sup>41</sup> A Grid Supply Point (GSP) is a Systems Connection Point at which the Transmission System is connected to a Distribution System.

waterbodies also present limitations to routeing within this Section. To avoid these constraints, which includes the large curtilage of Fenby Hall, two crossings of the E.ON gas pipeline may be required. Further west, within Section W5U, an existing woodland block is located adjacent to the A18. Crossing this will require removal of a woodland (the extent of removal would be determined at later stages), but this is unlikely to technically constrain routeing.

#### North Thoresby to Woodthorpe

- 6.2.54 South-west of North Thoresby, there are several constraints to routeing within Section W6. These include the Viking CCS NSIP, E.ON gas pipeline, woodland blocks, and crossing the A16, Black Leg Drain and its associated areas of Flood Zone 2 and 3. Due to the lack of properties within this Section, other constraints present are not considered significant to the routeing of an overhead line. Once the Western Corridor crosses the A16 south of North Thoresby (in Section W6) it widens and continues south. From this point the routeing flexibility within the Western Corridor is less constrained.
- 6.2.55 The Viking CCS NSIP continues to constrain the Western Corridor as it extends south through Sections W7, W8, W9 and W10. Within these Sections, this scheme is predominantly located along the eastern edge of the Sections and can be avoided through routeing to the west. However, where it runs through the centre of Section W7 and W8, crossing would be required.
- 6.2.56 Flood Zones 2 and 3 are a routeing constraint throughout the Western Corridor as it travels south of Ludborough. Flood Zones 2 and 3 present in these areas are associated with larger drains and watercourses within each Section, including Louth Canal, The Beck, Old Eau, Great Eau, Woldgrift Drain and Boygrift Drain. Most areas of Flood Zones 2 and 3, except for Sections W12, W12A and W15, are narrow and can be avoided by careful routeing or be oversailed with relative ease. Within Sections W12, W12A and W15, they cover a large area and therefore cannot be avoided, resulting in likely access and construction limitations and a requirement for infrastructure to be designed accordingly.
- 6.2.57 In addition to the Viking CCS NSIP and Flood Zones, Section W7 also contains the E.ON gas pipeline, scattered residential properties, and the Lincolnshire Wolds Railway (heritage railway). However, the width of this Section means that these can be avoided through careful routeing (at later stages) or crossed without the requirement for technically complex solutions.
- 6.2.58 Continuing south towards Louth, routeing flexibility within Section W8 is generally unconstrained. Except for the Viking CCS NSIP and small areas of Flood Zones 2 and 3, routeing would need to consider scattered constraints including residential properties and farm complexes (with associated curtilage) and woodland blocks. However, within Section W9 routeing flexibility decreases due to the Louth Canal which crosses the corridor and constraining commercial, residential, and industrial buildings on its eastern bank, a NPG 33 kV overhead line and underground cable, and a small drain near to the Louth Canal. The placement of infrastructure is more restricted in this area, however sufficient flexibility exists to facilitate the routeing of an overhead line through this Section.
- 6.2.59 East of Louth, within Section W10, routeing flexibility continues to be constrained by the Viking CCS NSIP, residential properties, the Covenham to Miningsby Reservoir pipeline ('Covenham pipeline') and Rushmoor Country Park to the centre and east. Routeing to the south and west of this Section provides greater flexibility, however a

NPG 33 kV overhead line in this area would require modification prior to construction of the Project.

- 6.2.60 The Covenham pipeline and NPG 33 kV overhead line continue south into Section W11. Within this Section, these and other scattered constraints provide limited restrictions to routeing flexibility as they can be easily avoided through careful routeing (at later stages).
- 6.2.61 Alternative connections exist from the Western Corridor in this area via Link W7-E6 and Link W10-E9. Link W7-E6 is largely free from constraint, however, routeing of an overhead line within this link should consider a camping and caravanning site (CE Brader Camping and Caravanning), large farm holdings and their associated curtilages. Sufficient room exists to the northern edge of this link to route around any constraining features, but routeing to the south-east of Grange Farm may require oversailing of a strawberry plantation and the camping and caravanning site. Link W10-E9 lies to the south of North Cockerington. Routeing of an overhead line in Link W10-E9 should take into account a single residential property located within the centre of the link, a scheduled monument (as noted in **Paragraph 6.2.26**), also located within the centre and a small section of Flood Zone 2 and 3 in the north. The residential property can be avoided entirely but the scheduled monument may not be avoided entirely, and the area of Flood Zone 2 and 3 can be oversailed.
- 6.2.62 South-east of Louth, the Western Corridor splits into three sections; W12, W12A and W12B. To the east, Section W12 and W12A would require a crossing of The Beck, Old Eau and Great Eau watercourses, the A157 and two gas pipelines which may restrict pylon placement. If routeing east in Section W12A an NPG 33 kV overhead line would also require modification. Comparatively, Section W12B is narrower which limits routeing flexibility. Routeing here should also consider a small water treatment works on the north-western boundary, where it connects to Section W13.
- 6.2.63 An alternative connection to the Eastern Corridor (Link W12-E11) lies to the south of Gayton le Marsh. Routeing here should consider woodland blocks, a residential property and waterbody, the New Clayton Engine Drain, and the Great Eau River. There would be limited flexibility for pylon placement at the crossing of the Great Eau River. Two gas pipelines route east to west and would further limit pylon placement. Sufficient standoff distances would be required but perpendicular crossings could be achieved. Approximately 40% of the link is within Flood Zones 2 and 3, concentrated at the western extent, and therefore infrastructure within these areas Flood Zones will need to be designed accordingly. There is potential for access and construction limitations due to flooding.

#### Woodthorpe to Burgh le Marsh

- 6.2.64 The Western Corridor merges as it routes into Section W13, and then splits again to either side of, and to avoid, Mother Wood. This area consists of mainly open countryside providing high flexibility for routeing. The Viking Link Interconnector underground cable ('Viking Link Interconnector') crosses the south of this Section and may limit pylon positioning in this area. An alternative connection to the Eastern Corridor (Link W13-E12) is located within the Saleby area. There is a high flexibility for routeing within the link, however this is reduced (limiting pylon placement) to the south where the Viking Link Interconnector is present and may result in the requirement for additional angle pylons to facilitate a perpendicular crossing. A viable alternative is available to the north of Saleby which avoids the Viking Link

Interconnector. A perpendicular crossing of the A1104 would also be required within the ink but would reduce routeing flexibility.

6.2.65 Section W14 continues south, routeing west of Alford. In this area the location of Alford crematorium constrains routeing, and to avoid oversailing the crematorium a route to the western extent of the Section (closer to the AONB) is required. Two NPG 33 kV overhead lines are also present and would require modification prior to the works. In addition, scattered areas of peaty soils should be avoided or would require more complex foundation designs, access limitations and introduce the risk of subsidence and waterlogging.

6.2.66 Towards Burgh le Marsh there are few constraints within Section W15. However, routeing would have to consider scattered constraints, predominantly in the south, including residential properties, multiple minor drains, a NPG 33 kV overhead line, woodland blocks and the Birdsong Green Burial Site and caravan parks.

## Summary

6.2.67 Overall, the presence of the Viking CCS NSIP is a key constraint to the Western Corridor, especially between the A46 and North Thorseby. In this area, the Western Corridor is generally narrower, therefore the Viking CCS NSIP in combination with constraints such as the Aura Power Solar Farm, existing pipelines and major underground cable assets present a considerable constraint to routeing of both an overhead line or underground cable, especially within Sections W1, W1U, W2, W2U and W5. Once south of North Thoresby, the Western Corridor widens and constraints to routeing predominantly consist of underground infrastructure and scattered above ground constraints which can be avoided or oversailed with careful routeing (at later stages), offering high flexibility.

## Holford Rules

6.2.68 Except for the AONB, the Western Corridor and its links has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**. Regarding the AONB, only those sections utilising underground cable are located within its boundary. In these underground cable sections, adverse impacts are unavoidable but largely restricted to construction impacts. In accordance with Holford Rule 1, alternative sections outside the AONB have been thoroughly considered.

6.2.1 The Corridor has generally avoided smaller areas of high amenity value through excluding these from the Corridor and its Links. The smaller areas of high amenity value which exist within the boundaries of the corridor and its links comprise:

- scheduled monuments within Section W2UA, Sections W8 to W13, Section W15 and Link W10-E9;
- ancient woodland within Sections W12, W12A, W12B, W13 and W14; and
- listed buildings within Section W9.

6.2.2 Where there are smaller areas of high amenity value sufficient space has been included within the corridor and its inks to enable flexible routeing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**. The exception to this is the *North Cockerington Hall moated site* Scheduled Monument located within Link W10-E9 where avoidance may not be possible.



- 6.2.69 The Western Corridor follows a largely direct route, in line with **Holford Rule 3**, from the north of the Overhead Line Study Area to North Thorseby and from North Thoresby to Burgh le Marsh it is the most direct Corridor. The use of any links would result in a direction change between the main corridor and therefore could result in a greater number of angle pylons being required (and therefore the route performing less well against Holford Rule 3). In particular, the connections routeing from west to east are considered to result in a less direct route.
- 6.2.70 The Western Corridor and its links were developed to avoid highly constrained areas, and specific constraints including settlements such as Laceby, Barnoldby le Beck, Brigsley, Ashby cum Fenby, North Thoresby, Louth and Alford (Holford Rule Supplementary Note 1). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to Manor (Laceby) Golf Club, the AONB, Barnoldby le Beck, Brigsley, Ashby cum Fenby, Tothill / Claythorpe Woods Ancient Woodland, four scheduled monuments in the vicinity of Tothill, and Alford. The width of the corridor has wide sections where the space is unconstrained, such as around the crossing of the B1200 and between Alford and Burgh le Marsh.
- 6.2.71 The Western Corridor, particularly south of Section W6, includes more land than is needed for the construction of an overhead line which provides flexibility and optionality when undertaking more detailed routeing, following consultation feedback, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 6.2.72 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 6.2.73 The Western Corridors would need to cross, either as an overhead line or an underground cable, a NPG 132 kV overhead line west of Barnoldby le Beck. The crossing of the overhead line is unavoidable and therefore does not align with regards to **Holford Rule 6**. Should an overhead line option be taken forward it is likely that adverse landscape and visual impacts may be experienced unless this is mitigated.
- 6.2.74 No industrial zones exist within the Western Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

- 6.2.75 The Western Corridor and its links between Grimsby West and North Thoresby is significantly constrained by the presence of the Viking CCS NSIP (Sections W2/W2U to W6), the AONB (Sections W2/W2U to W5/W5U) and narrow areas in proximity to residential properties (Sections W3, W4 and W6). An underground cable in this area would reduce the likely environmental impacts with regards to landscape, visual and the setting of heritage assets during operation. However, an underground cable is also likely to introduce other impacts during construction, due to watercourse crossings, proximity of archaeological features and interactions with existing or proposed pipelines.

6.2.76 Further south there are scattered constraints which require consideration. The width of the corridor between North Thorseby and Woodthorpe (Sections W7 to W11) offers significant flexibility for routeing. From Woodthorpe the narrower area, proximity to the AONB, Alford, the *Well Hall* Registered Park and Garden and the requirement to cross the Willoughby Branch Line LNR will increase the complexity and potential impacts of an overhead line utilising Section W14 and into Section W15.

6.2.77 A tabulated summary of the appraisal of the Western Corridor and its Links is provided in **Table 6-1**.

Table 6-1 Summary of Western Corridor Options Appraisal

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• The routing corridor and the presence of the existing Grimsby West Substations and 4KG 400 kV overhead line may in combination have adverse impacts on the landscape and visual amenity to the north.</li> <li>• The sensitivity of the local landscape within the corridor is reduced in places due to the presence of existing above ground electrical infrastructure.</li> <li>• There is potential for adverse visual effects on the AONB due to its proximity to the corridor in certain Sections.</li> <li>• There is potential for significant adverse impacts on views experienced by recreational receptors including users of the Sustrans National Cycle Routes and Lincolnshire Wolds Railway (historic railway).</li> <li>• Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• There is the potential for direct adverse impacts on Willoughby Branch Line LNR which is crossed by the Western Corridor.</li> <li>• There is potential for the Western Corridor to have functionally connected habitats to the Humber Estuary designated sites.</li> <li>• Headwater areas, coastal and floodplain grazing marsh, and ancient woodland priority habitats are within and adjacent to the Western Corridor.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Several listed buildings and scheduled monuments are scattered throughout the corridor and its links. Most of these can be avoided with careful routeing, however, impacts on setting are likely to arise should the overhead line be developed where the corridor is closest to these heritage assets.</li> </ul>

Theme	Topic	Summary
		<ul style="list-style-type: none"> <li>• There is the potential for there to be buried archaeology associated with designated heritage assets within the Western Corridor. within the Western Corridor. within the Western Corridor. within the Western Corridor.</li> </ul>
	Socio-economics	<ul style="list-style-type: none"> <li>• Adverse effects are likely on the Aura Power Solar Farm as it cannot be avoided.</li> <li>• The Viking CCS NSIP routes through the majority of the Western Corridor and oversailing would be required to prevent a direct interaction.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>• Flood Zones 2 and 3 cover most of the corridor south of Hasthorpe and present a constraint to construction of overhead lines in these areas.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• The Aura Power Solar Farm has the potential to reduce routeing flexibility.</li> <li>• To the west of Barnoldby le Beck an NPG 132 kV overhead line will require mitigation, such as removal or undergrounding, to ensure there is sufficient space for the proposed new overhead line.</li> <li>• To navigate constraints east of Louth, a NPG 33 kV overhead line will require modification prior to the construction.</li> <li>• To the west of Alford, two 33 kV overhead lines will require modification prior to the construction of a new overhead line in this location.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• Coordination with developers will be required to ensure the proposed new overhead line (or underground cable within some Sections) can be facilitated in combination with the various other proposed developments located within the Western Corridor including the Viking CCS NSIP throughout most of the corridor and Aura Power Solar Farm in the north.</li> <li>• The Viking CCS NSIP follows the Western Corridor through most Sections and is a key constraint to routeing, particularly between the A46 and North Thoresby.</li> <li>• Existing underground oil and gas pipelines and the Hornsea cables limit the positioning of pylons within the corridor.</li> </ul>

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Theme	Topic	Summary
		<ul style="list-style-type: none"><li>• Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings.</li><li>• Infrastructure is likely to be required within Flood Zones 2 and 3, particularly at the southern end of the Western Corridor, which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li><li>• Peaty soils are present at the southern end of the Western Corridor which may pose a risk to pylon foundations through ground subsidence and waterlogging. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li></ul>

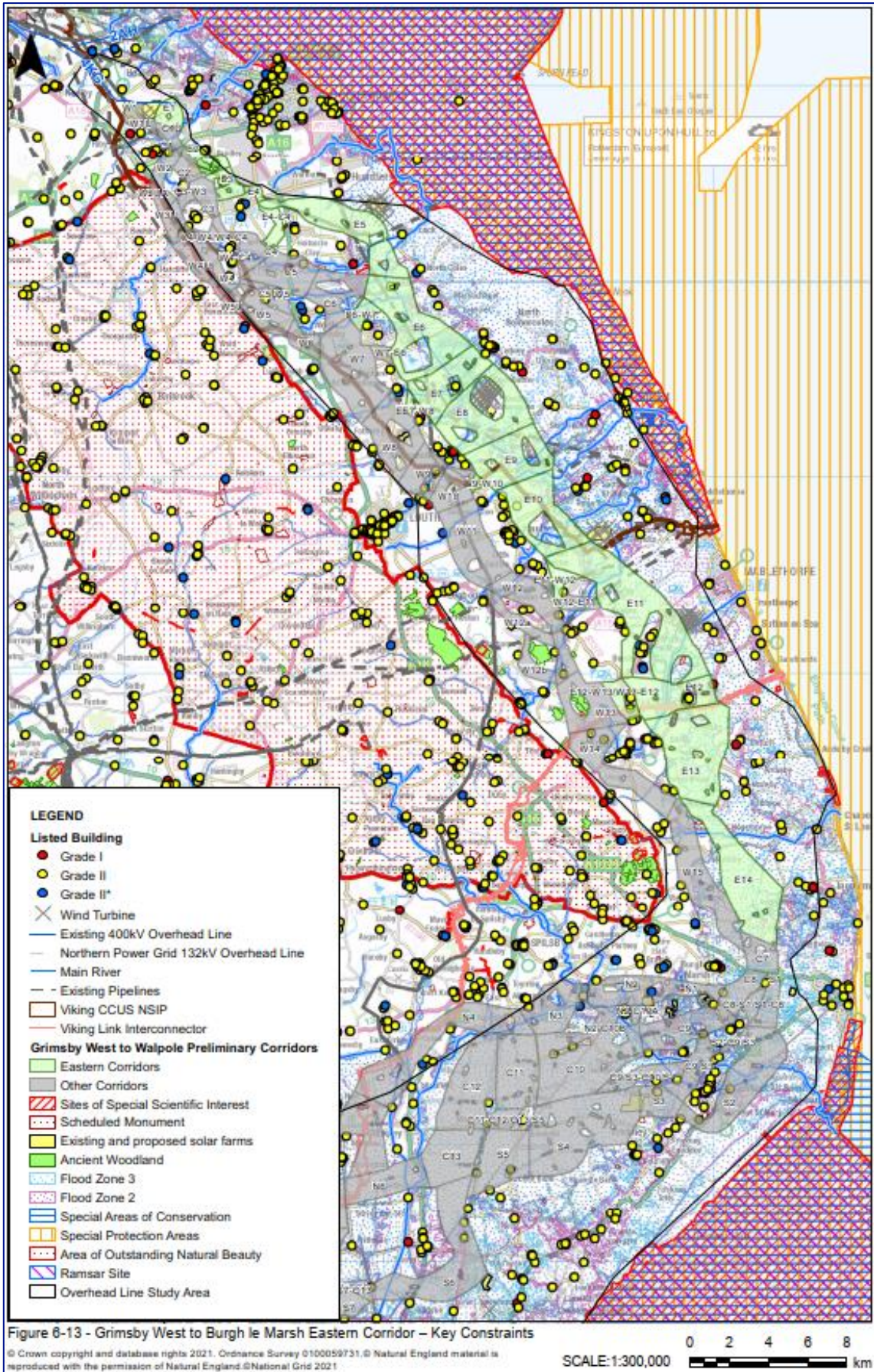
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## Eastern Corridor (Sections E1 to E14, E1U)

- 6.2.78 The Eastern Corridor (options prefixed with 'E') is shown in **Figure 6-13**. It starts at the 400 kV 4KG overhead line and routes south to meet the Central Corridor (Sections C1 and C1U). Between the 400 kV 4KG overhead line and the Sections C1 and C1U, two technology options are considered; an overhead line section (Section E1) and an underground cable section (Section E1U). An underground cable alternative is provided in this area to account for onward routeing via the Western Corridor underground cable Sections (W1U to W5U) described above. Should underground cables be utilised then SECs would be required where there is a transition between underground cable and overhead line. The precise siting of these would be undertaken at a later stage.
- 6.2.79 From Sections C1 and C1U, at the A46, the Eastern Corridor continues south-east, following the edge of settlement at Grimsby and Cleethorpes, to a narrow area between Waltham and Scartho at Section E4. Within this area existing NPG 132 kV overhead lines, located in Sections E2, E3 and E4 would require crossing, resulting in a minimum of two crossings. Following the narrow area in Section E4, the Eastern Corridor routes south-east through Section E5, to the south of Cleethorpes, before heading south and parallel to the coast, past the Tetney Oil and Gas Terminal ('Tetney Oil Terminal'). Between Sections E6 to E14, the Eastern Corridor routes south and parallel to the coast, between Fulstow, Withern and Sloothby to the west, and between North Cotes, Mablethorpe and Addlethorpe to the east. From Section E14 the Eastern Corridor then continues south-west to meet the Central Corridor (Section C7) again.
- 6.2.80 The Eastern Corridor is located furthest east of the corridors appraised between Grimsby West and Burgh le Marsh. Notable constraints for this corridor include the NPG 132 kV overhead lines, existing underground cable and pipeline infrastructure, Aura Power and Low Farm Solar Array, Bradley and Dixons Woods LNR, the Scartho and Bradley Gairs blocks of ancient woodland, Tetney Oil Terminal, sections of the Lincolnshire coastline that are internationally designated for their bird interest, Covenham Reservoir, existing windfarms, and Eastfield Airstrip, Flood Zones 2 and 3, *Hagnaby Abbey* and *Markby Prior* Scheduled Monuments, *Eastfield Farmhouse* Grade II listed buildings, Tetney Blow Wells SSSI, Grimsby West Urban Extension and associated housing allocation ('GWUE allocation'), the Louth Canal, the Viking CCS NSIP, Wigmore Park housing development ('Wigmore Park'), and the Outer Dowsing OWF. These constraints are shown on **Figure 6-13**. The corridor was progressed primarily due to it providing further optionality when routeing an overhead line south from Grimsby, driven by the constrained pattern of settlement; to provide an option to route further from the AONB and to provide an option resulting in less interaction with the larger settled areas of Louth and Alford further south.
- 6.2.81 In addition to the corridor itself, there are six links between the Eastern and either Central or Western corridors. These links have been provided where it would be possible to avoid constraints or pinch points associated with a particular Section by transferring from one corridor or section to another and are as follows.
- Link E4-C4, which connects the Eastern and Central corridors to the west of Holton le Clay.
  - Link E6-W7, which connects the Eastern and Western corridors to the north of Fulstow.

- Link E7-W8, which connects the Eastern and Western corridors to the south of Covenham St Mary.
- Link E9-W10, which connects the Eastern and Western corridors to the north of South Cockerington.
- Link E11-W12, which connects the Eastern and Western corridors to the south of Great Carlton and the north of Gayton le Marsh.
- Link E12-W13/W13-E12, which connects the Eastern and Western corridors to the south of Woodthorpe.

Figure 6-13 – Grimsby West to Burgh le Marsh Eastern Corridor – Key Constraints





## Environmental Factors

### Landscape and Visual

6.2.82 The Eastern Corridor is located within the Lincolnshire Coast and Marshes NCA (NCA 42) which is characterised by a wide coastal plain extending from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. The key landscape and visual features between Grimsby and Burgh le Marsh are the density of the population and the proximity to the AONB between Laceby and Waltham. The AONB is split into four LCAs, those of relevance to the Eastern Corridor comprise the Chalk Wolds LCA and South–Eastern Claylands LCA. A description of the key features of these LCA is provided in **Paragraph 6.2.6**.

#### Grimsby West to North Cotes

6.2.83 The existing NGET 400 kV and NPG 132 kV Grimsby West substations are in the north of the Eastern Corridor (Sections E1 and E1U). A section of the 400 kV 4KG overhead line routes in from the west, and several NPG 132 kV overhead lines route south from the existing NPG substation. The presence of this electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure but leaves the potential for intensified impacts from the creation of a wirescape. Therefore, careful consideration of the overhead line routing is required alongside the siting of the new Grimsby West substation. A new overhead line in this Section (E1) has the potential for adverse impacts upon views from nearby settlements (at Aylesby, Laceby, Laceby Acres, Wybers Wood and scattered residential properties) due to the wide, open nature of the landscape with long views and the proximity of the settlements. There is also the potential to adversely impact upon views from the AONB, however at over 2 km away, set in the context of Laceby and the outskirts of Grimsby, (and with careful routing and siting of infrastructure) significant adverse visual effects are considered unlikely here.

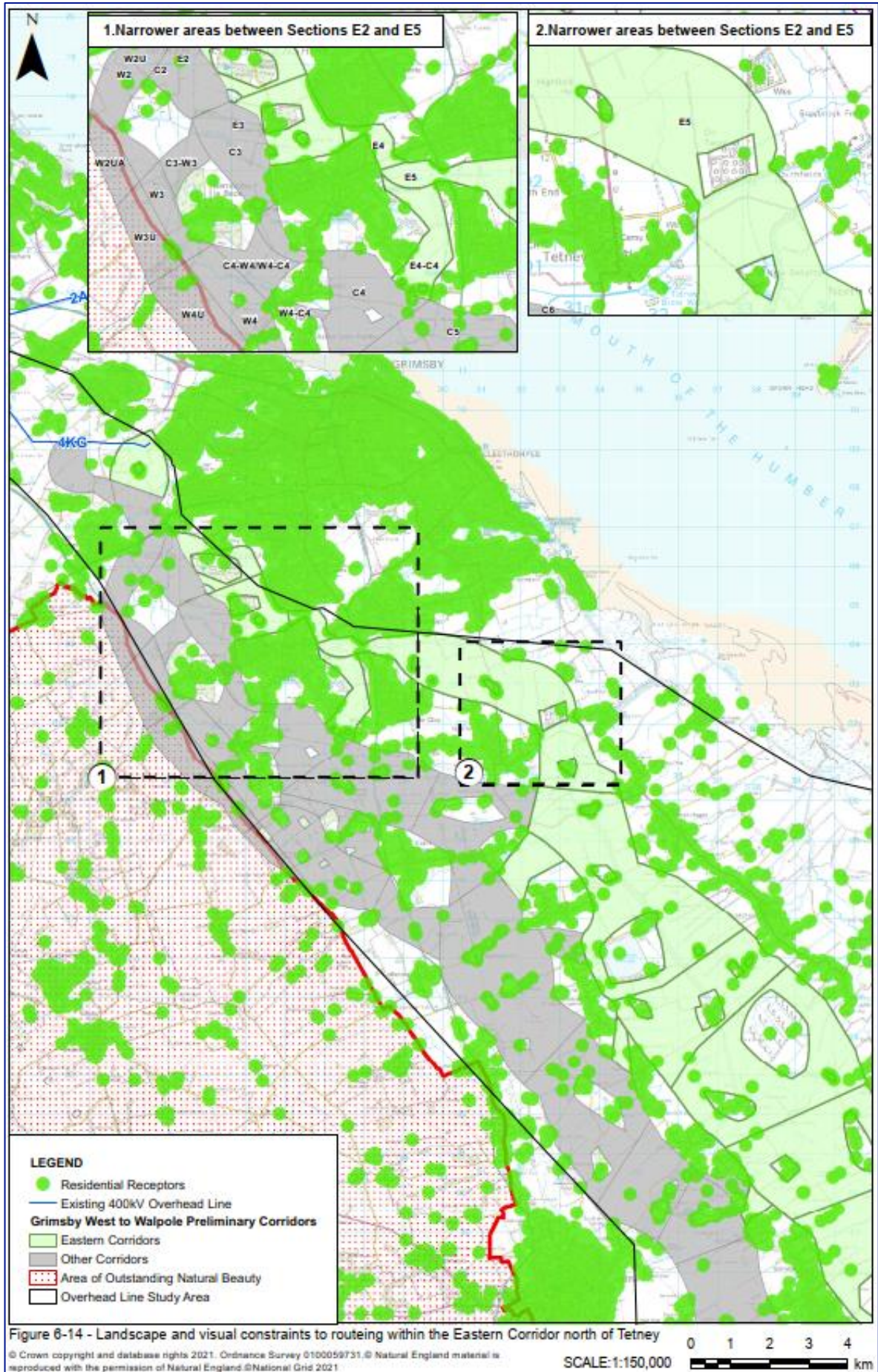
6.2.84 Compared to an overhead line, an underground cable would limit potential impacts to these receptors (as effects would generally be limited to the construction period). It is noted that there would still be the potential for visual impacts, predominantly associated with the presence of SECs. The severity of these effects is capable of being managed through careful siting, landscape mitigation planting and enhancement (at a later stage).

6.2.85 The AONB is the only nationally designated landscape in proximity to the Overhead Line Study Area. For the Eastern Corridor, only Sections E2 and E3 are located within 2 km for the AONB (approximately 1.7 km at their closest point). A new overhead line here would not be considered incongruous in the context of the AONB as it would be seen in the context of the urban fringes of Grimsby, Cleethorpes and satellite villages. East and south of Waltham, all other Sections are over 2.4 km (at their closest points) from the AONB and despite the open nature of the views, the risk of affecting the setting of the AONB from a new overhead line is limited due to the distance and intervening and surrounding development and vegetation. There is the potential to impact upon views to and from the AONB, however these would be set in the context of scattered settlement, the Tetney Oil Terminal, and existing onshore and offshore wind farms.

6.2.86 South of the A46 to Tetney (Sections E2 to E4 and Link E4-C4), the Eastern Corridor passes through narrow gaps either side of Bradley Woods and Dixon's Wood, between Scartho, Waltham and New Waltham, as shown in **Figure 6-14**, leaving little

flexibility for overhead line routeing. In this area potential significant impacts on visual amenity are considered more likely on the settlements of Nunsthorpe (Section E2), Scartho (Section E2 and E3), Waltham (Sections E3, E4 and E5 and Link E4-C4), New Waltham (Sections E3 and E4), and Holton le Clay (Section E4 and Link E4-C4). Other receptors where significant impacts to visual amenity could occur include users of Bradley and Dixon Woods LNR (Sections E2 and E3), users of Wanderlust Way (Sections E2 to E4) and users of Waltham Windmill Golf Club (Link E4-C4). The Eastern Corridor would cross two NPG 132 kV overhead lines in three locations (Sections E2, E3 and E4) and, as within Section E1, there is therefore potential for the creation of a wirescape. It is considered that the existing overhead lines would require undergrounding to enable crossings, avoid a wirescape and reduce potential for significant cumulative visual impacts.

Figure 6-14 – Landscape and visual constraints – Eastern Corridor north of Tetney



- 6.2.87 Immediately south of New Waltham and Cleethorpes the Eastern Corridor passes through Section E5. East of the A16 Louth Road this section is less densely populated, with widely scattered farms and clusters of farm cottages. West of the A16 Louth Road, Wigmore Park and an existing yard are located which result in a more populated area within the Section. The main visual receptors for Section E5 are those at New Waltham (including Wigmore Park), Humberston Grange, Holton le Clay, Tetney and those focussed along the A1031. Other sensitive visual receptors in this area include recreational users travelling along the Louth Canal and those at Tetney Blow Wells Nature Reserve.
- 6.2.88 The Eastern Corridor narrows within Section E5 to the east and west of Tetney Oil Terminal. Outside of these areas there is good routeing flexibility within Section E5. There is the potential to adversely impact on views from scattered residential properties, identified settlements and recreational receptors however, the width and limited constraints present within the Eastern Corridor in this area allows flexibility for the routeing of an overhead line. Due to the presence of the existing wind turbines, Tetney Oil Terminal and Tetney Sewage works, which are all notable in the landscape, the sensitivity of the landscape to adverse impacts from new infrastructure is reduced (see **Figure 6-15**). However, routeing will need to be considerate of potential cumulative effects with this industrial infrastructure.

#### North Cotes to Maltby le Marsh

- 6.2.89 South of the North Cotes (Sections E6 to E14 and Links E6-W7, E7-W8, E9-W10 and E11-W12) the Eastern Corridor passes through areas that are less densely populated, with widely scattered farms and clusters of farm cottages. Due to the proximity of populated residential areas, adverse visual effects on some individual receptors, particularly at the edges of villages, are considered unavoidable; however, the width and limited constraints of the Eastern Corridor in most of this area allows flexibility for the routeing of an overhead line. The links from the Eastern Corridor are narrower than the Eastern Corridor, meaning flexibility for routeing is limited. However, it is nonetheless considered that careful routeing of these sections and links could materially limit their adverse effects on visual amenity.
- 6.2.90 Within Section E6, the main visual receptors include residential receptors at North Cotes, Fulstow, Marshchapel, Grainthorpe, Covenham St. Bartholomew and Covenham St. Mary to the east and west of the corridor. Recreational receptors include those travelling along the Louth Canal and visiting Covenham Reservoir. The main receptors for Link E6-W7 are the residential areas and properties within Fulstow.
- 6.2.91 As the Eastern Corridor continues south into Sections E7 and E8, it nears Fen Farm Wind Farm which is specifically excluded from Section E8 with routes to the east and west. The presence of this infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure but also presents the potential for cumulative effects. The main visual receptors in this area include residential receptors at Austen Fen, Grainthorpe Fen, Grainthorpe and Covenham St. Mary for Section E7; at Conisholme, South Somercotes, Scupholme, North Cockerington and Alvingham for Section E8; and at Yarburgh for both Sections E7 and E8. In addition, there is the potential for adverse visual impacts upon receptors travelling along the Louth Canal. The Link E7-W8 is also in proximity to the areas of Covenham St Mary and Yarburgh and users of the local cycle network. Adverse visual impacts are considered unavoidable on some receptors; however, the number and severity of effects upon most receptors could be reduced through careful routeing.

- 6.2.92 South of Fen Farm Wind Farm within Section E9, the landscape continues to be wide and open with few scattered residential receptors at North Cockerington, South Cockerington, Grimoldby and Scupholme. Here there is the potential to connect to the Western Corridor via Link E9-W10 which is also in proximity to the residential receptors at North Cockerington and South Cockerington.
- 6.2.93 Within Section E10, the Eastern Corridor divides into an eastern and western leg to avoid the Eastfield Farm Airstrip before joining again as it reaches Section E11. Section E11 also splits into three to avoid Maltby le Marsh. There is also a Link from Section E11 to the Western Corridor (Link E11-W12). All are shown in **Figure 6-15**. These narrower areas create limited opportunities for flexible routeing of an overhead line to avoid impacts upon sensitive receptors. An overhead line within these sections and links would adversely impact the visual amenity of residential receptors at Grimoldby, Manby, Saltfleet by St. Peter (Section E10); Gayton le Marsh, Strubby, Maltby le Marsh, Beesby and Thorpe (Section E11); and Great Carlton and Gayton le Marsh (Link E11-W12). There is also the potential for adverse visual impacts on receptors at the New Inn and Willow Farm Caravan Parks (Section E10) and those travelling on the A1104 (Section E11). The presence of the Mablethorpe and Bambers Farm Wind Farms (at the eastern edge of Sections E10 and E11) means that the landscape here is less sensitive to new infrastructure but also presents the potential for cumulative effects. Within these areas, an overhead line would add to the impact of existing infrastructure which would all be located near to receptors. As a result, visual impacts are likely to be significant and unlikely to be adequately mitigated through careful routeing. Alternative mitigation may need to be considered to materially limit potentially significant adverse impacts.

Figure 6-15 – Landscape and visual constraints – Eastern Corridor between Tetney and Maltby le Marsh



## Maltby le Marsh to Burgh le Marsh

6.2.3 South of Maltby le Marsh, the Eastern Corridor is largely free from constraints with few scattered receptors and open landscapes providing good flexibility for routing. Links between the Eastern and Western Corridors exist here (Link E12-W13/W13-E12). The main residential receptors in these links include residential receptors at Beesby, Markby and Saleby for Section E12, at Asserby and Bilsby for Sections E12 and E13, at Thurlby, Huttoft, Mumby and Cumberworth for Section E13, and at Saleby and Thoresthorpe for Links E12-W13/W13-E12. Other sensitive visual receptions in this area include users of the A1111 (Sections E12 and E13). There are fewer visual receptors for Section E14, comprising mainly residential receptors at Bonthorpe, Cumberworth and those in scattered settlements at Marsh Farm, Bridge Farm, Cottage Farm and The Elms Caravan Parks, located to the north and south of this Section (see **Figure 6-15**). Due to the width of the sections and links and the scattered nature of receptors, careful routing together with the flexibility offered by these Sections is considered to materially limit the severity of impacts upon receptors.

## Ecology

6.2.4 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological assets where possible, and there remain few designated and important ecological areas identified within and in proximity to the Eastern Corridor and its links from the Eastern Corridor between Grimsby West and Burgh le Marsh. Those identified are appraised below.

6.2.5 The Eastern Corridor is located within 1.4 km of the Lincolnshire coast, along which the closest NSN and Ramsar sites are present. Those located along the coast are:

- The Humber Estuary designated sites, as described in Paragraph 6.2.16 above, located approximately 1.4 km from Section E5 at its closest point.
- Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC, which also overlaps with a SSSI and NNR, is located approximately 5 km from Section E10 at its closest point. The Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC is a dune system. The dune system contains good examples of shifting dunes and contains extensive areas of fixed dune vegetation (part of a successional transition) within largely intact geomorphologically active systems. The lime-rich dunes support a rich and diverse flora, with unusual species including pyramidal orchid and sea campion. This site supports an example of 'dunes with *Hippophae rhamnoides*' which develops on dune areas and is present in a range of successional stages. It also contains humid dune slacks which are part of a successional transition, and some have developed from saltmarsh to freshwater habitats after becoming isolated from tidal inundation by sand deposition.
- The Wash and North Norfolk Coast SAC, the Greater Wash SPA and The Wash Ramsar and SPA sites which also overlap with a SSSI and NNR ('The Wash designated sites'), located approximately 3.8 km from Section E14 at its closest point. The Wash designated sites are a vast intertidal embayment incorporating estuarine mudflats, sandbanks and saltmarsh. They are identified for numerous species of wintering waterbirds, an important area for passage birds, notable waders, supporting various breeding birds, an important shell fishery, and a breeding colony of seals.

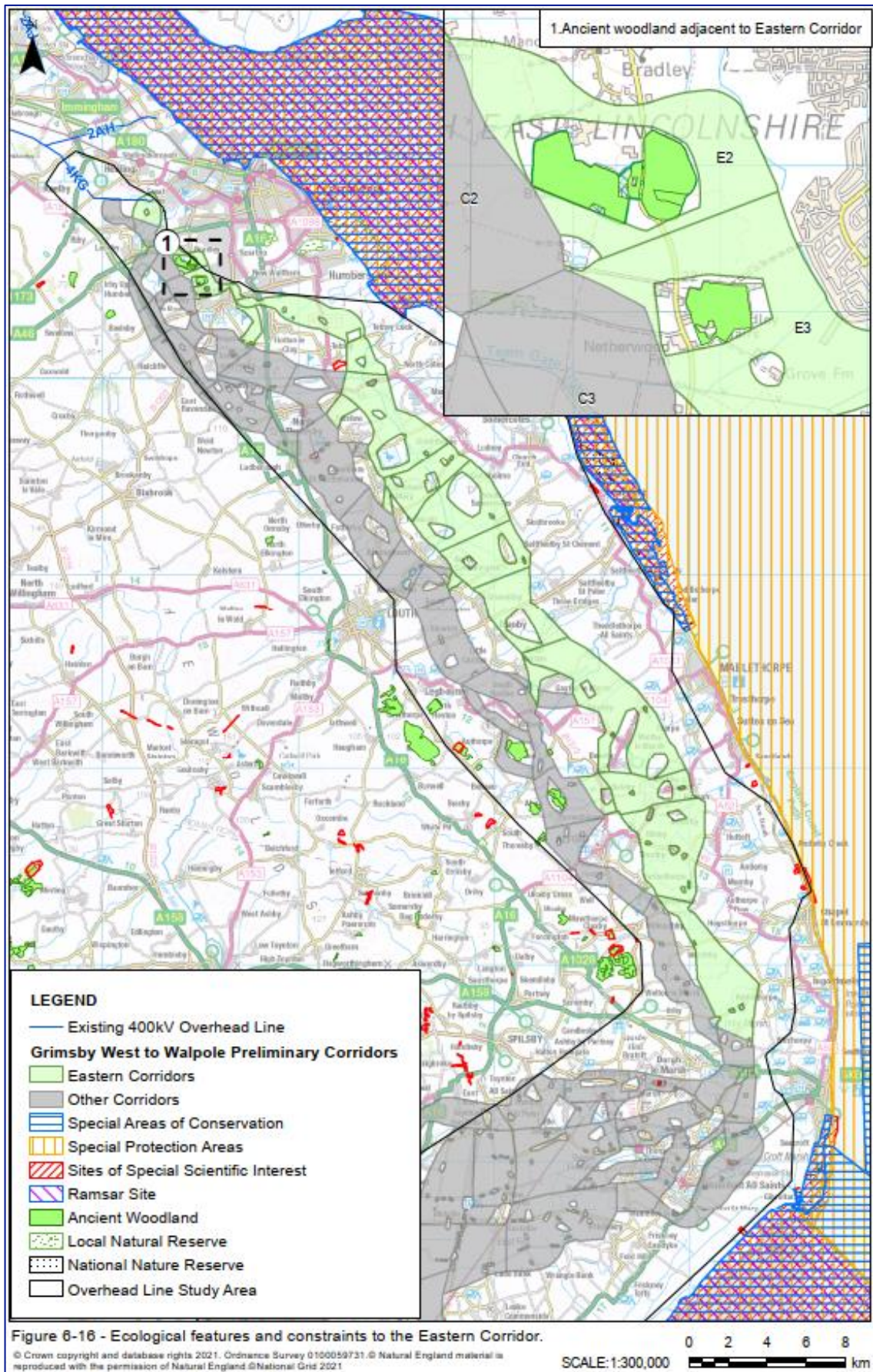
6.2.6 All Links from the Eastern Corridor are located over 5 km from the NSN and Ramsar sites. Impacts upon these designated sites from an underground cable (within Section

E1U) are limited to pollution during construction of functionally connected habitat. For the overhead line, impacts upon these designated sites are those from pollution during construction of functionally connected habitat and the risk of collision, flight path disruption, injury, and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA, as the Project development progresses. However, for the purposes of Options Appraisal, the Corridors and Sections located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routeing and standard construction measures, most of the Eastern Corridor is considered capable of being acceptable when considering the potential impacts on identified sites. Further detail assessments may identify use of additional mitigation and compensation may be required for Section E5 (located closest).

- 6.2.7 Within 2 km of the Eastern Corridor, the Tetney Blow Wells SSSI is located west of Section E5 and north of Section E6. The Eastern Corridor has been defined to avoid this site; however, it may be hydrologically connected to the SSSI, and therefore may result in adverse impacts. There is considered sufficient space to carefully route an overhead line further east (however closer to NSN and Ramsar sites at the coast) which would increase the distance from the SSSI. This, together with the implementation of standard construction measures is considered to minimise potential impacts upon the site. No other SSSIs are located within 2 km of the Eastern Corridor or its Links.
- 6.2.8 Other important habitats identified within the Sections of the Eastern Corridor and its Links comprise:
- Bradley and Dixon Woods LNR, Scartho Wood Ancient Woodland and the Bradley Gairs Ancient Woodland (see **Figure 6-16**) located adjacent to Sections E2 and E3. However, the Eastern Corridor Sections have been defined to avoid these sites.
  - Priority habitat, in the form of coastal and floodplain grazing marsh, river habitat and headwater areas, scattered throughout Sections E5 to E14 and priority river habitat within Link E6-W7.
- 6.2.9 As these important habitats are outside of the sections and links, and due to the scattered coverage of priority habitats it is considered that potential adverse impacts could be avoided and/or reduced through careful routeing (at later stages) or by oversailing some features. In addition, site observations noted that most priority habitat areas currently comprise arable land and therefore adverse effects on priority habitat are not considered likely.



Figure 6-16 – Ecological features and constraints to the Eastern Corridor north of Tetney



## Historic Environment

6.2.10 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Eastern Corridor and its links between Grimsby West and Burgh le Marsh. Those identified are appraised below.

### Grimsby West to North Cotes

6.2.11 Between Grimsby West and North Cotes no designated heritage assets are located within the Eastern Corridor or its links. Therefore, impacts on designated heritage assets are limited to effects on their setting.

6.2.12 In this area, there are numerous designated heritage assets within 1 km of the Eastern Corridor and its links. The most notable (shown in

### 6.2.13

6.2.14 **Figure 6-17)** in proximity are:

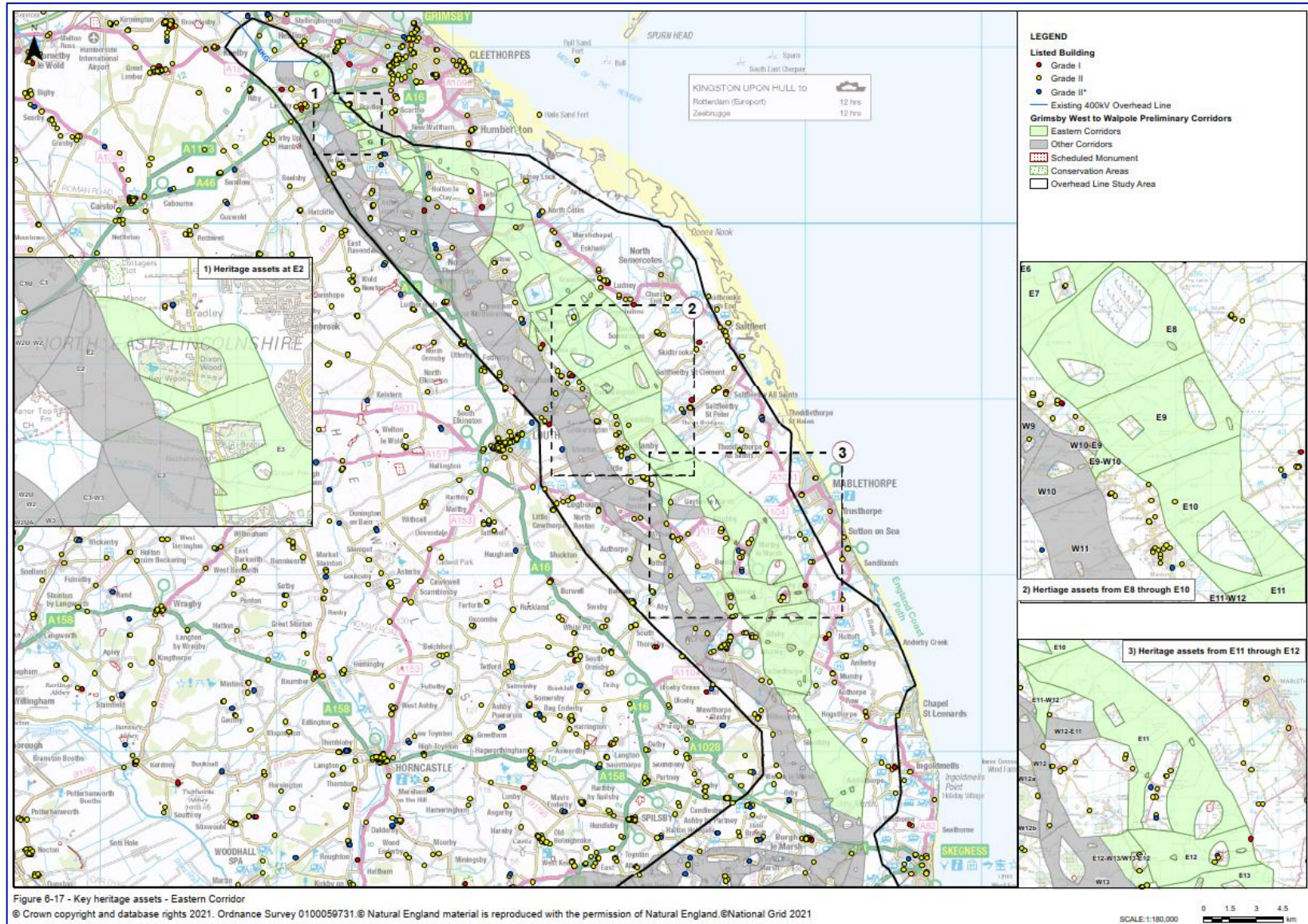
- the *Cottagers Plot Conservation Area* and two Grade II listed buildings (*Cross Approximately 14 Metres South Of Manor House* and *Manor House*) located approximately 150 m north of Section E2; and
- the Churchyard cross, St George's Church Scheduled Monument, a Grade I listed building (*Churchyard Cross Approximately 6 Metres South Of Nave Of Church Of Saint George*) and a Grade II listed building (*Church of Saint George*), approximately 150 m north of Section E2.

6.2.3 Within these Sections there are likely to be potentially significant impacts from routeing an overhead line in proximity to these designated heritage assets and an increased potential for disturbance of buried archaeology within the vicinity of these Sections. However due to the width of these Corridor Sections, there exists sufficient flexibility to materially reduce the severity of adverse impacts through careful routeing (at later stages).

#### North Cotes to Maltby le Marsh

6.2.1 South of North Cotes there are a few scattered designated heritage assets at the edge of the Eastern Corridor and its links. Only Section E10 contains a designated asset, the Grade II Listed *Eastfield Farmhouse* building. However, due to the width of Section E10, it is considered that direct impacts could be avoided through careful routeing (at later stages). Should this occur then impacts on designated heritage assets are limited to affects upon their setting.

Figure 6-17 – Key heritage assets - Eastern Corridor



6.2.2 In this area, there are numerous designated heritage assets within 1 km of the Eastern Corridor and its links. The most notable in proximity are:

- Grade II listed building the *Warehouse at Thoresby Bridge* located in an area specifically excluded from Section E6;
- the *Cross in St Lawrence's churchyard* Scheduled Monument and two Grade II listed buildings at Churchthorpe located south of Link E6-W7;
- Grade II listed buildings (*Bridge Farm House and Warehouse*) located in an area specifically excluded from Section E7;
- the *North Cockerington Hall moated site* Scheduled Monument located approximately 250 m west of Section E9 (within the Link W10-E9); and
- a Grade I listed building, two Grade II\* listed buildings and 11 Grade II listed buildings in the villages of Alvingham, North Cockerington and Grimoldby, located within 200 m of Sections E8, E9 and E10.

6.2.4 Within these Sections there is likely to be potentially significant impacts from routeing an overhead line in proximity to these designated heritage assets and an increased potential for disturbance of buried archaeology (due to an assumed greater presence) within the vicinity of these Sections. However due to the width of these Corridor Sections, there exists sufficient flexibility to materially reduce the severity of adverse impacts through careful routeing (at later stages).

#### Maltby le Marsh to Burgh le Marsh

6.2.3 South of Maltby le Marsh there are a few scattered designated heritage assets at the edge of the Eastern Corridor and its links. No designated heritage assets are located within the sections or links and therefore impacts on designated heritage assets are limited to affects upon their setting. In this area, there are numerous designated heritage assets within 1 km of the Eastern Corridor and its links. The most notable in proximity are:

- the *Moated site 100 m south of Stain Farm* Scheduled Monument located approximately 150 m east of Section E11;
- the *Chestnut Farmhouse* Grade II listed building at Gayton le Marsh located adjacent to Link E11-W12;
- 10 Grade II listed buildings and three Grade II\* listed buildings in the villages of Strubby, Maltby le Marsh and Beesby within 200 m of Section E11;
- the *Churchyard cross, St Margaret's churchyard, Saleby* Scheduled Monument and four Grade II listed buildings at Saleby, located in an area specifically excluded from Links E12-E13/W13-E12;
- *Hagnaby Abbey* Scheduled Monument and *Markby Priory* Scheduled Monument, located in areas specifically excluded from Sections E11 and E12;
- the *Church of St Andrew* Grade I listed building located adjacent to Section E12 at its eastern edge;
- Grade II listed buildings located at Beesby and Cumberworth, adjacent to Sections E13 and E14; and
- the *Butterbump round barrow cemetery* Scheduled Monument located to the west of Section E14.

6.2.4 Impacts to the setting of most designated heritage assets identified above could be limited through careful routeing within the Sections and Links. However, the proximity of Hagnaby Abbey and Markby Priory to an overhead line routed along the east of Sections E11 and E12 has potential to significantly increase the scale of impacts. Additionally, buried archaeology may be present within these areas. Routeing along the western leg of Section E11 and the western extent of Section E12 will reduce the potential setting effects upon these designated heritage assets.

## Socio-economics

### Grimsby West to North Cotes

6.2.5 Sections E1 and E1U are constrained due to the presence of several socio-economic features (see **Figure 6-18**), comprising:

- GWUE allocation across the east of these Sections; and
- Aura Power Solar Farm across the north-west of these Sections.

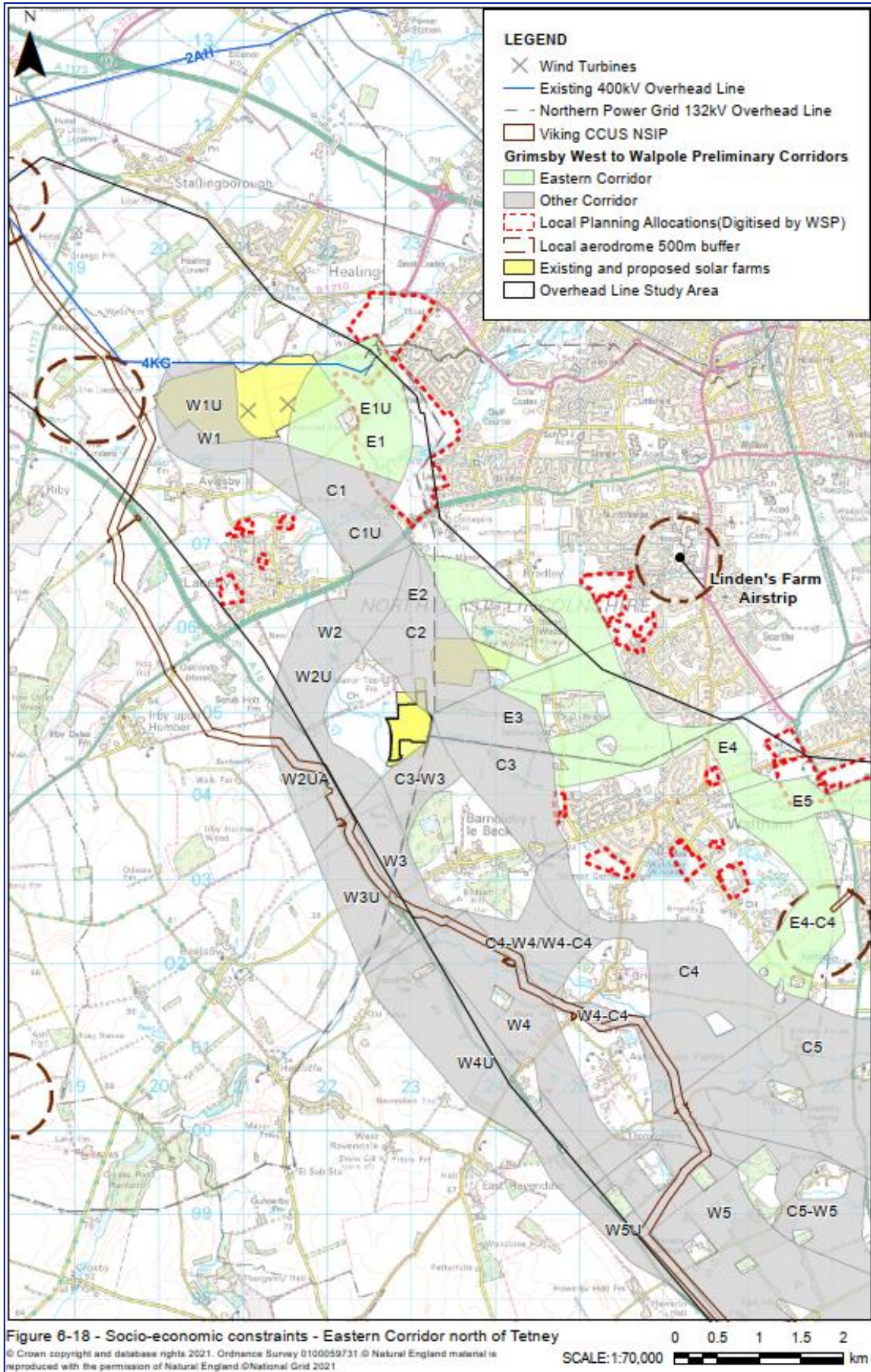
6.2.6 The extent of these constraints is such that they are unavoidable and therefore adverse effects on their operation and/or purpose is likely, although careful routeing (at later stages) would reduce the severity of potential adverse impacts.

6.2.7 Further south, the consented Low Farm Solar Array (application reference DM/0483/15/FUL) covers a large swathe of Section E2, and Wigmore Park covers a large swathe of Section E5 considerably limiting the routeing flexibility. The Low Farm Solar Array could be avoided by routeing to the north of Bradley Woods and the narrower corridor at Bradley Road. Wigmore Park could be avoided by routeing south through Section E5 at the A16 Louth Road, however, to avoid oversailing an existing property and equestrian centre with the overhead line, this would leave an area of approximately 80 m in width for routeing. See **Figure 6-18**.

6.2.8 Link E4-C4 provides a from Section E4 to Section C4. The Waltham Windmill Golf Club is located at the western edge of this link. Its presence at the link boundary means that an interaction can be avoided through careful routeing and impacts are likely to be during construction only.

6.2.9 The Tetney Oil Terminal provides a constraint to routeing within Section E5. Potential adverse impacts upon the Tetney Oil Terminal are likely to be unavoidable due to the narrowness of Section E5 directly adjacent to this receptor. However, the impacts are unlikely to be significant and predominantly constrained to those during the construction period.

Figure 6-18 – Socio-economic constraints - Eastern Corridor north of Tetney



## North Cotes to Maltby le Marsh

6.2.10 South of Section E5, there are few identified socio-economic constraints for the Eastern Corridor and its links which would be material to routeing. Those identified between North Cotes and Maltby le Marsh comprise the Eastfield Farm Airstrip (Section E10) and Viking CCS NSIP (within Link E9-W10 and present within Sections E9 and E10). Potential adverse impacts upon the operation of the Eastfield Farm Airstrip are likely to be unavoidable due to the narrowness of Section E10 in proximity to the airstrip. A route to the east of Section E10 would reduce, but is unlikely to avoid, impacts upon the operation of the airstrip and its aircraft flight paths. The Viking CCS NSIP routes parallel through the centre of Link E9-W10. Due to this links narrowness and even with careful routeing, an interaction with the scheme may be unavoidable. Within Sections E9 and E10 there is sufficient space available for careful routeing to reduce potential impacts upon the Viking CCS NSIP.

## Maltby le Marsh to Burgh le Marsh

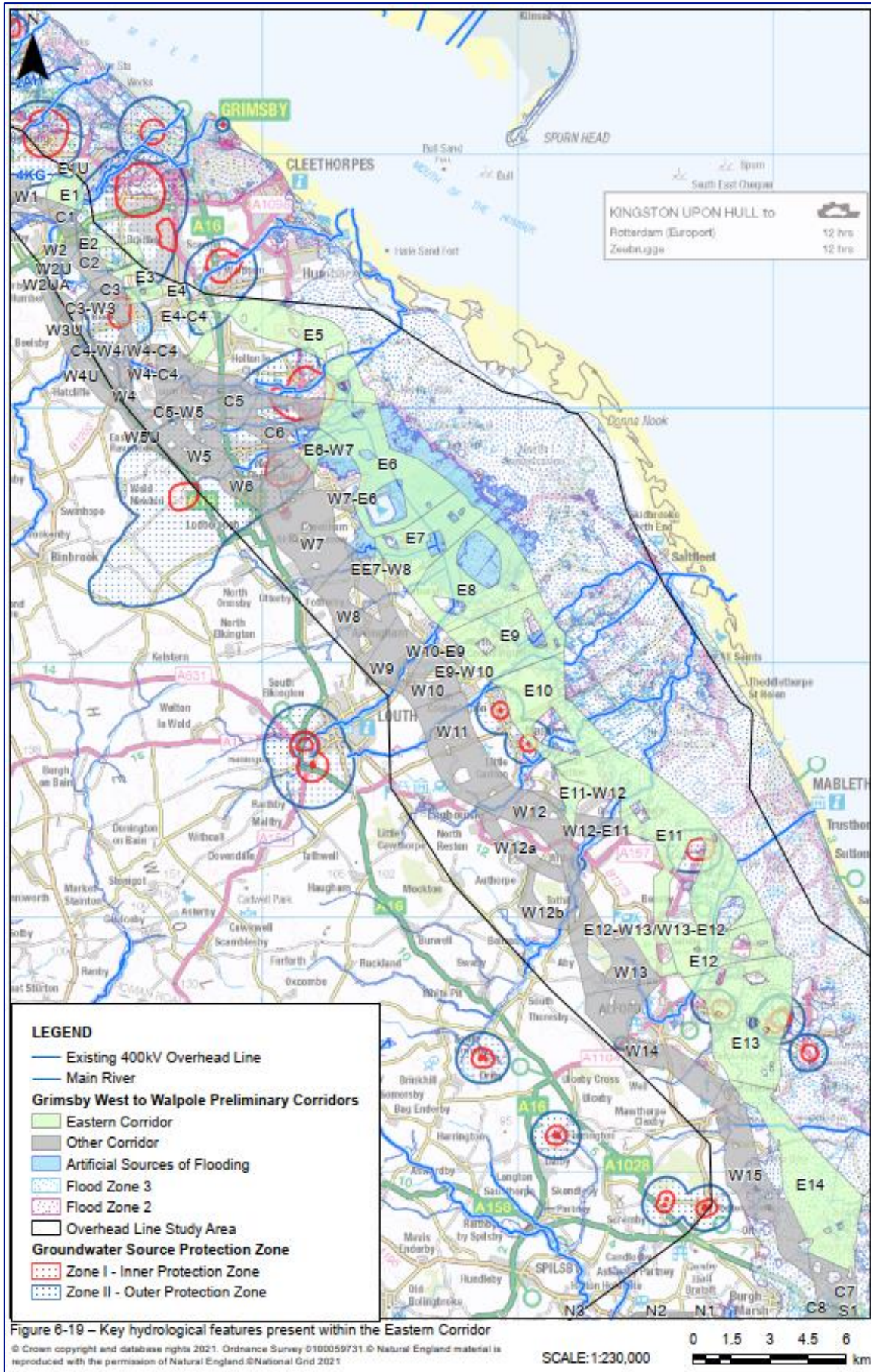
6.2.11 South of Maltby le Marsh the only notable socio-economic feature is the Outer Dowsing OWF. The cable corridor for this scheme currently routes along the south-eastern boundary of Section E14 where its presence will limit routeing flexibility. Direct impacts on Outer Dowsing OWF could be avoided by routeing west.

## Other Considerations

- 6.2.12 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.
- 6.2.13 Residential receptors are predominantly located outside, or within areas specifically excluded from the Eastern Corridor and links. Within the corridor and links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality impacts are anticipated during operation and no potentially significant adverse noise and vibration impacts are anticipated during operation for most of the Eastern Corridor and its links. However, at narrower areas in Sections E2, E3, E4, E5 and E11, the proximity of residential receptors adjacent to these corridor sections may mean that potentially significant adverse noise impacts remain following careful routeing.
- 6.2.14 There is a large expanse of Flood Zone 2 and 3 covering the majority the Eastern Corridor between Section E5 and Section E14, including the Link E6-W7. There are also numerous watercourses and drains throughout and a large area of flood zone associated with the Covenham Reservoir. In addition, the Tetney Oil Terminal, located adjacent to Section E5, presents a risk for potential interaction with contaminated land. The watercourses and waterbodies, most notably the Louth Canal which routes from Section E5 to Section E8, can either be avoided through careful routeing (at later stages) or be oversailed, and there are no constraints which are considered to have potential adverse impacts to the extent that they would significantly hinder routeing an overhead line. However, the large expanse of Flood Zones 2 and 3 are unavoidable and will present a constraint to construction of the overhead line throughout the extent of the Eastern Corridor.
- 6.2.15 An underground cable in Section E1U would have limited interaction with water features (limited to Pyewipe Farm and Laceby Beck) and as such, this feature is not considered to significantly restrict routeing in this area.



Figure 6-19 – Key hydrological features present within the Eastern Corridor



## Summary

6.2.16 Most of the environmental features and constraints relevant to the Eastern Corridor and its links are located between the A46 and North Cotes, within Sections E1 to E5. In this area those which exert most influence on a new overhead line are considered to be:

- the density and proximity of the settlement whilst routeing through multiple narrow areas;
- potential cumulative landscape and visual impacts from the interaction with two NPG 132 kV overhead lines;
- the GWUE allocation;
- the Aura Power Solar Farm;
- the Wigmore Park development.

6.2.17 Compared to an overhead line north of the A46 (Section E1U), there are fewer features which will have a significant influence on routeing a new underground cable.

6.2.18 South of the Tetney Oil Terminal in Section E5, there are fewer receptors within the Eastern Corridor and its Links. Those present include Eastfield Farm Airstrip (Section 10), residential receptors and narrow areas in proximity to Maltby le Marsh (Section E11), potential impacts to the setting of *Hagnaby Abbey* and *Markby Priory* Scheduled Monuments (Section E12 and E13) and the expanse of Flood Zones 2 and 3, watercourses and drains covering Sections E6 to E14. It is considered that most of the other receptors identified can be avoided through careful routeing (at later stages) or be oversailed, limiting the potential for significant adverse effects.

6.2.19 Overall, north of the A46 (Section E1U) an underground cable would be environmentally preferred over an overhead line due to it being below ground infrastructure (and therefore reducing landscape and visual impacts and those to settings of heritage assets). Once south of the A46 (where only an overhead line technology is considered) there are numerous constraints which materially impact the routeing of an overhead line until it reaches North Cotes. From North Cotes there are fewer constraints to routeing and a new overhead line through these Sections, except for Sections E12 and E13, is less likely to result in potentially significant adverse effects.

### Engineering and System Factors

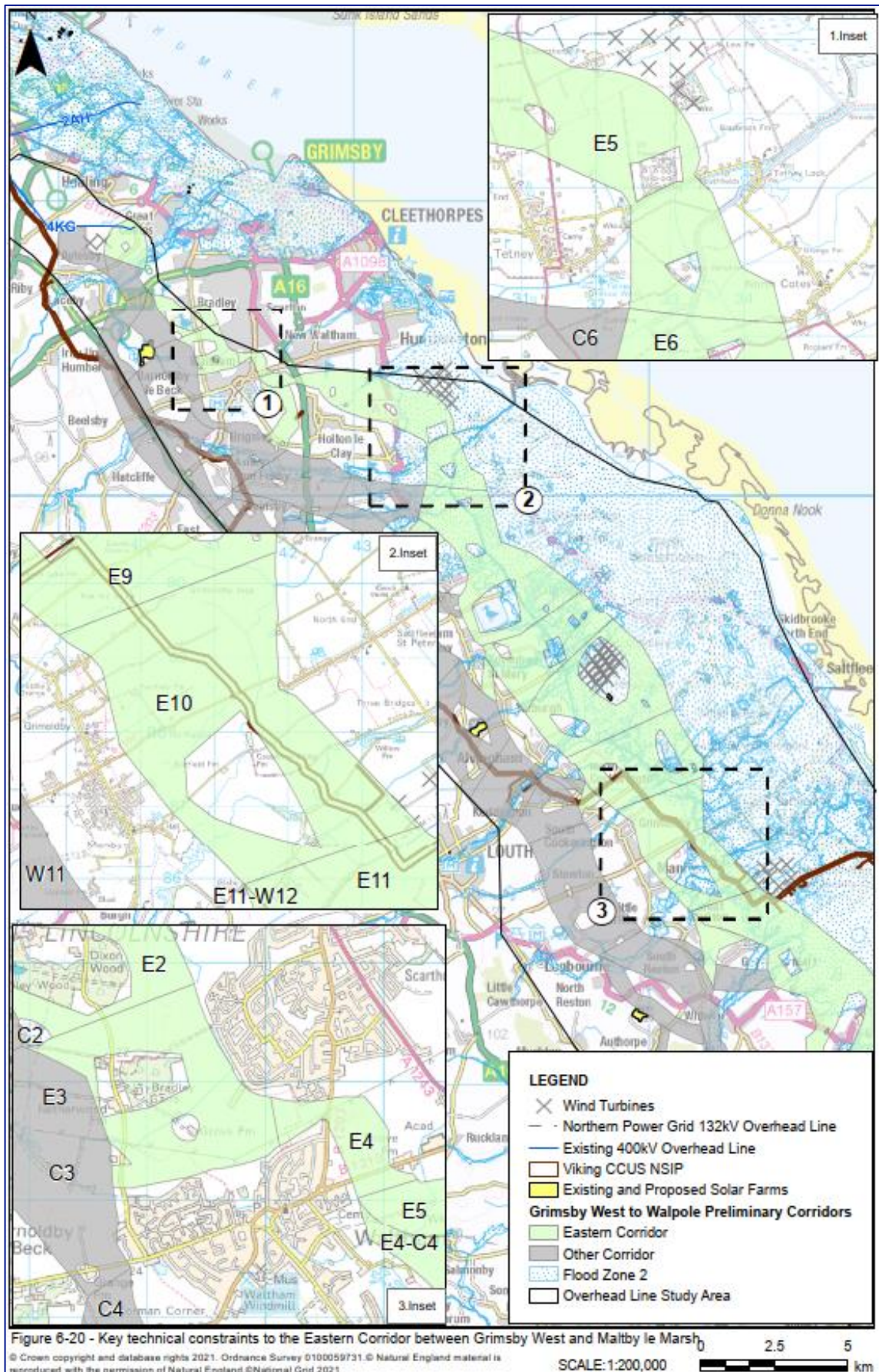
6.2.20 There are several constraints located throughout the Eastern Corridor and its links that are considered likely to reduce routeing flexibility and/or increase the technical complexity.

#### Grimsby West to North Cotes

6.2.21 In the north, in proximity to the existing NGET 400 kV and NPG 132 kV Grimsby West substations, the main technical constraints are scattered and predominantly located to the west of Sections E1 and E1U. Flexibility for routeing is reduced by the Aura Power Solar Farm and GWUE allocation. Two wind turbines are located to the west, which further limits routeing flexibility to the west of these Sections. The extent of these constraints is such that they are unavoidable and therefore adverse effects on their operation and/or purpose is likely, although careful routeing (at later stages) would reduce the severity of potential adverse impacts.

- 6.2.22 South of the A46, the presence of the Hornsea cables, oil and gas pipelines and the proposed Low Farm Solar Array considerably limit routeing to the south of Bradley Woods in Section E2 and into Section E3, see **Figure 6-20**. Avoiding these features could be achieved by routeing to the north of Bradley Woods and then south, adjacent to Scartho, and into Section E3. However, this would likely increase the number of angle pylons, result in routeing through a narrower corridor along Bradley Road; and, the presence of Scartho Wood Ancient Woodland, Bradley & Dixon Woods LNR and Bradley Gairs Ancient Woodland located adjacent to these Sections would need to be considered. East of Bradley Gairs Ancient Woodland, an oil and gas pipeline would require crossing, if continuing into Section E4, at a narrower area between the woodland and Scartho, see **Figure 6-20** potentially requiring cathodic protection studies. Within this area NPG 132 kV and 33 kV overhead lines are also present and would also require modification prior to construction of the Project.
- 6.2.23 As Section E3 leads into Section E4 there is a narrow area, approximately 150 m in width, see **Figure 6-20**, along the B1203 Grimsby Road where routeing is considerably reduced due to existing oil and gas pipelines and the presence of a NPG 132 kV overhead line. The NPG 132 kV overhead line would require modification in advance of construction for the Project, however due to the presence of the existing pipelines and the narrowness of the Section, this would likely prove extremely challenging due to the limited space. In this narrow area, crossings will be required of the B1203, the B1219, and existing oil and gas pipelines for a second time, which would require the use of additional angle pylons. The reduced flexibility for routeing in Section E4 would significantly increase the technical complexity of constructing an overhead line in this area.
- 6.2.24 To the east of Waltham, an alternative connection is provided between Waltham and Holton le Clay, Link E4-C4. Within this link, a disused airfield (currently used for commercial purposes), Buck Beck (and an unnamed tributary), and the edge of Waltham Windmill Golf Club limit routeing flexibility. There are also numerous residential properties along Cheapside Road at the southern end of the link, which reduces flexibility to route an overhead line to areas between properties of approximately 80 m to 150 m.

Figure 6-20 – Key technical constraints to the Eastern Corridor between Grimsby West and Maltby le Marsh



- 6.2.5 South of the B1219, Section E5 routes east and passes through a narrower area, approximately 130 m in width, along the A16. At this location existing oil and gas pipelines, Wigmore Park, and an Anglian Water pipeline present significant constraints to routeing and would likely result in the use of additional angle pylons. Cathodic protection studies would be required for the existing oil and gas pipelines. To the north-west of North Thoresby lies the alternative connection, Link C5-W5. Routeing of an overhead line within this Link should consider scattered constraints including woodland blocks and mature trees, parkland, and a large field drain. The Viking CCS NSIP is present, located either side of Grainsby. This scheme reduces routeing flexibility and would potentially require multiple crossings with sufficient stand-off distances.
- 6.2.6 Once through the narrow area at the north of Section E5, the corridor widens considerably and there are few constraints to routeing until in the vicinity of the Tetney Oil Terminal. At the Tetney Oil Terminal the existing gas and oil pipelines converge, the Hornsea cables are present and there are narrower areas to the east and west of the terminal itself which are covered by Flood Zones 2 and 3. These narrower areas present a significant technical constraint.
- 6.2.7 The Flood Zones 2 and 3 in Section E5 cannot be avoided (Flood Zone 3 coverage ranges between 40% and 100%) and would likely result in access and construction limitations, particularly during the winter months, which would impact upon Project programme. The infrastructure located in these areas would need to be designed accordingly.
- 6.2.8 To the south of the Tetney Oil Terminal, Section E5 widens again as it routes south. Here constraints are generally scattered, restricted to small clusters, located at the periphery of Sections, and can be crossed or avoided without increasing technical complexity, except for the Louth Canal and Flood Zones 2 and 3. Drains and small watercourses which require crossing and are also present, however due to the width of the section they are not considered to materially limit routeing flexibility.

#### North Cotes to Maltby le Marsh

- 6.2.9 The Louth Canal is present within Sections E6, E7 and E8, routeing from north-east to south-west. This waterway may require multiple crossings, however due to the wide nature of these sections and the limited number of constraints within them, perpendicular crossings should be achievable.
- 6.2.10 Anglian Water pipelines and NPG 33 kV overhead lines are also present within Sections E6, E7 and E8. These may require multiple crossings and may restrict the placement of infrastructure. Further south in Section E8 achieving a 300 m stand-off (to avoid turbines toppling onto the overhead line) from several wind farms limits routeing flexibility in Sections E8 (especially Fen Farm Wind). However due to the width of the Sections and scattered constraints, this is not considered a material limitation.
- 6.2.11 An E.ON gas pipeline routes through the west of Sections E7 and E8 and continues from north to south-east through Section E9. A crossing of this pipeline would be required within one of these Sections and to facilitate a perpendicular crossing, additional angle pylons may be required. Cathodic protection studies would be required for the pipeline. In addition to the E.ON gas pipeline, the Saltfleetby Gas Field, located east of Section E9, has connecting pipelines which enter the south-east of Section E9 and would limit routeing flexibility. However, as with the E.ON pipelines,

routeing in proximity to the pipeline could be limited by careful routeing (at later stages).

- 6.2.12 There are three alternative routes through to the Western Corridor within this region, Links E6-W7, E7-W8 and E9-W10.
- 6.2.13 Link E6-W7 lies to the north of Fulstow and routeing of an overhead line within this Link should consider scattered constraints including fishing lakes, small watercourses such as New Dike, an unnamed drain and a NPG 33 kV overhead line. The NPG 33 kV overhead line would require modification prior to construction of the Project. There is good flexibility for routeing, however approximately 90% of the Link is within Flood Zones 2 and 3, and therefore avoidance is not possible. Infrastructure within these areas would need to be designed accordingly and the presence of Flood Zones 2 and 3 may result in access and construction limitations during flood events.
- 6.2.14 Link E7-W8 lies to the west of Covenham St. Mary and routeing of an overhead line within this Link should consider scattered constraints including a residential property located on the eastern boundary, an E.ON gas pipeline that crosses perpendicular from east to west and a small area of Flood Zone 2 and 3 located along a minor drain to the north. It is likely that infrastructure can be routed to avoid or oversail (where applicable) these features and therefore routeing flexibility is good.
- 6.2.15 Link E9-W10 lies between North Cockerington and South Cockerington. Routeing of an overhead line within this Link, should consider curtilages associated with residential properties and farmsteads, two small drains (Green Dike and unnamed), two NPG 33 kV underground cable assets and the Viking CCS NSIP. The presence of these features in this narrow area will significantly limit routeing flexibility, especially ensuring sufficient stand-off distances from the Viking CCS NSIP.
- 6.2.16 The Viking CCS NSIP, crosses the south-western extent of Section E9 and continues into Section E10 routeing in a south-easterly direction into the north-eastern extent of Section E11. However, with minimal other constraints present and given the wide nature of the Sections, this is not considered to materially limit routeing. Further south, achieving a 300 m stand off from several wind farms limits routeing flexibility in Sections E10 (where Gayton Wind Farm is located to the south-east) and E11 (where Mablethorpe and Bambers Farm wind farms located adjacent).
- 6.2.17 A private airstrip, Eastfield Farm Airstrip, has been specifically excluded from Section E10. However further investigation (at a later stage) would be required to establish the potential impact of an overhead line on the airstrip's operation and flight paths should this Section be taken forward. West of Maltby le Marsh lies Strubby Airfield, home to a gliding club. Within the western leg of Section E11, the active runway of the airstrip constrains routeing flexibility. Routeing along the eastern leg would increase the distance from the runway and provide adequate room to minimise disruption on the airfield. For an overhead line route along the western leg, further investigation is required as the Project progresses to establish the potential impact on the airstrip's operation and flight paths.
- 6.2.18 Continuing south towards Maltby le Marsh within Section E11, an overhead line would need to cross the Great Eau, two gas pipelines, the A157 and the A1104. These constraints do not materially limit routeing flexibility due to the wide nature of this Section.
- 6.2.19 An alternative, Link E11-W12, is located to the west of Gayton le Marsh. Routeing here should consider a small farm complex at its centre and a gas pipeline which

routes from north-east across to the west, which may limit the positioning of new infrastructure; however, it is considered a perpendicular crossing could be achieved.

6.2.20 South of Maltby le Marsh, Section E12 comprises an area with high routing flexibility. Routing should consider the scattered constraints including properties, woodland blocks, the Viking Link Interconnector and the A1111. The Viking Link Interconnector and the A1111 both of which continue into Section E13, route east to west across the Sections and as such achieving perpendicular crossings is not considered problematic. Much like Section E12, Sections E13 and E14 are relatively unconstrained for routing, which should consider the scattered underground cables (the Viking Link Interconnector within Section E13, and Triton Knoll offshore windfarm export cables ('Triton Knoll') within Section E14), scattered properties, drains and existing 33 kV overhead lines.

## Summary

6.2.21 Overall, the Eastern Corridor Sections between E1/E1U and E6, and within Section E11, are considerably constrained and narrow in places. At the north of the Eastern Corridor, the presence of the Aura Power Solar Farm, GWUE allocation, Hornsea cables, pipelines and NPG 132 kV overhead lines present a considerable constraint to routing of an overhead line within Sections E2, E3, E4 and E5, especially at narrow areas within each. At Section E11 the narrower areas and presence of Strubby Airfield, combined with other features present a considerable constraint to routing of an overhead line. Other Sections of the Eastern Corridor and its links are generally wide and comparatively unconstrained from a technical perspective. However, the extent of Flood Zones 2 and 3 increases the likelihood of additional maintenance costs and construction programme delays (particularly during the winter period and when associated with potential flood events). Flooding is more likely to be prevalent in Sections E5 to E11.

## Holford Rules

6.2.22 The Eastern Corridor and its links have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**. However, it is noted that although not within the Eastern Corridor, the NSN and Ramsar sites located on the coast are generally within 5 km.

6.2.23 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded for the Corridor and its links. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its links comprise:

- ancient woodland and LNRs within areas specifically excluded from Sections E2 and E3;
- Scheduled Monuments within areas specifically excluded from Sections E11 and E12; and
- Grade II listed buildings.

6.2.24 Where there are smaller areas of high amenity value sufficient space has been included within the Corridor and its links to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

6.2.94 Except for the northernmost end of the Corridor (Sections E2, E3, and E4), the Eastern Corridor performs well with regards to Holford Rule 3 as it follows a largely direct route between North Cotes and Burgh le Marsh. The use of any links would

result in a direction change between the main corridor Sections and therefore could result in a greater number of angle pylons being required (and as a consequence, the route performs less well against **Holford Rule 3**). In particular, the Links routeing from west to east are considered to result in a less direct route.

- 6.2.25 The Eastern Corridor and its links were developed to avoid highly constrained areas, and specific constraints including the settlements of Laceby, Waltham, New Waltham, Holton le Clay, Grimsby, and Cleethorpes (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in each area. Narrow sections are present where constraints are present such as in proximity to Bradley Woods Ancient Woodland and Waltham, New Waltham, Holton le Clay and Tetney Terminal. Wider sections are present where space is generally unconstrained, such as around the crossing the A1031 and the Louth Canal.
- 6.2.26 The Eastern Corridor includes more land than is needed for construction of an overhead line which provides flexibility and options when undertaking more detailed routeing, following consultation feedback, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 6.2.27 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 6.2.28 The Eastern Corridor would need to cross, either as an overhead line (in Section E1) or an underground cable (in Section E1U), the two NPG 132 kV overhead lines north of Waltham. The crossing of these overhead lines are unavoidable and therefore does not align with regards to **Holford Rule 6**. Should an overhead line option be taken forward, it is likely that adverse landscape and visual impacts may be experienced unless properly mitigated.
- 6.2.29 No industrial zones exist within the Eastern Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

- 6.2.30 The Eastern Corridor and its links between Grimsby West and North Cotes is significantly constrained by the presence of narrower areas immediately adjacent to residential areas, by designated ecological sites, and the presence of existing pipelines, overhead lines and proposed development subject to planning applications or Local Plan allocations. An underground cable in Section E1U would, compared to an overhead line (Section E1), reduce the likely environmental impacts on landscape and visual receptors and the setting of heritage assets during operation. It is also considered that an overhead line in this area (Section E1) is not likely to result in significant adverse impacts following the implementation of careful routeing.
- 6.2.31 Further south there are scattered constraints which require consideration. These include residential properties, pipelines, underground cables, wind farms, Eastfield Farm Airstrip and areas of Flood Zones 2 and 3. The width of the Eastern Corridor further south generally offers significant flexibility for routeing.



6.2.32 A tabulated summary of the appraisal of the Eastern Corridor is provided in **Table 6-2**.

Table 6-2 Summary of Eastern Corridor Options Appraisal

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• A new overhead line and the presence of the existing Grimsby West Substations, 4KG 400 kV overhead line and several NPG 132 kV overhead lines may in combination have adverse impacts on the landscape and visual amenity to the north. The NPG 33 kV and 132 kV overhead lines may have adverse in combination impacts with the proposed 400 kV overhead line between Waltham and Scartho.</li> <li>• The sensitivity of the local landscape within the corridor is reduced in places due to the presence of existing electrical infrastructure.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of the Bradley and Dixon Woods LNR, Tetney Blow Wells Nature Reserve, Louth Canal, Covenham Reservoir, the local cycle network and the Wanderlust Way.</li> <li>• Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts, particularly within the narrower corridor between South Waltham and New Waltham and within the narrow corridor (Section E11) around Maltby le Marsh.</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• Bradley and Dixon Woods LNR and Tetney Blow Wells SSSI are adjacent to the Eastern Corridor.</li> <li>• There is potential for the Eastern Corridor to have functionally connected habitats and pollution pathways to the Humber Estuary designated sites.</li> <li>• Headwater areas, river habitat and coastal and floodplain grazing marsh priority habitats are within and adjacent to the Eastern Corridor.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Several listed buildings and scheduled monuments are scattered adjacent to the Corridor and its Links. Most of these can be avoided with careful routeing, however, impacts on setting are likely to arise should the overhead line be developed where the Eastern Corridor is closest to these heritage assets.</li> </ul>

Theme	Topic	Summary
	Socio-economics	<ul style="list-style-type: none"> <li>• Adverse effects are likely on the Aura Power Solar Farm and GWUE allocation as these constraints cannot be avoided within the Corridor.</li> <li>• Low Farm Solar Array and the Wigmore Park development cover large swathes of Section E5 to the north and east of Waltham, respectively, and would limit opportunities for routeing in this area.</li> <li>• Potential impacts on the Tetney Oil Terminal and the Eastfield Farm Airstrip (north of Gayton le Marsh) may be unavoidable due to the presence of narrower corridor sections.</li> <li>• The Viking CCS NSIP routes through the Corridor and is a considerable constraint to routeing.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>• Flood Zones 2 and 3 covers the majority of the Corridor and presents a constraint to the construction of overhead lines in these areas.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• The Aura Power Solar Farm and GWUE allocation have the potential to reduce routeing flexibility in the north.</li> <li>• To the west of Scartho multiple NPG 33 kV and 132 kV overhead lines will require mitigation, such as removal or undergrounding, to ensure there is sufficient space prior to the construction of a new overhead line.</li> <li>• Sections of an NPG 33 kV overhead line to the south of Folstow would need to be removed should this Link (E6-W7) be progressed.</li> <li>• Narrower areas in the vicinity of Tetney Oil Terminal present a significant technical constraint where the Tetney Oil Terminal, oil and gas pipelines, Hornsea cables and Flood Zones 2 and 3 converge.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• Coordination with developers will be required to ensure the proposed new overhead line (or underground cable within some Sections) can be facilitated in combination with the various other proposed developments located within the Eastern Corridor including the Viking CCS NSIP, Aura Power Solar Farm and Outer Dowsing OWF.</li> </ul>

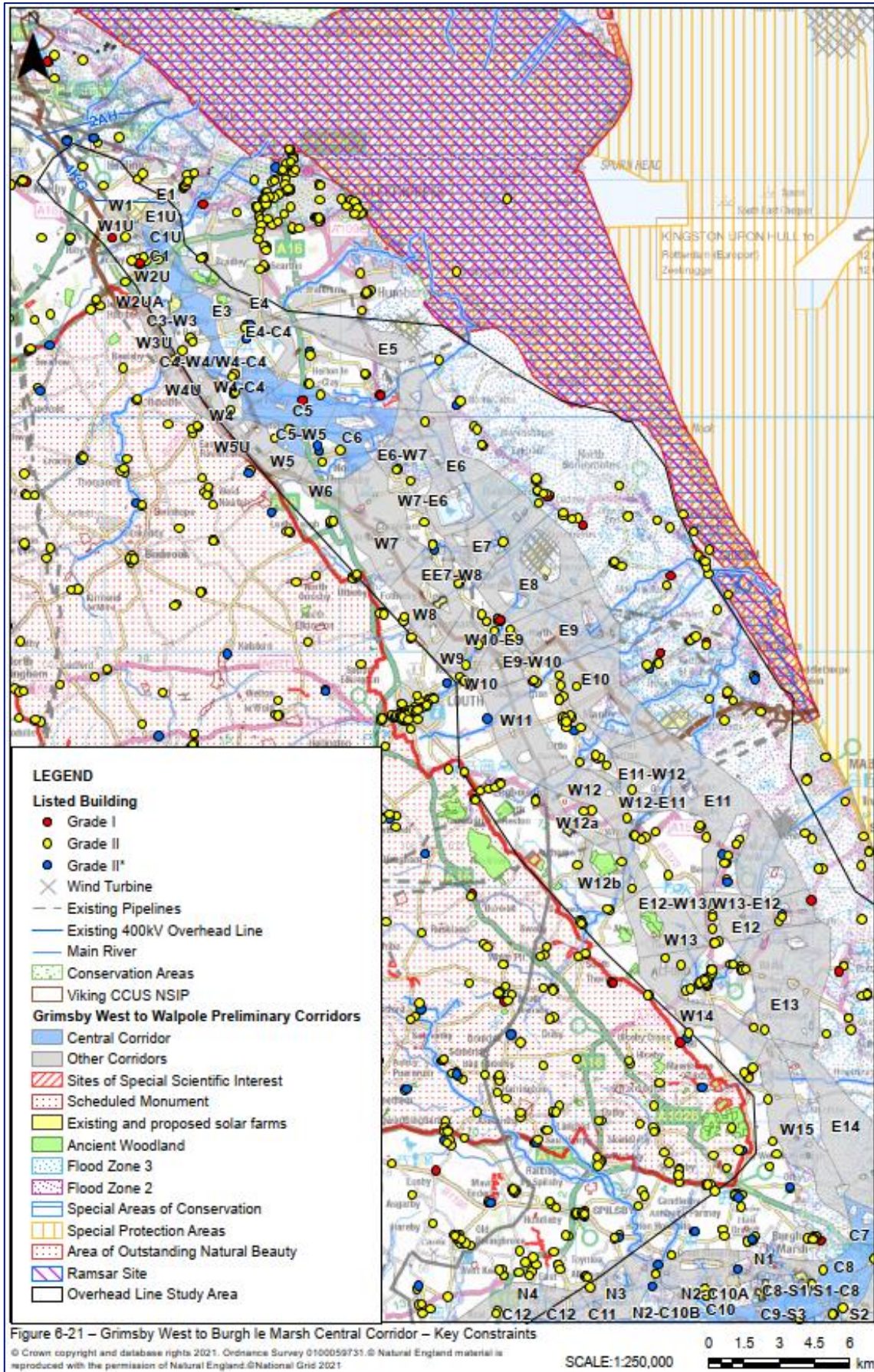
Theme	Topic	Summary
		<ul style="list-style-type: none"> <li>• The Viking CCS NSIP crosses multiple sections and links and is a key constraint to routeing.</li> <li>• Anglian Water pipelines and NPG 33 kV overhead lines between Tetney and North Cockerington may restrict the placement of infrastructure within the Corridor.</li> <li>• Existing underground oil and gas pipelines and the Hornsea cables limit the positioning of pylons within the Corridor.</li> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings, such as crossing the B1203 and B1219.</li> <li>• A series of wind farms east of the Corridor between Covenham St Mary and Bilsby (Fen Wind Farm, Gayton Wind Farm, and Mablethorpe and Bambers Wind Farm) would present a minor constraint to routeing flexibility.</li> <li>• Eastfield Airstrip has been specifically excluded from the Corridor to the south of Grimoldby and Stubby Airfield is located to the west of Maltby le Marsh. Further investigation would be required to establish the potential impacts of an overhead line on the flight paths from these two locations.</li> <li>• Infrastructure is likely to be required within Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>

## Central Corridor (Sections C1 to C7)

### Central Corridor (overhead line and underground cable)

- 6.2.95 The Central Corridor (options prefixed with 'C') begins where Sections W1/W1U and E1/E1U converge between Laceby and Grimsby. An overhead line option (Section C1) and an underground cable alternative (Section C1U) are provided in this area. An underground cable alternative is provided in this area to account for an onward route via the Western Corridor underground cable Sections (W1U to W5U) as described above. Should underground cables be utilised then SECs would be required where there is a transition between underground cable and overhead line. The precise siting of these would be undertaken at a later stage.
- 6.2.96 The Central Corridor then heads south between a narrower area between Waltham and Barnoldby le Beck in Section C3 and continues to Section C4 which heads between another narrower area between Waltham and Brigsley. In Section C2 the Central Corridor crosses NPG 132 kV overhead lines. Following Section C4, the Central Corridor heads south-east via Sections C5 and C6 before it splits into an eastern and western leg to avoid linear settlement (along Grainsby Lane and the B1201) and connects to the Western Corridor (Section W7) and the Eastern Corridor (Section E6). North of Burgh le Marsh the Western Corridor (Section W15) and Eastern Corridor (Section E14) merge into Section C7. Section C7 heads south from Marsh Lane to north of the A158 between Burgh le Marsh and Skegness.
- 6.2.97 The Central Corridor is located between the Eastern and Western Corridors and merges with them at Section C6 into Section E6 (east) and Section W7 (west). This is due to the pattern of settlements (the linear pattern of towns and villages down the centre, west and east of the Overhead Line Study Area) and the distribution of environmental and socio-economic receptors, which resulted in two larger corridors, with Connections Links between them. Notable constraints for the Central Corridor include the NPG 132 kV overhead lines, existing underground cable and pipeline infrastructure, Low Farm and Laceby Solar Farms, Bradley and Dixons Woods LNR, the Scartho and Bradley Gairs blocks of Ancient Woodland, Flood Zones 2 and 3, the GWUE allocation, the Viking CCS NSIP, Tetney Blow Wells SSSI, and Triton Knoll. These constraints are shown on **Figure 6-21**. The Central Corridor was progressed primarily due to balancing the required 400 kV overhead line from proximity to the AONB and its setting, together with smaller scattered settlement to the west, against the larger urban areas of Grimsby and Cleethorpes and sections of the Lincolnshire coastline that are internationally designated for their bird interest to the east.
- 6.2.98 In addition to the Central Corridor itself, there are three links between the Central and either Western or Eastern Corridors. These links have been provided where it would be possible to avoid constraints or pinch points associated with a particular section by transferring from one corridor or section to another and are as follows.
- Link C3-W3, which connects the Central and Western Corridors north of Barnoldby le Beck.
  - Link C4-W4/W4-C4, which connects the Central and Western Corridors south of Barnoldby le Beck.
  - Link C5-W5, which connects the Central and Western Corridors south of Ashby cum Fenby.

Figure 6-21 – Grimsby West to Burgh le Marsh Central Corridor – Key Constraints



## Environmental Factors

### Landscape and Visual

6.2.33 The Central Corridor is located within the Lincolnshire Coast and Marshes NCA (NCA 42) which is characterised by a wide coastal plain extending from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. The key landscape and visual features between Grimsby and Burgh le Marsh are the density of the population and the proximity to the AONB between Laceby and North Thoresby, and the density of population at Burgh le Marsh. The AONB is split into four LCAs, those of relevance to the Central Corridor comprise Chalk Wolds LCA and South–Eastern Claylands LCA. A description of the key features of these LCA is provided in **Paragraph 6.2.6**.

#### Grimsby West to North Thoresby

6.2.34 The 400 kV 4KG overhead line, and NGET 400 kV and NPG 132 kV Grimsby West substations are located approximately 1.5 km north and north-east respectively of the Central Corridor in Sections C1 and C1U. Existing electrical infrastructure north (400 kV substations and overhead lines) and north-east (132 kV substations and overhead lines) means that the landscape here is less sensitive to adverse impacts from new infrastructure. A new overhead line in this Section has the potential to cause adverse impacts upon views from nearby settlements (at Aylesby, Laceby and scattered properties) due to the wide, open nature of the landscape with long views and the proximity of the settlement. There is also the potential to adversely impact upon views from the AONB, however at over 1.8 km, set in the context of Laceby and the outskirts of Grimsby (and with careful routeing and, where applicable siting of infrastructure) significant adverse visual effects are considered unlikely here.

6.2.35 Compared to an overhead line, an underground cable in this area would result in fewer potential landscape and visual impacts by virtue of the infrastructure being below ground. It is noted that there would still be the potential for visual impacts, predominantly associated with the presence of SECs. The severity of these effects is capable of being managed through careful siting, landscape mitigation planting and enhancements (at a later stage).

6.2.36 Following south between Laceby and North Thoresby (where Sections C2 to C6 and Links C3-W3, C4-W4/W4-C4 and C5-W5 are located), the area is more densely populated than other parts of the Overhead Line Study Area. In this area parts of the Central Corridor, and all its Links, are within 2 km of the AONB. The closest Section to the AONB is part of Section C2 at approximately 1.2 km, and the Links C3-W3, C4-W4/W4-C4 and C5-W5 which are within 1 km. The introduction of a new overhead line in these sections and links could be considered incongruous in the context of the AONB; however, this potential is reduced due to the presence of a NPG 132 kV overhead line within Sections C2 and C3 and Link C3-W3 (reducing the sensitivity of the landscape to adverse impacts from new infrastructure). Due to the proximity of the links to the AONB (including Link C3-W3 where the landscape sensitivity is less sensitive to adverse impacts), there is the potential that, even with careful routeing, significant adverse visual effects on the AONB and views to/from the AONB may not be avoided and therefore other mitigation in these links may need to be considered.

6.2.37 The area, between Laceby and North Thoresby (Sections C2 to C6 and Links C3-W3, C4-W4/W4-C4 and C5-W5), is more densely populated than other parts of the Overhead Line Study Area with the main visual receptors for the Corridor and its

Links located to the east and west at Aylesby, Laceby, Wybers Wood, Bradley, Nunsthorpe, Scartho, Waltham, Holton le Clay, Brigsley, Ashby cum Fenby, Barnoldby le Beck, Tetney, Grainsby, North Thoresby and those within the AONB. Other visual receptors in this area include those using numerous recreational paths such as PRoW between the identified towns, villages and the AONB, users of Laceby Golf Club, and users of Wanderlust Way. There are three narrower areas within the Central Corridor and its Links between Laceby and North Thorseby. These comprise one within Section C3 at Waltham Road between Barnoldby le Beck and Waltham; one within Section C4 at the B1203 Waltham Road between Brigsley and Waltham; and one within Link C4-W4/W4-C4 south of Brigsley. Significant adverse visual effects on some individual residential and recreational receptors are considered unavoidable, particularly at the narrower areas, due to the proximity of an overhead line. Careful routeing (at a later stage) could limit the number and the severity of adverse effects.

#### Marsh Lane to Burgh le Marsh

6.2.38 South of Marsh Lane and north-east of Burgh le Marsh is Section C7. This Section is approximately 4.7 km from the AONB (and its South-Eastern Claylands LCA). A new overhead line here is unlikely to be considered incongruous in the context of the AONB as it would be seen (views to the coast are a key feature of the AONB LCA here) in the context of the urban fringes of Burgh le Marsh and Skegness. The main visual receptors for Section C7 are residential receptors at Burgh le Marsh, Skegness, and linear settlement along roads between the two towns. Other visual receptors include those using numerous recreational paths between these towns and the caravan parks (including Sycamore Farm and Cherry Lea Holiday Park) east and west of this Section. With careful routeing (at later stage) it is considered that the severity of visual adverse effects could be materially reduced, although adverse visual effects on some individual receptors are considered unavoidable.

#### Ecology

6.2.39 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological assets where possible, and there remain few designated and important ecological areas identified within and in proximity to the Central Corridor and its links between Grimsby West and Burgh le Marsh. Those identified are appraised below.

6.2.40 The Central Corridor and its links are located within 4 km of the Lincolnshire coast, along which the closest NSN and Ramsar sites are present. Those located along the coast in proximity to the Central Corridor are:

- The Humber Estuary designated sites, as described in **Paragraph 6.2.16** above, located approximately 4 km from Section C6 at its closest point.
- The Wash designated sites, as described in **Paragraph 6.2.83** above, located approximately 3.9 km from Section C7 at its closest point.

6.2.41 Impacts upon these designated sites from an underground cable (within Section C1U) are limited to pollution during construction of functionally connected habitat. For an overhead line, impacts upon these designated sites are those from pollution during construction of functionally connected habitat and the risk of collision, flight path disruption, injury, and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA, as the Project development progresses. However, for the purposes of Options Appraisal, the



Corridors and Sections located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routeing and standard construction measures, the Corridor and its links are considered capable of being acceptable when considering the potential impacts on identified sites.

6.2.42 Within 2 km of the Central Corridor, the Tetney Blow Wells SSSI is located north-east of Section C6. The Central Corridor has been defined to avoid this site; however, it may be hydrologically connected to the areas within these Sections and therefore infrastructure may adversely impact the SSSI. However, there is considered sufficient space to carefully route further east, and implement standard construction measures to minimise impacts upon the site. No other SSSIs are located within 2 km of the Central Corridor or its links.

6.2.43 Other important habitats identified within the Sections of the Central Corridor and its Links comprise:

- Scartho Woods and Bradley Gairs Ancient Woodland and Bradley Wood and Dixon Woods LNR located adjacent to Sections C2 and C3;
- Priority habitat coastal and floodplain grazing marsh present within Sections C6 and C7.

6.2.44 Given these areas are outside the Sections and Links, and their coverage, it is considered that potential adverse impacts could be avoided and/or reduced to an acceptable level through careful routeing (at later stages) and by oversailing. In addition, site observations noted that most priority habitat areas currently comprise arable land and therefore adverse effects on priority habitat are not considered likely.

### Historic Environment

6.2.45 As described in **Chapter 5**, the Central Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Central Corridor and its links between Grimsby West and Burgh le Marsh. Those identified are appraised below.

#### Grimsby West to North Thoresby

6.2.46 Between Grimsby West and North Thoresby the only designated heritage assets located within the Central Corridor and its links are within Sections C5 and C6. Section C5 contains the Grade II listed building the *Waithe Water Mill building*. Due to the width of Section C5 it considered that direct impacts could be avoided through careful routeing (at later stages). Should this occur then impacts on designated heritage assets are limited to affects upon their setting. *The Round Barrow Cemetery with outlying barrow to the west of Tetney and north of the Waithe Beck* Scheduled Monument overlaps the eastern edge of both Section C5 and C6.

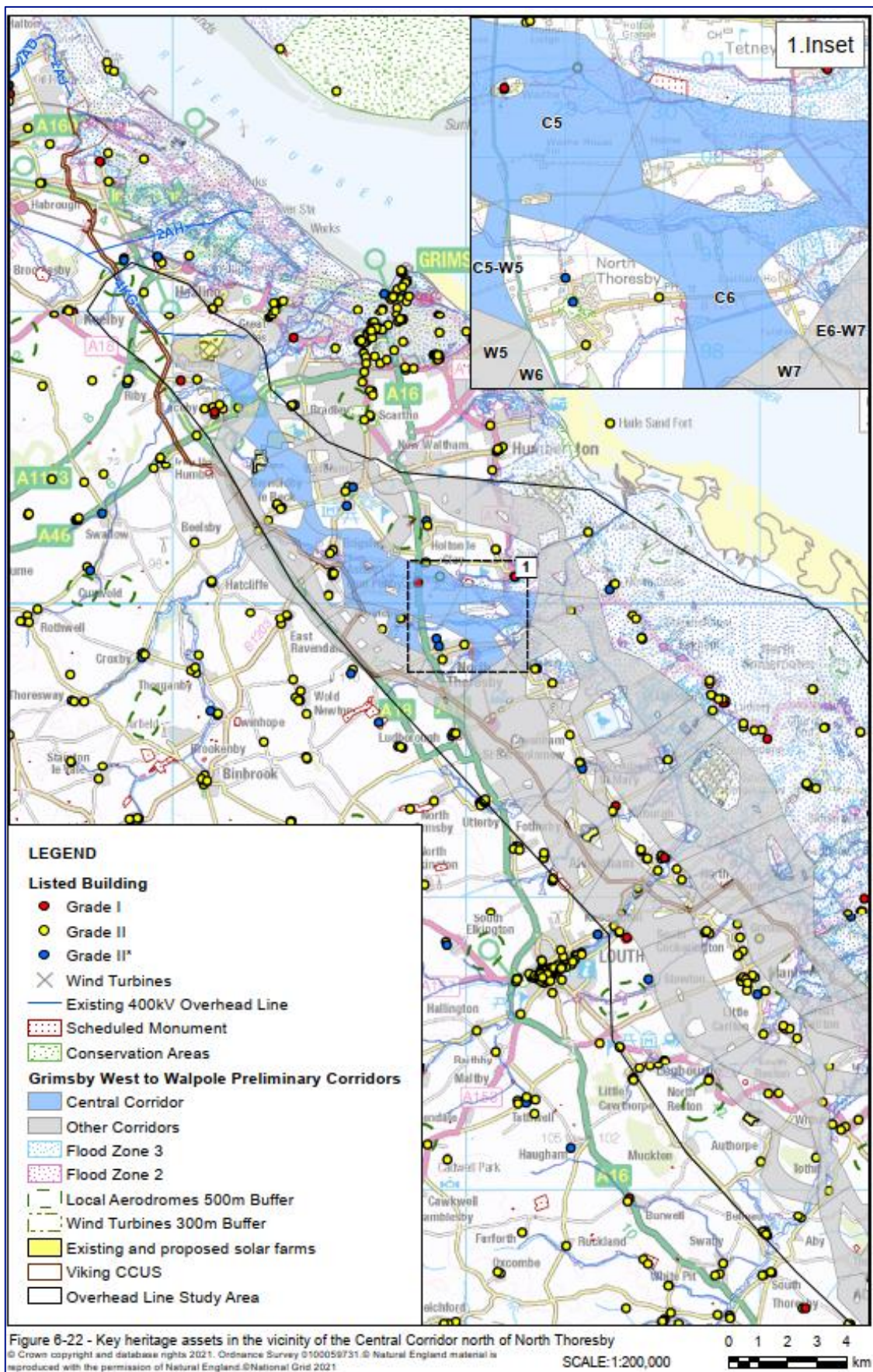
6.2.47 In this area, there are numerous designated heritage assets within 1 km of the Central Corridor and its links, the majority of which are located within the populated areas of Bradley, Laceby, Ashby cum Fenby, Barnoldby le Beck, Brigsley, Tetney, Grainsby and North Thoresby. The most notable (shown in **Figure 6-22**) **Figure 6-22 – Key heritage assets in the vicinity of the Central Corridor north of North Thoresby in proximity are:**

- a Grade II listed building at Little Laceby, located adjacent to Section C1 and C1U;

- *Cross in St Martin's churchyard* Scheduled Monument, *Church of St Martin* Grade I listed building and *Cross In Churchyard Of Church Of St Martin* Grade II Listed Building, located adjacent to Section C5;
- a Grade II\* and a Grade II listed building at Gainsby, located adjacent to Link C5-W5; and
- a Grade II listed building at Westbrook House, located within 150 m of Section C6.

6.2.48 Within these sections and links there is likely to be potentially significant impacts where routing an overhead line in proximity to these designated heritage assets and an increased potential for additional buried archaeology within the vicinity of these sections and links. However due to the width of these corridors there is sufficient flexibility to materially reduce adverse impacts through careful routing (at later stages).

Figure 6-22 – Key heritage assets in the vicinity of the Central Corridor north of North Thoresby



## Marsh Lane to Burgh le Marsh

6.2.49 There are no designated heritage assets within Section C7. Within 1 km the only designated heritage asset is the *Old Marsh Chapel* Grade II listed building, located approximately 550 m south of the Section. Due to the distance from Section C7, and with careful routeing there is sufficient flexibility to materially reduce impacts on the setting of this asset.

## Socio-economics

### Grimsby West to North Thoresby

6.2.50 Several socio-economic receptors are present at the edges of Sections C1, C1U, C3, C4 and C5. It is anticipated that interactions, and therefore adverse effects can be avoided through careful routeing (at later stages). Those identified are:

- The GWUE allocation is located along the eastern edge of Sections C1 and C1U;
- Housing allocation HOU292 located at the eastern edge (west of Waltham) of Section C3;
- Caravan and camping sites are located at the edge, adjacent to Section C4; and
- Tetney Golf Club is located at the northern edge of Section C6.

6.2.51 South of the A46 within Section C2, the existing Laceby Solar Farm and a planned extension, and the Low Farm Solar Array are present. Careful routeing (at later stages) to avoid these constraints would result in narrow corridor of less than 100 m in width and as such, they constrain to routeing flexibility. The extent of these features is such that they are unlikely to be fully avoided during construction and/or operation of the Project and therefore adverse effects on their operation and/or purpose is likely, although careful routeing would generally reduce the severity of potential adverse impacts.

6.2.52 South of Brigsley, the Viking CCS NSIP routes through Sections C4 and C5 and Link C5-W5. However, an overhead line could potentially oversail this proposed pipeline.

6.2.53 The Lincolnshire Wolds Railway (heritage railway) is present in Section C6, and the Sustrans Grimsby Link local cycle route is located in Section C3. These features could be avoided through careful routeing (at a later stage) or be oversailed reducing potential impacts upon these features and their users.

### Marsh Lane to Burgh le Marsh

6.2.54 The Outer Dowsing OWF is the only relevant socio-economic feature identified within Section C7 (at its eastern extents), although camping and caravan sites are located adjacent. It is anticipated that interactions, and therefore adverse effects can be avoided through careful routeing (at later stages).

## Other Considerations

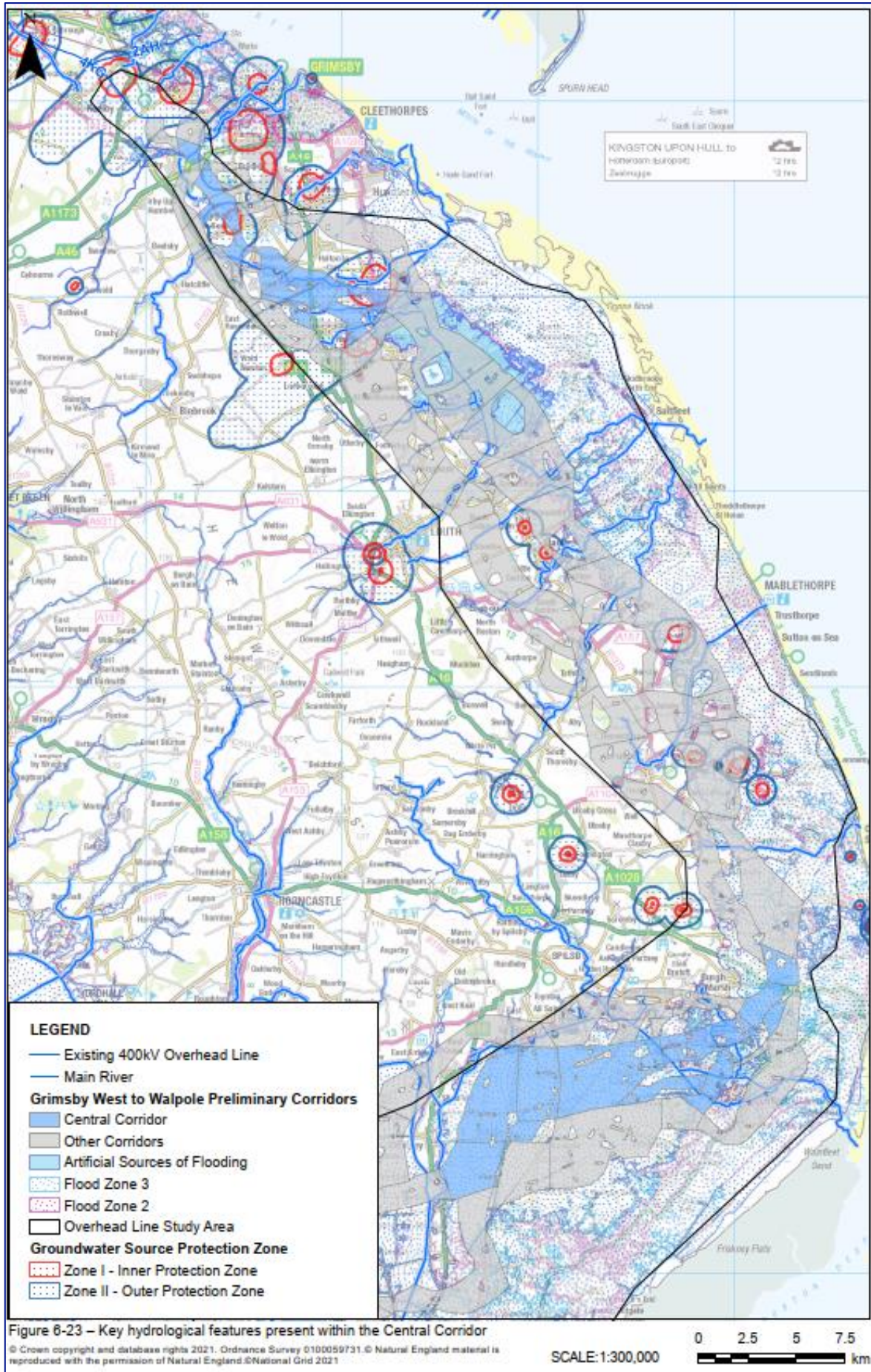
6.2.55 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.

6.2.56 Residential receptors are predominantly located outside the Central Corridor and links. Within the corridor and links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of

temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality is anticipated during operation and no potential adverse noise and vibration impacts are anticipated during operation for most of the Central Corridor and its links. However, at narrower areas along Waltham Road and the B1203 Waltham Road the proximity of residential receptors adjacent to the corridor may mean that potentially significant adverse impacts remain following careful routeing.

6.2.57 There are constraints associated with water, primarily due to the presence of the main rivers, WFD river waterbodies, IDB waterbodies and smaller watercourses, in combination with Flood Zone 2 and 3 (and an area at risk reservoir flooding in Section C1 and C1U) which are present across much of the Corridor and its Links (see **Figure 6-23**) south of North Thoresby. There are no constraints which are considered to have potential adverse impacts to the extent that they would significantly hinder routeing, however the extent of Flood Zones 2 and 3 coverage within Section C7 means that the location of infrastructure in this area cannot be avoided and will present a constraint to construction in this Section.

Figure 6-23 – Key hydrological features present within the Central Corridor



## Summary

6.2.58 Most of the environmental features and constraints relevant to the Central Corridor are located between Grimsby West and North Thoresby, within Sections C1, C1U, C2, C3 and C4 and its Links. In this area those which exert most influence on a new overhead line are:

- the AONB (most notably for Links towards the Western Corridor);
- the density and proximity of the settlement whilst routeing through several narrow areas;
- potential cumulative landscape and visual impacts from the interaction with two NPG 132 kV overhead lines; and
- Laceby Solar Farm and a planned extension, and the proposed Low Farm Solar Array.

6.2.59 Compared to an overhead line between the A46 and North Thoresby, there are fewer features which will significantly influence a new underground cable.

6.2.60 South of North Thoresby the Central Corridor to Burgh le Marsh is limited to Section C7. In this area those environmental features and constraints which exert most influence on a new overhead line are scattered residential and recreational receptors, watercourses and Flood Zone 2 and 3. These constraints can be avoided, or affects can be mitigated, through careful routeing (at later stages), oversailing, and the implementation of standard mitigation measures.

## Engineering and System Factors

6.2.61 There are several constraints located throughout the Central Corridor and its Links that are considered likely to reduce routeing flexibility and/or increase the technical complexity.

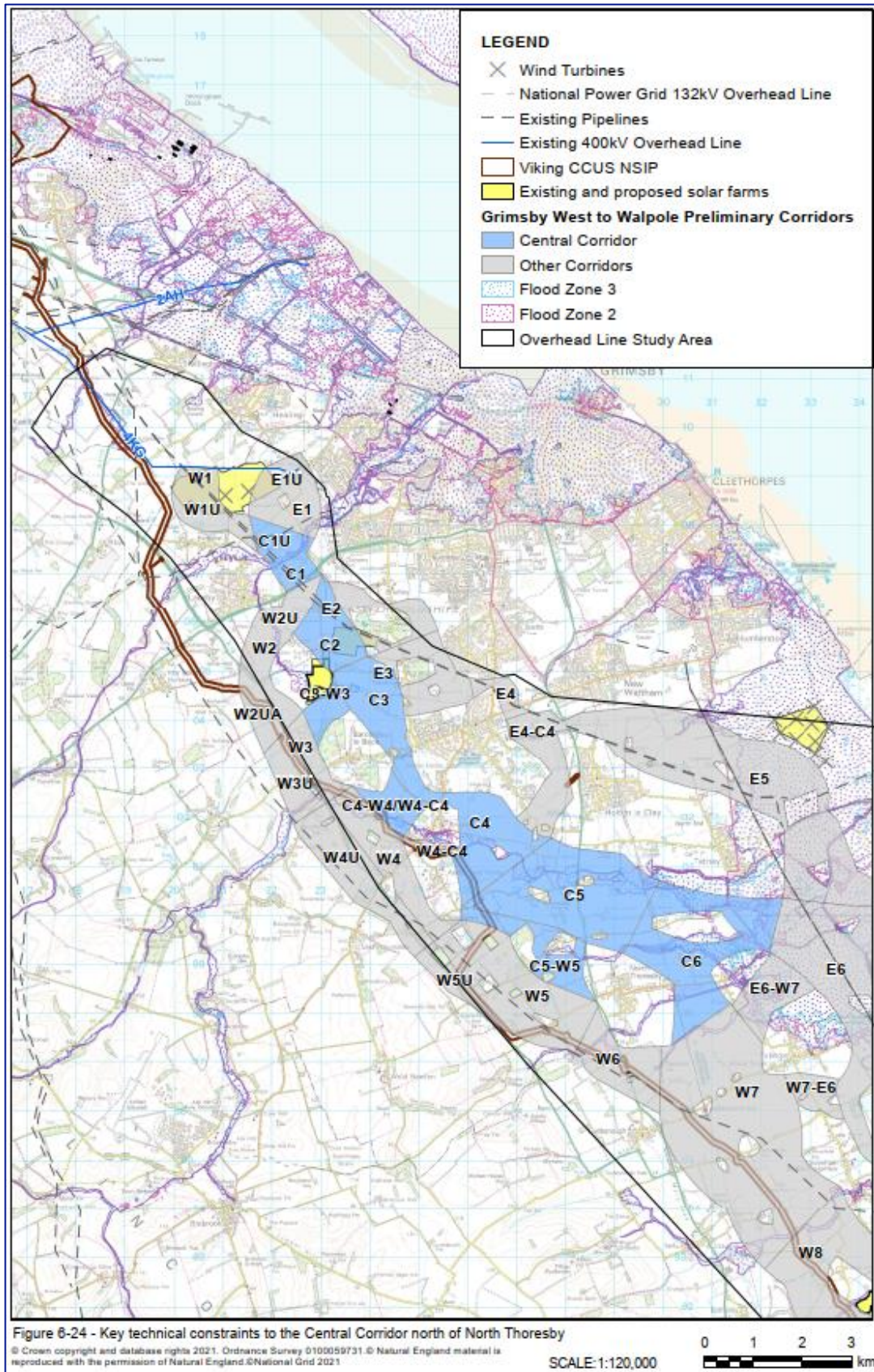
### Grimsby West to North Thoresby

6.2.62 For the northern sections (Sections C1-C5) of the Central Corridor, the Hornsea cables present a constraint to routeing flexibility. South of Aylesby Road, routeing is also restricted by the presence of oil and gas pipelines which run from north-west to south-east. To achieve sufficient stand-off distances, routeing to the east is required where an overhead line or underground cable may interact with two small areas of peaty soils in proximity to Laceby Beck. Should these areas of peat require disturbance, additional specific pylon foundation, access, or cable designs may be required. If present reinstatement would be required following construction to ensure the peat is returned to its previous health. Laceby Beck, and the associated Flood Zone 2 and 3 area, and the A46 will require crossing, however these features are not considered to significantly limit routeing within these Sections.

6.2.63 Once across the A46, within Section C2, the cables and pipelines continue to restrict routeing flexibility, with a potential requirement to parallel this infrastructure. Should this occur cathodic protection studies would be required. NPG 132 kV and 33 kV overhead lines are also present in Section C2 and would require modification in advance of the Project, see **Figure 6-24**. To the west of Bradley Woods, the routeing flexibility is significantly reduced by the proposed Low Farm Solar Farm and the proposed extension to Laceby Solar Farm. To avoid oversailing these developments, technical solutions may require the use of additional angle pylons increasing technical

complexity. The modification of the NPG 132 kV overhead lines may reduce technical complexity associated with avoiding these solar farms through increased flexibility within the Section.

Figure 6-24 – Key technical constraints to the Central Corridor north of North Thoresby





- 6.2.64 Continuing south into Sections C3 and C4, towards Barnoldby le Beck and Waltham, a narrower area on Waltham Road and the Hornsea cables (see **Figure 6-24**), would restrict pylon positioning such that oversailing of a small commercial storage yard to the east may be required. Either side of this narrower area are NPG 132 kV and 33 kV overhead lines, woodland blocks, Team Gate Drain and its associated Flood Zone 2 and 3. Despite the presence of these features within these Sections, they are unlikely to materially limit routeing flexibility.
- 6.2.65 South of the narrower area on Waltham Road, the Hornsea cables again present a considerable constraint by crossing Section C4 three times, including a narrower area along the B1203 Waltham Road. In this area, achieving sufficient stand-off distances may require the use of additional angle pylons. At the narrower area along the B1203 it may be necessary to parallel these existing cables. There are few other constraints to routeing within this Section, but those present comprise scattered woodland blocks, Waithe Beck and an associated area of Flood Zone 2 and 3, other smaller waterbodies, and the Viking CCS NSIP. These would be unlikely to materially limit routeing.
- 6.2.66 Alternative connections from the Central Corridor are via Links C3-W3 and C4-W4/W4-C4. Link C3-W3 includes woodland and two NPG 132 kV overhead lines which would reduce routeing flexibility. The woodland could be avoided through careful routeing (at a later stage), however the existing overhead lines would require modification prior to construction of the Project. These Links also contain a small area of Flood Zone 2 and 3 however this could be avoided or oversailed. Continuing south, Link C4-W4/W4-C4 was developed to allow connections east or west of Brigsley. Within this Link, flexibility for routeing is reduced due to a requirement to cross the Hornsea cables, the Viking CCS NSIP and a small area of Flood Zone 2 and 3 associated with Waithe Beck.
- 6.2.67 From the narrower area along the B1203 the width of the Corridor (Sections C4 to C6) significantly increases. Routeing in these Sections should consider scattered constraints, including residential properties, farm complexes, woodland blocks, watercourses with associated Flood Zones 2 and 3, the A16 and A1031, several existing 33 kV overhead lines and the Lincolnshire Wolds Railway. The extensive overlap of these Sections with Flood Zones 2 and 3 (approximately 40%) in north-east of Section C6 means it would be difficult to avoid. This could result in access and construction limitations and require infrastructure to be designed accordingly.

#### Marsh Lane to Burgh le Marsh

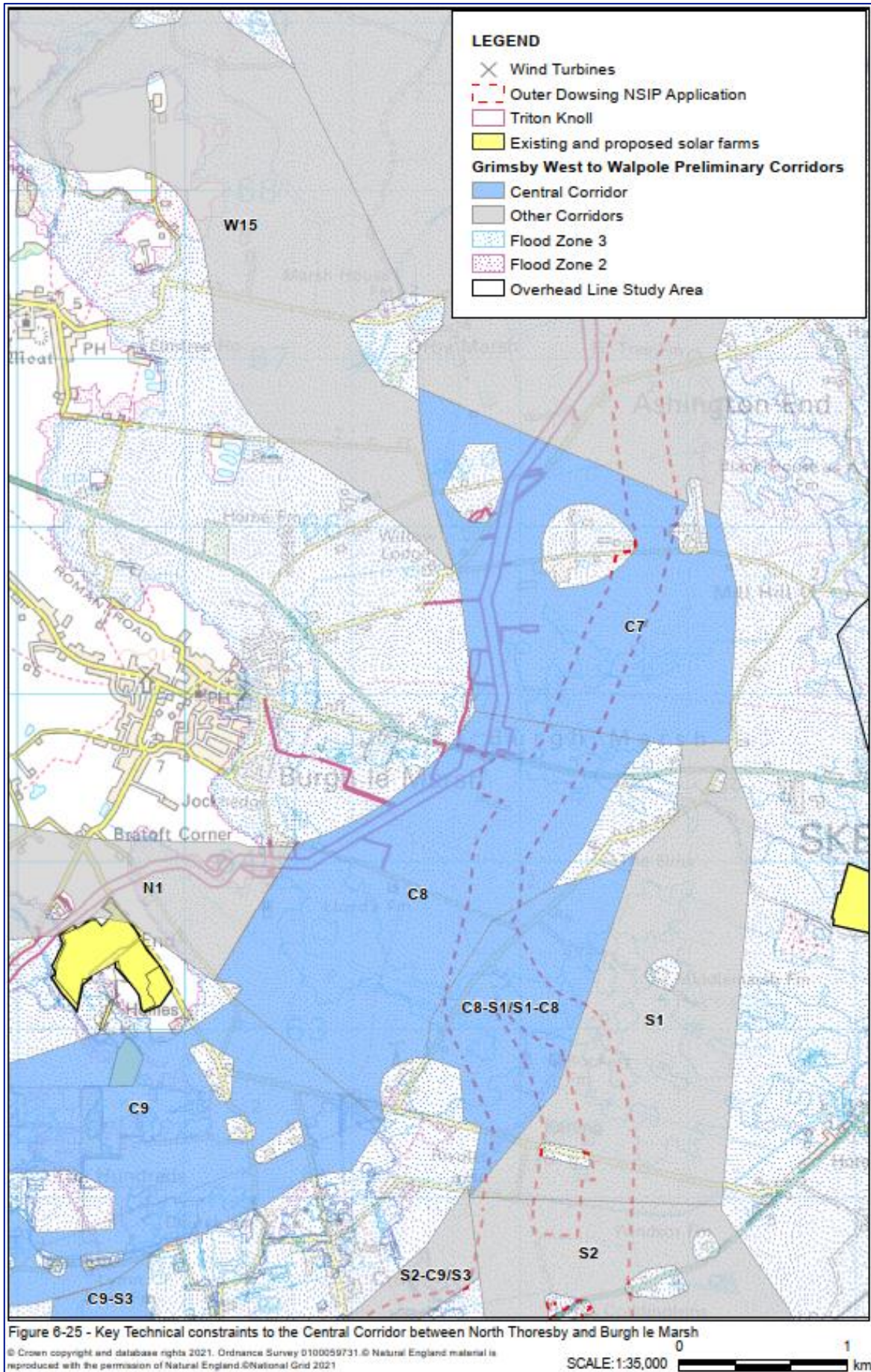
- 6.2.68 North of Burgh Le Marsh (Section C7) there are few, scattered, constraints (see **Figure 6-25**) which include residential properties and farm complexes, woodland blocks, water bodies (fishing lakes), the Outer Dowsing OWF and the Triton Knoll. Narrower areas along Youngers Lane, between residential and commercial properties, would limit routeing flexibility. Should Outer Dowsing OWF (east) and Triton Knoll (to the west) be avoided by routeing to the centre/east, a commercial curtilage and fishing lake may require oversailing. It is also noted that Section C7 is entirely within Flood Zone 2 and 3 which could result in access and construction limitations and require infrastructure to be designed accordingly.

#### Summary

- 6.2.69 Overall, the presence of the Hornsea cables and existing pipelines present a considerable constraint to routeing of an overhead line or underground cable within

Sections C1 and C3. However, outside these areas the Central Corridor north of North Thoresby has few constraints which would be considered likely to materially affect routeing. Within Section C7 there are but a few constraints which are considered avoidable following careful routeing, although routeing flexibility is reduced to existing gaps between residential and commercial properties along Younger's Lane.

Figure 6-25 – Key technical constraints to the Central Corridor between North Thoresby and Burgh le Marsh



## Holford Rules

- 6.2.70 The Central Corridor and its Links have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 6.2.71 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded for the Corridor and its Links. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its Links comprise a scheduled monument (*The Round Barrow Cemetery with outlying barrow to the west of Tetney* at the edge of Sections C5 and C6) and a listed building (*Waithe Water Mill building*, Grade II listed building in Section C5). Where there are smaller areas of high amenity value, sufficient space has been included within the Corridor and its Links to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 6.2.72 The Central Corridor performs well with regards to **Holford Rule 3** as it follows a largely direct route from Grimsby West and North Thorseby. From here it could divert east into the Eastern Corridor, resulting in a less direct route, or continue south into the Western Corridor resulting in a more direct route. The use of any Links from the Central Corridor would result in a direction change between the main corridor and therefore could result in a greater number of angle pylons being required (and therefore the route performing less well against Holford Rule 3).
- 6.2.73 The Central Corridor and its Links were developed to avoid highly constrained areas, and specific constraints including settlements such as Laceby, Barnoldby le Beck, Brigsley, Ashby cum Fenby, Holton le Clay and North Thoresby (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in a given area. Narrow sections exist where constraints are present such as routing between Barnoldby le Beck/Waltham, and Brigsley/Waltham, and avoiding residential properties north of Burgh le Marsh. Wider sections are present where space is generally unconstrained, such as around the crossing the A16, the B1200 and between Alford and Burgh le Marsh.
- 6.2.74 The Corridor includes more land than is needed for construction of an overhead line which provides flexibility and options when it comes to more detailed routing, following consultation, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 6.2.75 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 6.2.76 The Central Corridor would need to cross two NPG 132 kV overhead lines north-west of Waltham and within Link C3-W3, should it be selected. The crossing of the overhead line is unavoidable and therefore does not align with regards to **Holford Rule 6**. Should an overhead line option be taken forward it is likely that adverse landscape and visual impacts may be experienced unless properly mitigated.
- 6.2.77 No industrial zones exist within the Central Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

- 6.2.78 The north of the Central Corridor is considerably constrained by the presence of the proposed solar farms (Section C2), the crossing of the NPG 132 kV overhead lines (Sections C2 and C3) and two narrower areas (Sections C3 and C4) in proximity to residential areas. South of Waltham there are scattered constraints which require consideration. The width of the Central Corridor offers significant flexibility for routeing.
- 6.2.79 A tabulated summary of the appraisal of the Central Corridor (between Grimsby West and Burgh le Marsh) is provided in **Table 6-3**.

Table 6-3 – Summary of Central Corridor Options Appraisal between Grimsby West and Burgh le Marsh

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• The sensitivity of the local landscape within the Central Corridor is reduced in places due to the presence of existing electrical infrastructure.</li> <li>• There is potential for adverse setting and visual effects on the AONB due to its proximity to some of the Corridor and Links.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of the Laceby Golf Club, the Wanderlust Way and caravan parks.</li> <li>• Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• Scartho Woods, Bradley and Dixon Woods Ancient Woodland, Bradley and Dixon Woods LNR and Tetney Blow Wells SSSI are adjacent to the Central Corridor.</li> <li>• There is potential for the Central Corridor to have functionally connected habitats to the Humber Estuary and the Wash designated sites.</li> <li>• Coastal and floodplain grazing marsh, and ancient woodland priority habitats are within and adjacent to the Central Corridor.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Several listed buildings and scheduled monuments are scattered within or adjacent to the Central Corridor and its Links. Most of these can be avoided with careful routeing, however, impacts on setting are likely to arise should the overhead line be developed where the Corridor is closest to these heritage assets.</li> </ul>
	Socio-economics	<ul style="list-style-type: none"> <li>• The GWUE allocation is located along the eastern edge of Sections C1 and C1U.</li> <li>• South of the A46, the existing Laceby Solar Farm, its planned extension, and the proposed Low Solar Farm Array all present a moderate constraint to routeing flexibility of the Central Corridor.</li> </ul>

Theme	Topic	Summary
		<ul style="list-style-type: none"> <li>The Viking CCS NSIP and Outer Dowsing OWF routes through the central Sections of the Central Corridor and oversailing would be required to prevent a direct interaction.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>Flood Zones 2 and 3 cover Section C7 and cannot be avoided.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>To the north, NPG 132 kV and 33 kV overhead lines are present and will require mitigation, such as removal or undergrounding, to ensure there is sufficient space for the proposed new overhead line.</li> <li>Paralleling existing underground cables may be required at a narrower area along the B1203.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>Existing underground oil and gas pipelines and the Hornsea cables limit the positioning of pylons within the Corridor, particularly to the north.</li> <li>Underground cables towards Barnoldby le Beck and Waltham create a pinch point that would create a restriction to routeing and pylon positioning, potentially leading to the oversailing of a storage yard.</li> <li>Proposed Solar Farms (Low Farm and the extension to Laceby) considerably reduce flexibility for routeing and additional large angle pylons may be required.</li> <li>Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings.</li> <li>Infrastructure is likely to be required within Flood Zones 2 and 3, particularly in Section C7, which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>

## 6.3 Comparative Appraisal and Conclusion

6.3.1 Following the above Options Appraisal, the appraisal findings were considered and the relative merits of the different options for the 400 kV transmission connection between Grimsby West and Burgh le Marsh were compared. The corridor was broken down into smaller components (listed below) for the purposes of comparative appraisal as each of the sections and links has localised constraints which could be avoided through alternative routeing. Therefore, it was likely that a combination of Sections and Links, rather than a single corridor would be used. The defined components of the route between Grimsby West and Burgh le Marsh were considered in isolation (i.e., without consideration of the emerging preferences for the Grimsby West siting zones or LCS siting zones) and broadly approached in a sequential manner routeing north to south:

- Stage 1 – Consider the best performing Sections between the 4ZM 400 kV overhead line and the A46;
- Stage 2 – Consider the best performing Sections and Links between the A46, North Thoresby and North Cotes; and
- Stage 3 - Consider the best performing Sections and Links between North Thoresby, North Cotes and Burgh le Marsh.

6.3.2 The steps are graphically shown in **Appendix A**.

6.3.3 The need to use underground cables in any part of the route will be reviewed as the design process progresses, in response to survey findings to obtain baseline data and stakeholder and community feedback.

6.3.4 This section presents the factors considered to influence the decision-making process for determining the emerging preferred corridor between Grimsby West and Burgh le Marsh taking into consideration the features shown on **Figure 6-26** and **Figure 6-27**. As the design progresses, regular reviews will be undertaken to ensure the emerging preferred corridor taken forward at this stage remains the optimum corridor when all environmental, socio-economic and technical aspects are considered.

### Stage 1 - 4ZM 400 kV overhead line to the A46

6.3.5 Stage 1 considers the following Sections and Links between the existing 4KG 400 kV overhead line in the north and southwards towards the A46:

- Western Corridor (Sections W1 and W1U);
- Central Corridor (Sections C1 and C1U); and
- Eastern Corridor (Sections E1 and E1U).

6.3.6 The Sections W1 and W1U provided the opportunity for an overhead line or underground cable to connect into the Grimsby West siting areas GW1 and GW2. Sections E1 and E1U provided the opportunity for an overhead line or underground cable to connect into Grimsby West siting areas GW3 and GW5. Sections C1 and C1U provided the opportunity for an overhead line or underground cable to connect directly into Grimsby West siting area GW3 or to connect to Sections W1, W1U, E1 and E1U.



- 6.3.7 When comparing the Western Corridor and Eastern Corridor there was little to differentiate between the two. Both Corridors would be constrained by the two wind turbines, Aura Power Solar Farm, ConocoPhillips pipelines and Hornsea cables. The Western Corridor sections would be constrained by the Viking CCS NSIP and Lindens Farm Airstrip, whilst the Eastern Corridor sections would be constrained by the GWUE allocation. Use of an underground cable would reduce the potential adverse effects upon the landscape, visual, heritage and ecological receptors. The technical challenges of crossing the ConocoPhillips pipelines and Hornsea cables via underground cable mean that the technological preference within these Sections is via an overhead line.
- 6.3.8 Both Western and Eastern Corridors connect to the Central Corridor at the A46. Therefore, Sections C1 and C1U are the only available options to route south of the A46 in this area. Use of an underground cable here would be favourable from a landscape, visual, heritage and ecological perspective as it would result in a reduction of environmental effects associated with these topics. However, use of an underground cable here would be less favourable when considering impacts upon the water environment (including impacts related to surface water flooding and reservoirs) and technical complexity due to the additional impacts and /or complexities of crossing Laceby Beck, Wellbeck Spring, the A46 and potentially the ConocoPhillips pipelines and Hornsea cables via underground cable. Considering these technical challenges, the technological preference within these Sections is via an overhead line.
- 6.3.9 Subject to the emerging preferences between the A46 and North Thorseby/North Cotes (Stage 2), as these Sections are outside nationally designated landscapes (the AONB is approximately 1.8 km from the AONB at its closest point at the A46) and considering the potential impacts of an overhead line in Section C1, the starting presumption (in line with the NPS EN-5 and National Grid's Approach to Consenting) and emerging preference is for the use of overhead line technology (i.e. Sections W1, E1 and C1).

### **Summary of Decision**

- 6.3.10 The following Sections are more preferred and therefore selected to progress at this stage:
- Western Corridor Section W1 (overhead line)
  - Eastern Corridor Section E1 (overhead line)
  - Central Corridor Section C1 (overhead line)
- 6.3.11 The following are less preferred and therefore not progressed at this stage:
- Western Corridor Section W1U (underground cable)
  - Eastern Corridor Section E1U (underground cable)
  - Central Corridor Section C1U (underground cable)

## Stage 2 – A46, North Thoresby and North Cotes

6.3.12 Stage 2 considers the following corridors between the existing 4KG 400 kV overhead line in the north, southwards towards North Thoresby and North Cotes as shown in **Figure 6-26**:

- Western Corridor (Sections W2 to W6 and W2U to W5U);
- Central Corridor (Sections C2 to C6);
- Eastern Corridor (Sections E2 to E6);
- Western Corridor to Central Corridor Links (Link C3-W3, Link C4-W4/W4-C4, Link W4-C4 and Link C5-W5); and
- Central Corridor to Eastern Corridor Link (Link E4-C4).

6.3.13 The material factors for an overhead line in this area are the landscape and visual and the technical complexity of routeing and construction within each route.

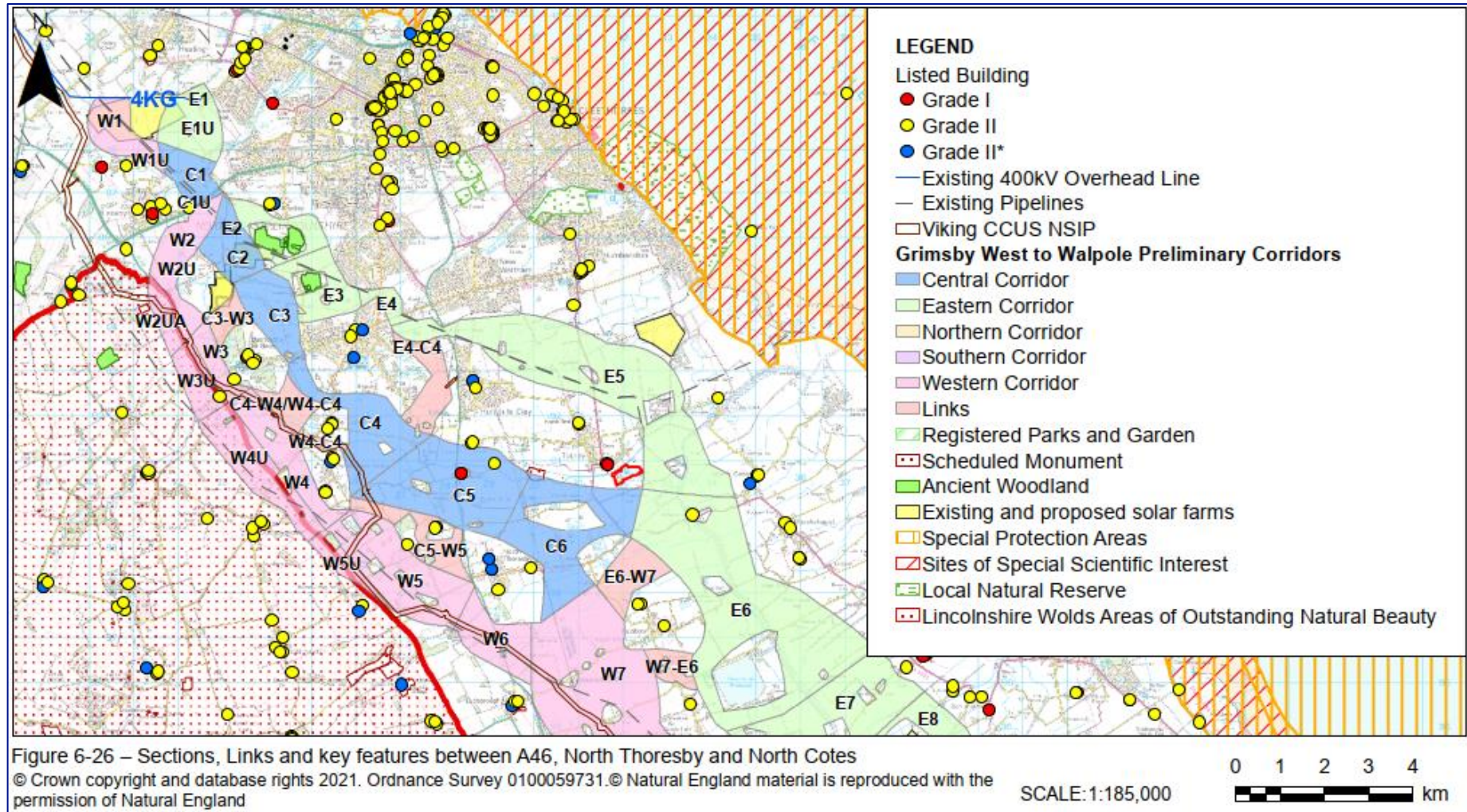
6.3.14 When considering other environmental and socio-economic features in this area the options are comparatively similar. Individual areas or features make specific Sections and Links less preferred. These are:

- From an ecological perspective, proximity to Bradley & Dixon Woods Ancient Woodland in the narrower corridor to the north makes Section E2 less preferred.
- From an ecological perspective, the closer proximity of Section E5 to the designated NSN and Ramsar sites along the Lincolnshire Coast make it less preferable. In addition, this Section and the eastern extent of Section C6 are in proximity to the Tetney Blow Wells SSSI (the only terrestrial designated ecological site in this area).
- From a heritage perspective, the Eastern Corridor is more distant from designated heritage assets, although like the Western and Central Corridors due to the open flat landscape, there would still be the potential to adversely affect the setting of scattered designated assets. An underground cable in Section W2UA is more likely to encounter buried archaeology due to proximity of the Civil War earthwork fort scheduled monument.
- From a water perspective, the extensive coverage of Flood Zone 2 and Flood Zone 3 within Section E5 make it less preferred (in line with the policy tests (sequential and exception tests) as set out in NPS EN-1).
- From a noise, vibration and air quality perspective, use of the Eastern Corridor is less preferred due to the number of narrower areas present along this Corridor and therefore the potential for intensified impacts on residential receptors.
- From a socio-economic perspective, the Eastern Corridor would adversely affect Wigmore Park (Sections E4 and E5) and the Western Corridor would potentially impact upon the Viking CCS NSIP application (potentially multiple crossings). Therefore, from a socio-economic perspective the Central Corridor is preferred.

6.3.15 Compared to Sections W2 to W5, Sections E2 to E5 are located further from the AONB and are further set in the urban fringe context. Sections C2 to C6 are located between the two (approximately 1.2 km from the AONB at its closest point). It is considered that routeing further east (closer to the urban fringes) within Sections C2 and C3 or within Sections E2 to E4 would limit potential for significant adverse impacts to the setting of (and views/to from) the AONB from a new overhead line. The

proximity of Sections W2 and W3 to the AONB mean that potentially significant adverse impacts from an overhead line are unlikely to be avoided (and use of underground cables in this area in line with NPS EN-5 (Paragraph 2.9.21) would need to be considered to materially reduce potential impacts on the setting of the AONB). Therefore, when considering impacts on this nationally designated landscape, Sections E2 to E5 are comparatively better and Sections W2 to W6 are comparatively worse.

Figure 6-26 – Sections, Links and Features between A46, North Thoresby and North Cotes



- 6.3.16 All routes from the A46 to North Thoresby and North Cotes must cross existing 132 kV overhead lines; the Western Corridor would result in one crossing; the Central Corridor would require one or two crossings; and the Eastern Corridor would require two crossings. Each of these crossings, if not mitigated, would have the potential to result in the creation of a wirescape (with these existing overhead lines). As it requires multiple crossings, the Eastern Corridor is considered more likely to result in a wirescape.
- 6.3.17 When considering the potential impacts upon visual receptors (residential, recreational, commercial and transport receptors), the Western Corridor is more remote from the main settled areas (urban fringes and satellite villages), however it is directly adjacent to the AONB and those residential and recreational receptors within its boundary. In comparison the Eastern Corridor is predominantly within and between these main settled areas and must navigate narrower areas near numerous residential properties and the extensive local road network. Those narrower areas are north of Bradley & Dixon Woods (Section E2); between Waltham and Scartho (Sections E3 and E4); between Waltham and New Waltham (Section E4); between Holton le Clay and New Waltham (Section E5); in proximity to Tetney Oil Terminal (Section E5); and in proximity to existing wind turbines north-east of Tetney Oil Terminal (Section E5). In comparison to these Corridors, the Sections of the Central Corridor are less remote than the Western Corridor but more remote than the Eastern Corridor. Therefore, visual impacts associated with the Central Corridor (predominantly on residential properties (high sensitivity receptor)) are likely to be greater than the Western Corridor but less than the Eastern Corridor.
- 6.3.18 Overall, from a landscape and visual perspective, an overhead line utilising the Central Corridor was preferred over the Western Corridor (due to its proximity to the AONB) and the Eastern Corridor (due to its potential visual impacts).
- 6.3.19 When comparing the underground cable Sections (W2U, W2UA, W3U, W4U and W5U) to an overhead line in other Sections in this area, an underground cable would perform comparatively better from a landscape and visual perspective. As impacts would be largely temporary and related to construction activities (as the permanent infrastructure is underground). However, an underground cable would require continuing underground into Sections W5 where a SEC (to transition to an overhead line) and continuation as an overhead line would be required. An overhead line within Section W5 would (as described above) likely result in significant adverse impacts to the AONB setting due to its proximity.
- 6.3.20 From a technical perspective the most challenging Sections to routeing an overhead line would be within Sections E2 to E5. This is due to a combination of narrower areas, zig-zagging sections requiring use of additional angle pylons, and multiple constraints to routeing including two 132 kV overhead lines, ancient woodland, ConocoPhillips pipelines, the proposed Low Farm Solar Farm and proposed housing planning application. In comparison, routeing within Sections C2 to C6 would be less challenging as the Sections are generally larger with fewer narrower areas, and although constraints are present (including two 132 kV overhead lines, the Hornsea cables and the Viking CCS NSIP), they can generally be avoided whilst maintaining a largely direct route and using fewer angle pylons.
- 6.3.21 In comparison to the other Corridors, routeing an overhead line in Sections W2 to W6 is least challenging as, although Sections are slightly narrower, they are generally free from technical constraints to routeing (one 132 kV overhead line, the ConocoPhillips pipelines and Viking CCS NSIP) and maintain a largely direct route.

However, based on proximity to the AONB it is likely than an underground cable would be required (as outlined in **Paragraph 6.3.17**).

6.3.22 The complexity of an underground cable in the Western Corridor (overhead line and underground cable sections) would be more technically complex than for an overhead line due to crossings of watercourses, A-roads and the existing and proposed pipelines and the increased potential for encountering buried archaeology associated with the Civil War earthwork fort scheduled monument. Therefore, within the Western Corridor an overhead line would be the preferred technological solution.

6.3.23 When considering alternative Links:

- Links C4-W4/W4-C4, W4-C4 and C5-W5 were comparatively free from constraints, however, utilising these Links would necessitate routeing through a Section adjacent to the AONB (Section W4, W5, C4 or C5) and was therefore less preferred;
- Link E4-C4 was comparatively free from constraints. Therefore, utilising this Section would be preferred over Section E5. However, despite this, Section E4 (not preferred) would still need to be used to access this Link and therefore overall, this was not a preferred option.

6.3.24 All Sections are compliant with Holford Rule 1 (avoid major areas of highest amenity value) and Holford Rule 2 (avoid smaller areas of high amenity value). Sections W2UA, W3U, W4U and W5U are located within the AONB and as underground cable Sections, they are (regardless of technology) considered compliant with the principles of Holford Rules 1 and 2. All Sections, are located within an open suburban landscape with level topography and few woodland blocks, which are specifically avoided where present, and therefore with regards to Holford Rules 4, 5 and 7, no single Corridor or combination of Sections and Links emerges as preferred.

6.3.25 For Holford Rule 3 (choose the most direct line, with no sharp changes of direction and thus fewer angle pylons), a route utilising the Eastern Corridor would result in the least direct route and, especially within narrower areas, would likely require a greater number of angle pylons. Use of the Western or Central Corridors would both likely result in largely direct routes of similar lengths and similar changes in direction (and therefore comparable numbers of angle pylons). Use of Links would likely require changes in direction and therefore potentially greater use of angle pylons.

6.3.26 As described in **Paragraph 6.3.16**, existing overhead lines are present and influence the level of compliance with Holford Rule 6 (avoid creation of a wirescape). The Western Corridor requires fewest interactions with the existing 132 kV overhead lines (one crossing), the Central and Eastern Corridors would require the most (two crossings).

6.3.27 Overall, potential impacts upon the setting of (and views to/from) the AONB from an overhead line along the Western Corridor and Links to/from the Corridor resulted in these being less preferred. The technical complexity and potential environmental impacts (primarily visual) of routeing through the narrower areas within the Eastern Corridor, especially Sections E4 and E5 resulted in these also being less preferred. For these reasons, it is considered that these Sections are least preferred. The starting presumption (in line with the NPS EN-5 and National Grid's Approach to Consenting) is for an overhead line and it is considered that following careful routeing (predominantly east) and by modification of the NPG 132 kV overhead lines, an overhead line within the Central Corridor between the A46 and North Thorseby will reduce the severity of adverse effects, when compared to the other corridors. In addition, the use of an underground cable (via the Western Corridor sections W2U to

W5U) is the less preferred technological solution, is less preferred from a water perspective (due to multiple crossings including those of several watercourses and proximity to historic landfills), has a greater potential to impact upon buried archaeology (potentially associated with the *Civil War earthwork fort 350 m north-east of Walk Farm* Scheduled Monument, and would introduce additional costs (costs detailed further in **Chapter 13**). Therefore, between the A46 and North Thorseby/North Cotes an overhead line utilising Sections C2 to C6 is the emerging preference.

### Summary of Decision

6.3.28 The following Sections and Links are preferred and therefore were selected to progress at this stage:

- Central Corridor (Sections C2 to C6) – an overhead line using the Central Corridor Sections C2 to C6 was preferred to limit impacts on the AONB (its setting and views/from the AONB) and visual receptors (at the more populated urban fringes of Grimsby and Cleethorpes) and reduce technical complexity and environmental impacts associated with narrower areas or underground cabling.
- Western Corridor to Central Corridor Links (Link C4-W4/W4-C4 and Link W4-C4) – these Links are progressed to increase the routing flexibility for overcoming the narrower area in Section C4 between Brigsley and Waltham.

6.3.29 The following Sections and Links are preferred and therefore were not progressed at this stage:

- Western Corridor (Sections W2 and W6 - overhead line) – An overhead line within these Sections is highly constrained due to potential impacts upon the setting of (and views to/from) the AONB. Potential impacts upon the AONB were considered such that for these Sections undergrounding as a form of mitigation would likely be required.
- Western Corridor (Sections W2U and W5U – underground cable) – An underground cable is more technically complex than an overhead line due to the crossing of the Viking CCS NSIP, existing pipelines, the A18 and watercourses (in proximity to historic landfills). In addition, use of an underground cable would result in greater costs (costs described further in **Chapter 13**) and the increased potential to encounter buried archaeology.
- Eastern Corridor (Sections E2 and E5) - The technical complexity and potential environmental impacts of routing through the narrower areas within Sections E2 to E4 were sufficient to discount these options. Section E5 was constrained through technical complexity, and visual, water and ecological impacts.
- Western Corridor to Central Corridor Links (Link C3-W3 and Link C5-W5) – Use of these Links C3-W3 and C5-W5 presented potential adverse impacts to the setting of (and views/to from) the AONB.
- Central Corridor to Eastern Corridor Link (Link E4-C4) – Use of this Link was not progressed due to Section E4 being less preferred based on environmental and technical constraints.

## Step 3 - North Thoresby and North Cotes to Burgh le Marsh

6.3.30 This area runs from North Thorseby and North Cotes in the north, southwards towards Burgh le Marsh and only considers the use of an overhead line. It includes the following sections, as shown in **Figure 6-27**:

- Western Corridor (Sections W7 to W15);
- Central Corridor (Section C7);
- Eastern Corridor (Sections E6 to E14); and
- Links between the Western Corridor and Eastern Corridor (Link E6-W7, Link W7-E6, Link E7-W8, Link W10-E9, Link E9-W10, Link E11-W12, Link W12-E11 and Link E12-W13/W13-E12).

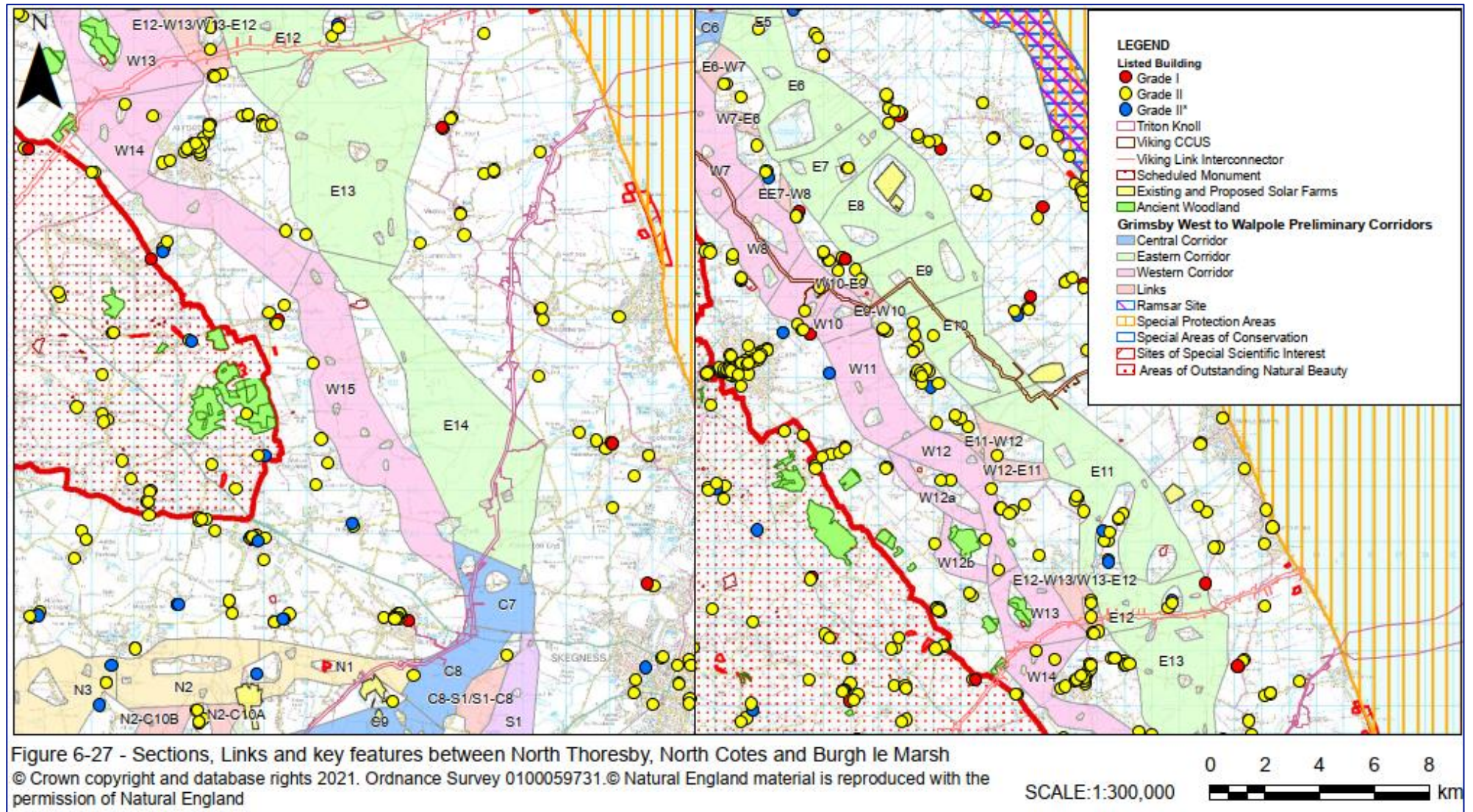
6.3.31 The proximity of the AONB to the Sections in this area mean that it is still a key factor for decision making. However, due to the greater distances from the AONB, the width of the Sections and the proximity of the Western and Eastern Corridors to each other (boundaries of each are generally within 1 km), it is not the sole differentiator when determining preferred Sections. As described in **Paragraph 6.2.12**, the proximity of Sections W12B, W14 and W15 to the AONB are such that potentially significant adverse impacts on the setting of (and views/to from a key feature of the South-Eastern Claylands LCA) the AONB from an overhead line are unlikely to be avoided without mitigation in the form of undergrounding. Therefore, these Sections are notably less preferred.

6.3.32 Between Sections W7 to W12 and Sections E6 to E11, there are comparatively fewer designated heritage assets, including scheduled monuments, in closer proximity to the Eastern Corridor. Therefore, the Eastern Sections are marginally preferred from a heritage perspective, except for the eastern leg of Section E11 where an overhead line may have significant adverse impacts on *Hagnaby Abbey* scheduled monument and associated listed buildings. Sections E6 to E11 are also in closer proximity to the NSN and Ramsar sites along the Lincolnshire Coast and are therefore less preferred from an ecological perspective.

6.3.33 North of North Cockerington, the Louth Canal routes through the centre of Sections E6, E7 and E8 (where a minimum of two crossings would be required) before it routes east to west across Section W9. There is also a slightly greater abundance of drains and watercourses within the Eastern Corridor, and a significantly greater extent of Flood Zones 2 and 3. In addition the Eastern Corridor includes a large area at risk from reservoir flooding (from Covenham Reservoir) which is unavoidable should flooding occur. The cumulative presence of these features increases the technical complexity of routeing in these Sections and potential impacts upon the water environment. Therefore, the Eastern Corridor in Sections E6 to E11 are less preferred from a water perspective (compared to the Western Corridor Sections W7 to W12). This is in line with the policy tests (sequential and exception tests) as set out in NPS EN-1. In addition, these Sections of the Eastern Corridor are less preferred to the corresponding Sections of the Western Corridor when considering the potential impacts upon (or seeking to avoid impacts upon) the operation of Eastfield Airstrip, is less preferred from a technical perspective (compared to the Western Corridor Sections W7 to W12).



Figure 6-27 –Sections, Links and key features between North Thoresby, North Cotes and Burgh le Marsh



- 6.3.34 From a landscape and visual perspective there is little to choose between Sections W7 to W12 and Sections E6 to E11. An overhead line within both Corridors is likely to adversely impact upon views from the line of villages located between the two including Covenham St Mary, Alvingham, North Cockerington, South Cockerington, Grimoldby, Manby, Little Carlton and Great Carlton. An overhead line in the Western Corridor is located slightly closer to the AONB and therefore may have a slightly greater potential to impact upon the setting of this nationally designated landscape. However, the siting of an overhead line in the Western Corridor would limit west-facing views of infrastructure on the skyline for local residents, recreational receptors and road users, due to the rising ground of the AONB forming a backdrop to views (in line with Holford Rule 4). In comparison, an overhead line in the Eastern Corridor (although further from the AONB), may result in more views of an overhead line with a sky background due to the flat topography towards the coast. There may also be potential adverse cumulative visual effects from the multiple wind farms in proximity. In addition, an overhead line in the Eastern Corridor may be marginally more prominent in views towards the coast (a key feature of the South-Eastern Claylands) from the AONB.
- 6.3.35 Within Sections W13, E12 and the Link between, an overhead line would be preferred to the eastern extent of Section W12 or the western extent of Section E12 due to the presence of scheduled monuments at the other extents of these Sections (and proximity of the AONB to the west Section W13), however, this would then result in an overhead line closer to the village of Saleby. Here there are few factors to distinguish between the Sections. An overhead line would need to be routed having regard to the Viking Link Interconnector, scattered listed buildings, watercourses, drains, reservoir flooding and Flood Zones 2 and 3 (mainly east of Section E12). It would also need to have regard to visual impacts to receptors, mainly at Saleby, Alford, Bilsby and Beesby, and the slight rise in topography from west to east towards the A1104.
- 6.3.36 In addition to its proximity to the AONB, Section W14 is comparatively narrow to Section E13. It is also located within proximity of the Grade II Well Hall Registered Park and Garden, Alford Crematorium, two residential properties adjacent to the A111 Alford Road, and would be overlooked by properties (and those travelling along roads) from the south-west. A route through Section W14 would also require crossing the Branch Line LNR and a small area of peaty soils and as such, Section W14 is considered least preferred. Further south there is little to differentiate between Sections W15 and E14, however the proximity to the AONB, a greater number of potentially impacted visual receptors (at Willoughby, Welton le Marsh and Orby) and a greater number of listed buildings associated with Section W15 mean that Section E14 would be more preferred environmentally. It would also be preferred from a technical perspective as it allows for a better entry into Section C7 (where the Western and Eastern Corridors merge between Burgh le Marsh and Skegness) due to narrower areas at the north-west of Section C7.
- 6.3.37 When considering the Holford Rules for the Sections between North Thoresby, North Cotes and Burgh le Marsh, all comply with Holford Rule 1. Except for small areas of ancient woodland at the edges of Sections W12B, W13 and W14, and the North Cockerington Hall moated site scheduled monument within Link W10-E9, all are compliant with Holford Rule 2. As the North Cockerington Hall moated site scheduled monument is at the centre of this narrow Link it is not preferred, as it is less compliant with Holford Rule 2. A route using the whole Western Corridor would be most direct (in line Holford Rule 3), although there is little difference between this Corridor and the Eastern Corridor when considering the opportunity for a direct route of an

overhead line. Use of the Links would result in less direct routes and would likely require use of additional angle pylons and therefore would conform less with Holford Rule 3. No Corridor is preferred when reviewing them against Holford Rules 4, 5 and 7, as they are all within an open flat suburban landscape with few woodland blocks (avoided where possible). No existing overhead lines of 132 kV or above are in this area and therefore no Corridor is preferred when considering the requirements of Holford Rule 6.

6.3.38 Overall, between Sections E6 to E11 and W7 to W12 the cumulative constraints of the following resulted in the Eastern Corridor being less preferred:

- Louth Canal;
- Closer proximity to ecologically designated sites along the coast (including the recently announced Lincolnshire Coronation Coast Nature Reserve and the coastline added to the UK's tentative list of World Heritage sites (as part of the East Atlantic Flyway));
- Potential for cumulative visual impacts with existing wind farms;
- Potential for views against a sky background;
- Greater interaction with Flood Zones 2, 3 and reservoir flooding; and
- a less direct overhead line route.

6.3.39 As Section W14 is least preferred, as detailed above, a route would then need to utilise Link W13-E12 to allow a route from Section W13 into E12. Although it is acknowledged that this is a less direct route, on balance this would be preferred when weighed against the potential impacts on the setting and views to/from the AONB of routing through Section W14, impacts to heritage assets, the Branch Line LNR and visual receptors. As described above, Sections E13 and E14 would be more preferred.

6.3.40 Except for the scenario detailed above, the use of the Links between North Thoresby, North Cotes and Maltby le Marsh are less preferred (with Link W10-E9 least preferred due to impacts upon a scheduled monument). Generally, the use of Links would result in a less direct route, use of more angle pylons and there is not considered to be a requirement to cross between the Corridors.

6.3.41 Therefore, the emerging preferences between North Thoresby, North Cotes and Maltby le Marsh are Sections W7 to W12, Section W13, Link E12-W13/W13-E12 and Sections E12 to E14 and Section C7.

### **Summary of Decision**

6.3.42 The following Sections and Links are preferred and therefore were selected to progress at this stage:

- Western Corridor (Sections W7 to W13) - Sections W7 to W13 are preferred as they avoid constrained areas of reservoir flooding, Flood Zone 2 and 3, the Louth Canal, ecologically designated sites along the Lincolnshire Coast and cumulative visual impacts with existing wind farms and form a more direct route.
- Eastern Corridor (Sections E12 to E14) - Sections E12 to E14 are preferred as they reduce the potential for impacts on the setting of the AONB, receptors at Alford, the Grade II Well Hall Registered Park and Garden and avoid the Branch Line LNR and peaty soils through the avoidance of Section W14.

- Western Corridor to Eastern Corridor Link (Link E12-W13/W13-E12) – Use of this Link is comparatively free of constraints and would allow the convergence of the two component routes outlined above.

6.3.43 The following Sections and Links are preferred and therefore were not progressed at this stage:

- Western Corridor (Sections W13 to W15) - Introducing a new overhead line through the Corridor between W13 and W15 would result in impacts on the setting of the AONB, receptors at Alford, the Grade II Well Hall Registered Park and Garden, and the Branch Line LNR.
- Eastern Corridor (Sections E6 to E11) - The area of the Eastern Corridor between E6 and E11 is constrained due to the presence of a large extent of reservoir flooding, Flood Zones 2 and 3 and the Louth Canal. Introducing a new overhead line through these corridor Sections would also result in impacts on ecologically designated sites along the Lincolnshire Coast and cumulative visual impacts with existing wind farms.
- Western Corridor to Eastern Corridor Links (Link E6-W7, Link W7-E6, Link E7-W8, Link W10-E9, Link E9-W10, Link E11-W12 and Link W12-E11) - Link W10-E9 was not preferred due to the presence of North Cockerington Hall moated site scheduled monument. The use of these Links would result in a less direct route and would require the use of additional angle pylons.

## Conclusion

6.3.44 Overall, when considered in isolation, the emerging preferred corridor between Grimsby West and Burgh le Marsh is an overhead line in Sections W1 or E1, Sections C2 to C6, Sections W7 to W12, Link W12-E12, Sections E12 to E14 and Section C7. This however will be subject to the identification of the emerging preferences for the Grimsby West siting area (set out in **Chapter 9**) and the LCS siting zone (set out in **Chapter 10**). The emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14**.

# 7. Options Appraisal – Burgh le Marsh to Weston Marsh

## 7.1 Introduction

- 7.1.1 This Chapter outlines the Options Appraisal (Step 7 as described in **Chapter 4**) for the corridors between Burgh le Marsh and Weston Marsh (**Figure 7-1**). The preliminary corridors have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6).
- 7.1.2 As described in **Chapter 5**, the corridor identification exercise identified three preliminary overhead line corridors between Burgh le Marsh and Weston Marsh and 14 links, these include the:
- Northern Corridor – Sections of which are denoted with the prefix “N” e.g., northern corridor section 1 is known as Section N1;
  - Southern Corridor - Sections of which are denoted with the prefix “S” e.g., southern corridor section 1 is known as Section S1;
  - Central Corridor – Sections of which are denoted with the prefix “C” e.g., central corridor section 1 is known as Section C1; and
  - Links - Named according to the sections they join, e.g., Link N1-C10 provides a link from section 1 of the Northern Corridor to section 10 to the Central Corridor.
- 7.1.3 The preliminary corridors and their associated sections are shown on Figure 7-2, Figure 7-3, and Figure 7-4. Key constraints for the preliminary Corridors between Burgh le Marsh and Weston Marsh are shown on Figure 7-5.

Figure 7-1 - Corridors between Burgh le Marsh and Weston Marsh

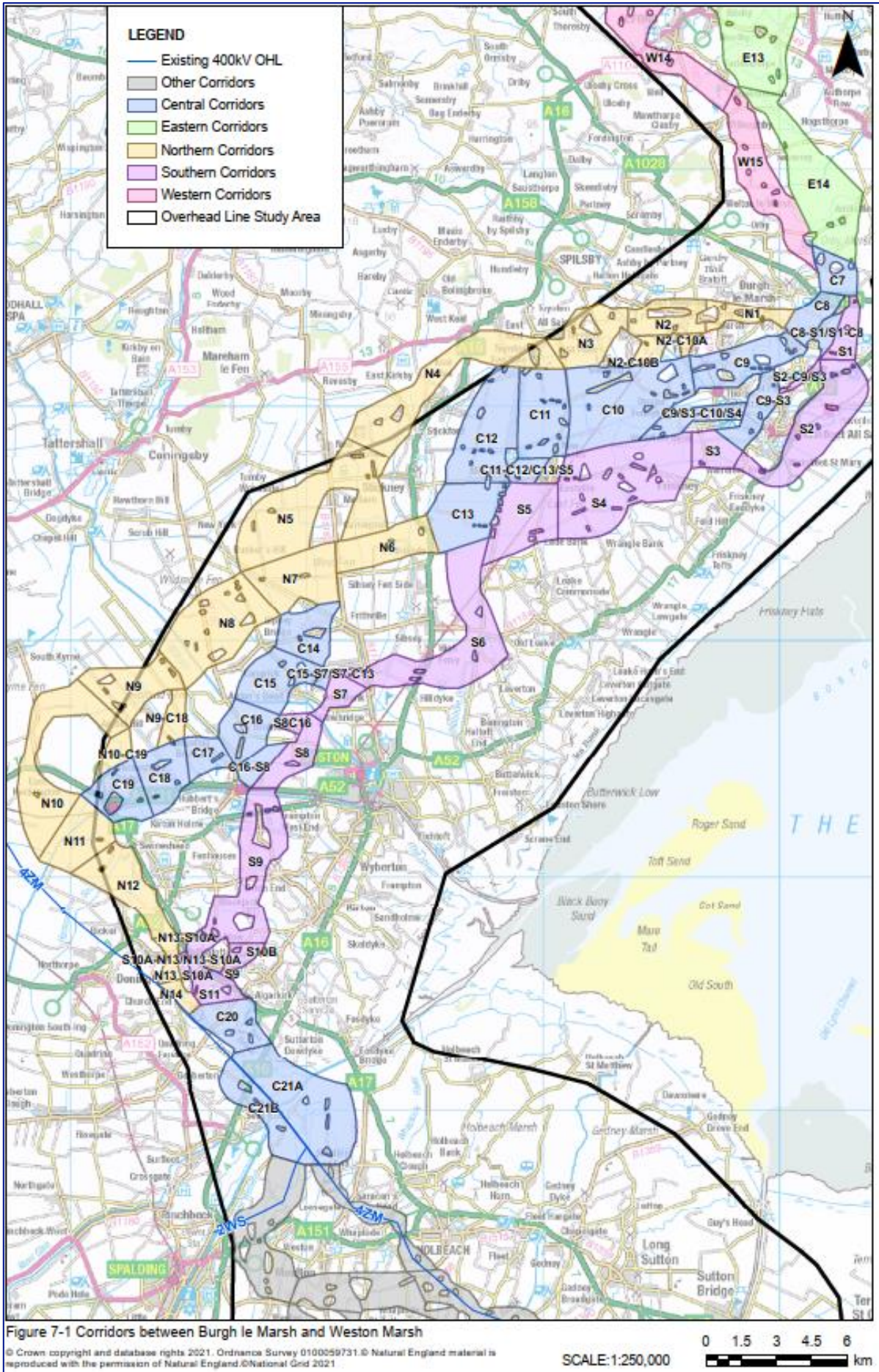


Figure 7-2 - Corridors between Burgh le Marsh and Sibsey Northlands

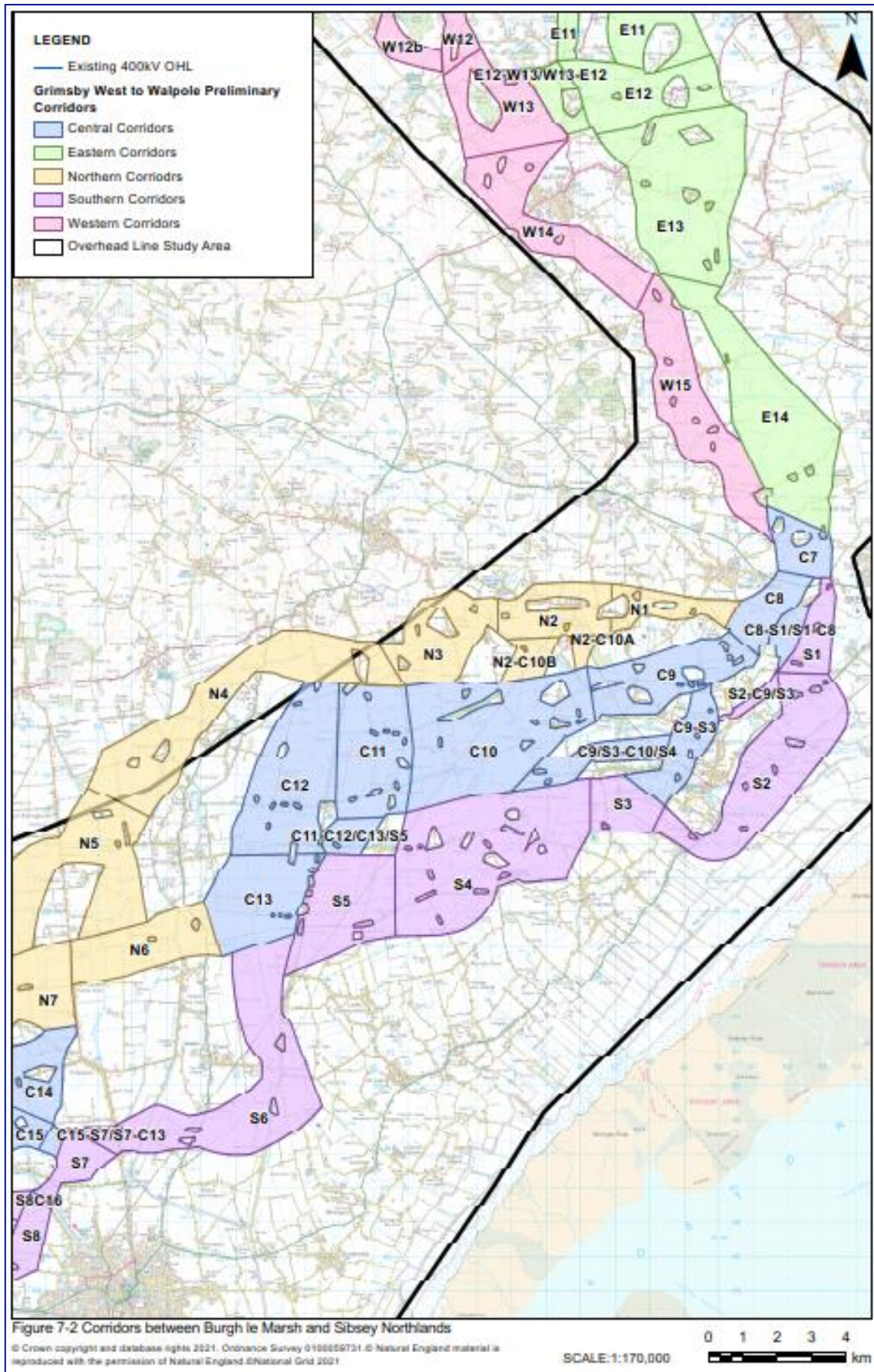
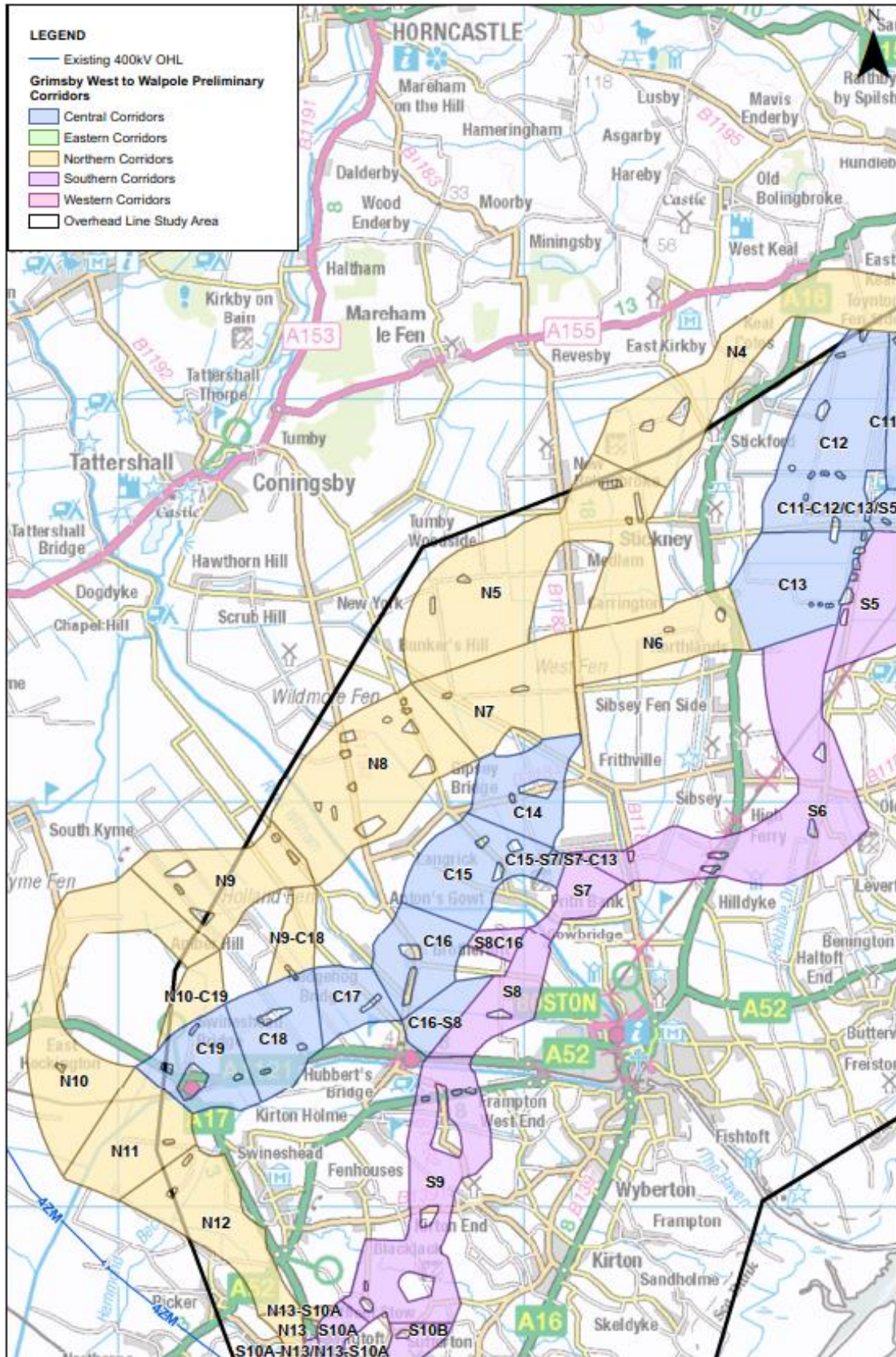


Figure 7-3 - Corridors between Sibsey Northlands and Swineshead



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SCALE: 1:150,000 0 1 2 3 4 km



Figure 7-4 - Corridors between Swineshead and Weston Marsh

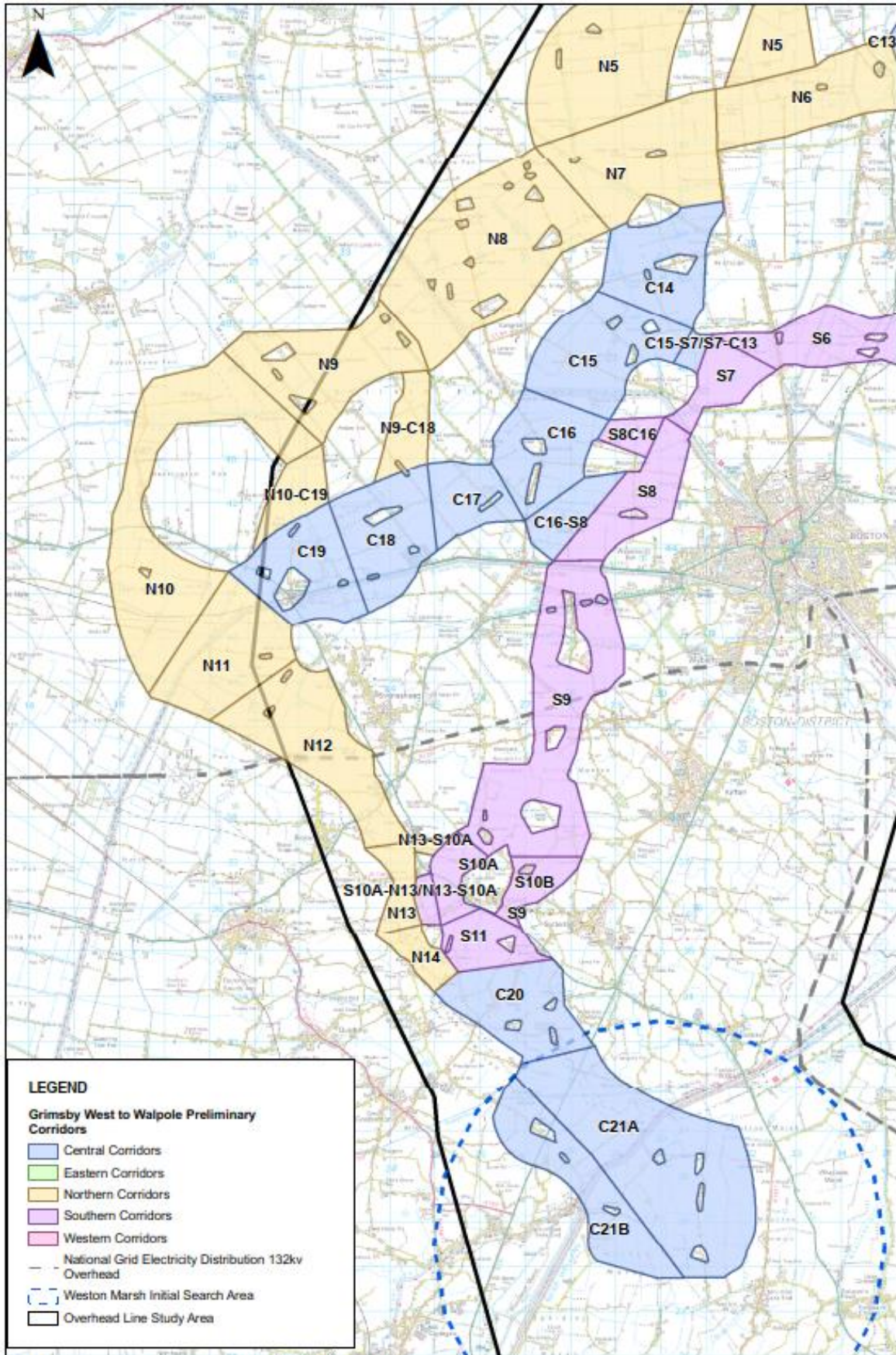
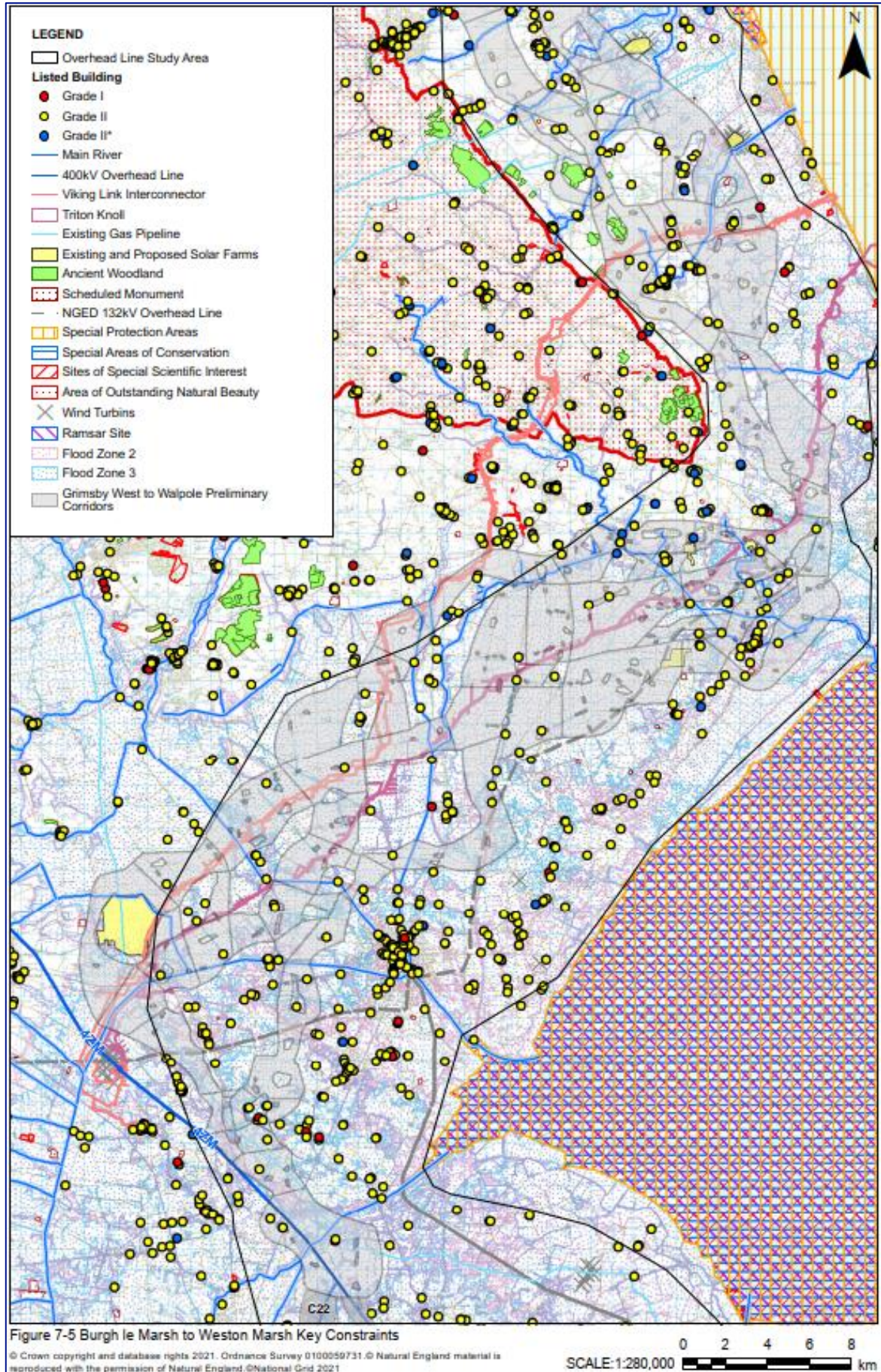


Figure 7-4 Corridors between Swineshead and Weston Marsh

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Figure 7-5 - Burgh le Marsh to Weston Marsh - Key Constraints



## 7.2 Options Appraisal

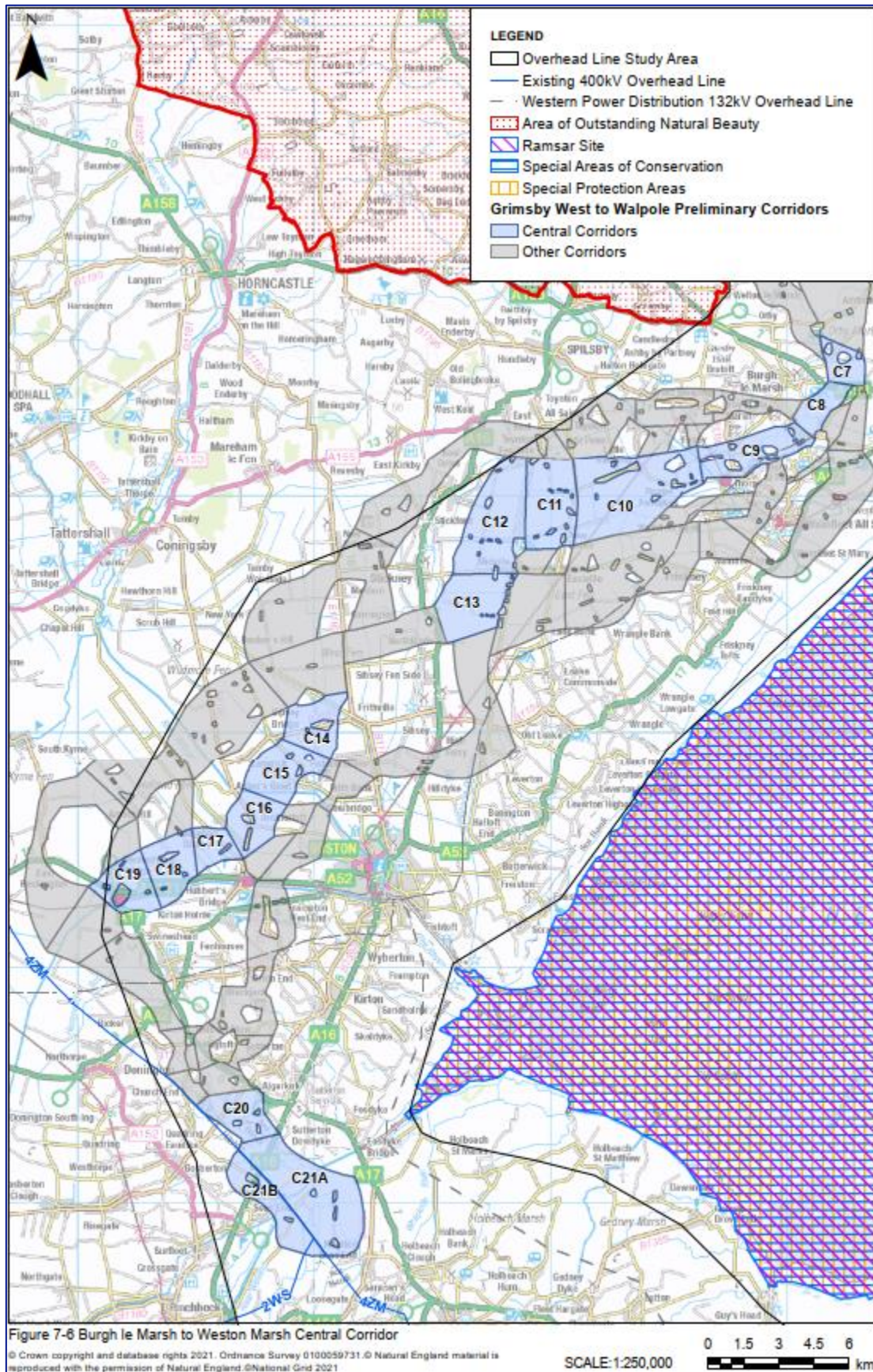
- 7.2.1 The Options Appraisal below has considered environmental, socio-economic and technical topics for each Section and link and was informed by the data gathered as outlined in **Tables 5-1** and **5-2**. For the current Project stage, relevant data comprises desk study information, supplemented by a site visit to select locations, on important receptors.

### Central Corridor Sections (Sections C8-C21)

- 7.2.2 The Central Corridor (Sections prefixed with 'C') (**Figure 7-6**) starts at the A158 Skegness Road east of Burgh le Marsh within Section C7. This Corridor routes south-west towards Croft and a NGED 132 kV substation before continuing west (into Section C9) through narrower areas located between the Hollies Solar Park, Skegness and Croft, and routing parallel to a NGED 132 kV overhead line, before continuing west of the Steeping River and the Grantham to Skegness Railway Line ('Poacher Railway Line') twice in Section C10 (east and west of the Steeping River). Prior to reaching Stickford (west of Section C12) the Corridor routes south to connect with the Northern Corridor (Section N6) and Southern Corridor (Section S6) north-west of Sibsey Northlands.
- 7.2.3 The Central Corridor then continues where it connects to the Northern Corridor (Section N7) to the north-west of Frithville and routes south-west towards Hubbert's Bridge (in Section C15), before continuing west parallel to the A1121 and the Poacher Railway Line to meet the Northern Corridor again at Swineshead Bridge (in Section C19).
- 7.2.4 The Central Corridor then continues where it connects to the Northern Corridor (Section N14) and Southern Corridor (Section S11) west of Sutterton, before continuing south (in Section C20), parallel to the 400 kV 4ZM overhead line to Weston Marsh. As the Corridor nears the Weston Marsh Zone, two Sections, Sections C21A and C21B, are provided either side of the 400 kV 4ZM overhead line.
- 7.2.5 This merger and splitting of the Central Corridor throughout the south of the Overhead Line Study Area is due to the pattern of settlement in this area and the distribution of environmental and socio-economic receptors.
- 7.2.6 In addition to the Central Corridor itself, there are six links between the Central and either Northern or Southern corridors. These links have been provided where it would be possible to avoid constraints or pinch points associated with a particular section by transferring from one corridor or section to another and are as follows.
- Link C8-S1/S1-C8, which connects the Central and Southern Corridors to the south of the A158.
  - Link C9-S3, which connects the Central and Southern Corridors between Thorpe St Peter and Wainfleet St Mary.
  - Link C9/S3-C10/S4, which connects the Central and Southern Corridors to another Link between these Corridors to the south of Thorpe Culvert.
  - Link C11-C12/C13/S5, which connects multiple Sections of the Central Corridor with the Southern Corridor around New Leake.
  - Link C15-S7/S7-C13, which connects the Central and Southern Corridors to the north of Antons Gowt.

- Link C16-S8, which connects the Central and Southern Corridors to the north of Hubbert's Bridge.

Figure 7-6 – Burgh le Marsh to Weston Marsh Central Corridor



## Environmental Factors

### Landscape and Visual

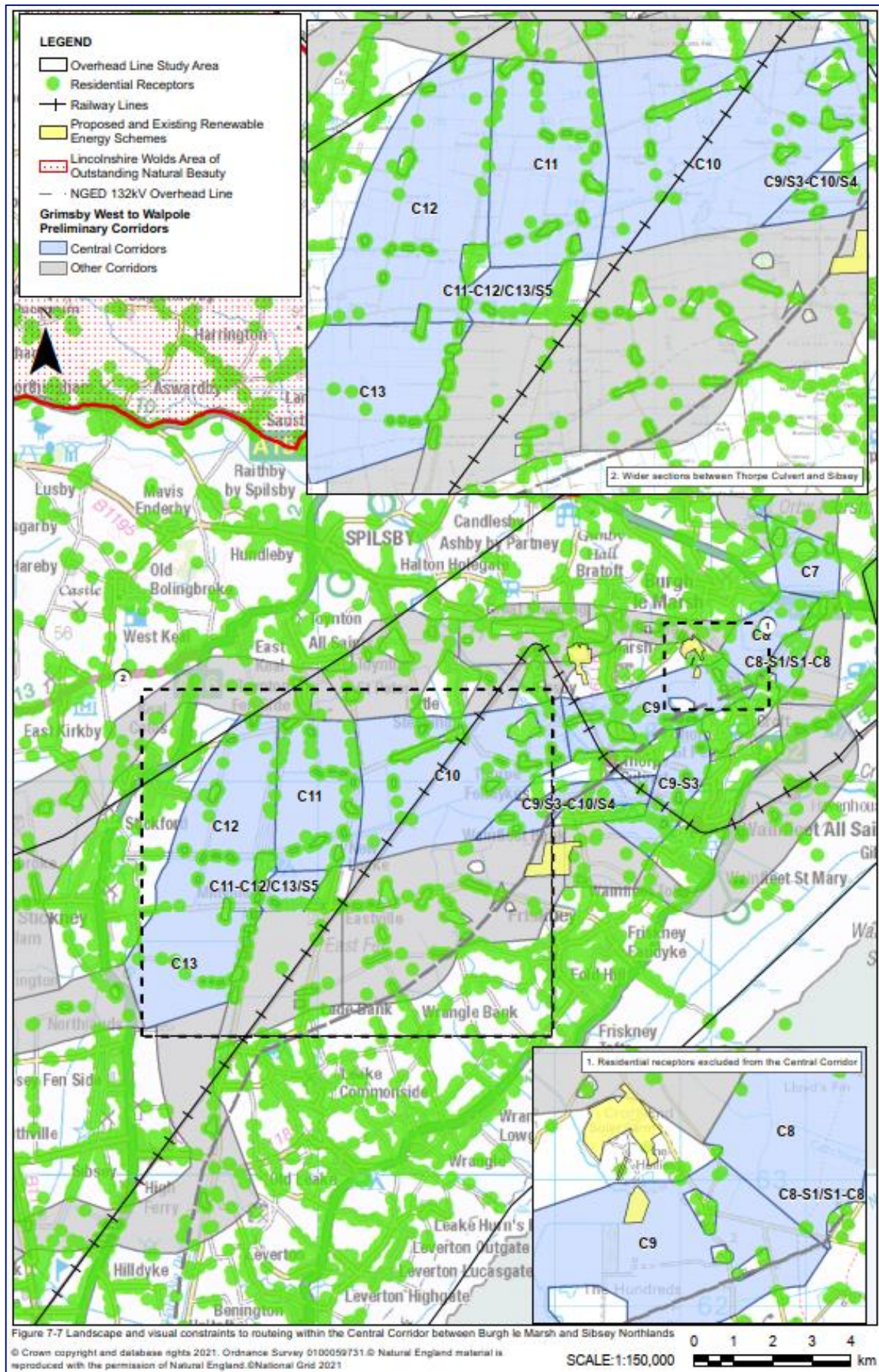
- 7.2.7 The Central Corridor and its links are located within two different NCAs. Sections C8 and C9 are located within NCA 42 Lincolnshire Coast and Marshes which is characterised by a wide coastal plain which extends from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. Section C10 is located at the transition between NCA 42 and NCA 46 The Fens. Sections C11 to C21 are located within NCA 46 which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The characteristics of these NCAs are similar and therefore are similar and therefore not considered to materially affect the potential impacts of an overhead line in the different Sections of the Corridor. The key landscape and visual features between Burgh le Marsh and Weston Marsh are the comparatively greater density of settlement between Burgh le Marsh and Wainfleet All Saints, the presence of NGED 132 kV overhead lines, and the linear settlement pattern between Burgh le Marsh and Weston Marsh.
- 7.2.8 Continuing from Section C7 (detailed in **Chapter 6**), the Central Corridor and its links between Burgh le Marsh and Weston Marsh are located within an open landscape. The open landscape has a level topography which offers considerable routeing flexibility, subject to individual constraints and receptors located within and surrounding specific sections and links. The scattered pattern of development and features, wide Corridors and Links, and open landscape is such that routeing should seek a more direct line (which would be in line with Holford Rule 3) where feasible. This will considerably reduce the potential for landscape impacts, especially where angle pylons or larger pylons for crossing rivers or infrastructure are required. The use of links may require additional angle pylons, increasing the potential for landscape and visual impacts. Across the Central Corridor, impacts upon some individual receptors are unavoidable but can be reduced through careful routeing.

#### Burgh le Marsh to Sibsey Northlands

- 7.2.9 The AONB is located approximately 4.7 km west of the Central Corridor at its closest point in Section C8. The AONB is split into four LCAs, the Ridges & valleys of the south-west LCA is of relevance to the Central corridor. The Ridges & valleys of the south-west LCA (north of Gunby to east of Horncastle and south of Ludford), key features include:
- *“Dramatic views south Bluestone Heath Road and Nab Hill – Hoe Hill ridge”* – enables wide open views of the landscape.
  - *“Mixed pattern of arable and pastoral farming”* – typical features of a rural landscape evident in views.
  - *“Old mixed hedgerows” and “Herb rich roadside verges”* – provides an opportunity to improve the connectivity of green infrastructure assets as part the mitigation.
- 7.2.10 A new overhead line here would not be considered incongruous in the context of the AONB due to its distance, and within Sections C8 and C9 (those closest to the AONB) as it would be seen in the context of the urban fringes of Burgh le Marsh and Skegness.
- 7.2.11 Continuing from Section C7 (detailed in **Chapter 6**) east of Burgh le Marsh, Sections C8 and C9 and Links C8-S1-C8, C9-S3 and C9/S3-C10/S4 are near existing above ground infrastructure. The Hollies Wind Farm and Solar Park is within the north of Section C9

respectively, and a NGED 132 kV overhead line and 132 kV substation is located at the south, travelling parallel to Section C9 for approximately 4 km. The presence of this existing electrical and renewable infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. However, its presence also constrains routeing and may result in intensified impacts should a wirescape (with the existing overhead line) be created. The main visual receptors in this area include residential receptors at Burgh le Marsh, Irby in the Marsh, Thorpe Culvert, Croft, Thorpe St. Peter, scattered residential properties, and users of Sycamore Lakes caravan park (Section C8) and the Steeping River (Section C9). Routeing flexibility is decreased in Section C9 due to the requirement to cross the Steeping River and Poacher Railway Line and to avoid impacting on a woodland block located south of the Hollies Solar Park, see **Figure 7-7**. Careful routeing should seek a greater separation from the NGED 132 kV overhead line to avoid significant adverse visual effects on identified receptors and creation of a wirescape. Should a route closer to this existing overhead line be taken this would require consideration of modification (via re-routeing, undergrounding or a GSP substation) of the 132 kV overhead line to materially reduce the severity of potential adverse impacts.

Figure 7-7 – Landscape and visual constraints to routing within the Central Corridor between Burgh le Marsh and Sibsey Northlands



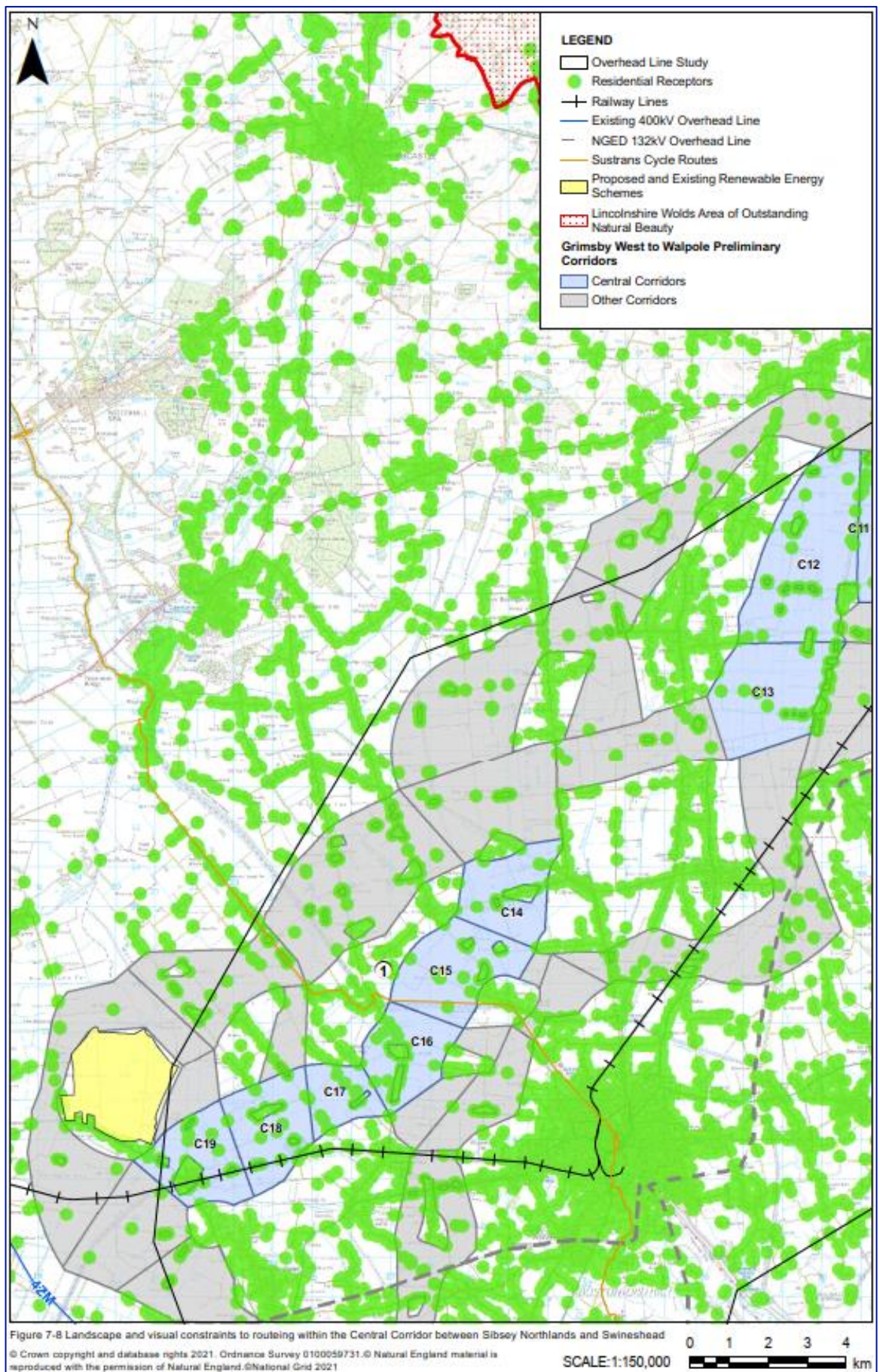
- 7.2.12 Continuing west from the Steeping River, along the boundary between Sections C9 and C10, there are narrower areas to the north and south of Thorpe Fendykes. The introduction of a new overhead line here has the potential to result in significant adverse visual impacts on some individual receptors due to the proximity of visual receptors.
- 7.2.13 From the Steeping River the Central Corridor widens considerably to Sibsey Northlands, increasing the routing flexibility within Sections C10 to C13 and the Link C11-C12/C13/S5. The main landscape features in this area are located within Section C10 and include occasional woodland and tree belts, the Poacher Railway Line, and Steeping River. Residential receptors, within and surrounding the Sections and Links comprise scattered villages and properties such as Thorpe Culvert, Little Steeping, Thorpe Fendykes (Section C10); Toynton Fen Side and Eastville (Section C11); Midville, New Leake and Hobhole Drain (Link C11-C12/C13/S5); Toynton Fen Side, Midville, Keal Cotes, Stickford, Fen Side and Stickney (Section C12); and Stickney and Midville (Section C13). Recreational receptors include users of the Steeping River (Section C10) and scattered caravan parks, most notably the Midville Caravan Park (Section C11 and C12). A new overhead line has the potential to result in significant adverse impacts to visual amenity for these receptors, although with careful routing it is considered that the number and severity of these impacts could be materially reduced.

#### Frithville to Swineshead

- 7.2.14 Between West Fen Drain to the north-west of Frithville, where the Central and Northern Corridors meet and the River Witham, are Sections C14 and C15 and Link C15-S7. In this area the scale of the landscape is reduced due to the presence of scattered woodland, tree belts, hedgerows, and hedgerow trees which are avoidable through careful routing. The density of population in this area increases towards Boston and the River Witham. The main visual receptors in these Sections and link include scattered properties and the villages of Frithville, Gipse Bridge, Fishtoft Drove (Section C14); and Frithville, Gipse Bridge, Langrick, Antons Gowt and Langrick Bridge (Section C15 and Link C15-S7). Within Section C15 and Link C15-S7 users of the River Witham and the NCN Route 1, parallel to the river, are key recreational receptors (**Figure 7-8**). A new overhead line has the potential to result in significant adverse impacts to visual amenity for these receptors, although with careful routing the number and severity of these impacts could be materially reduced. However potential adverse visual impacts upon the users of the River Witham and the NCN Route 1 are unavoidable as a crossing is required.



Figure 7-8 – Landscape and visual constraints to routing within the Central Corridor between Sibsey Northlands and Swineshead



- 7.2.15 Continuing south from the River Witham (Section C15) towards Swineshead (Section C19) there are fewer landscape features that reduce routing flexibility. Compared to north of the River Witham, the density of the population is increased slightly and here the key visual receptors are residential and recreational. There are scattered residential properties throughout and surrounding these sections (Sections C16 and C17) and Link C16-S8 including Langrick Bridge, Hedgehog Bridge, Brotherton and Boston West (Section C16 and Link C16-S8), and Hedgehog Bridge and Hubbert's Bridge (Section C17). Key recreational receptors include the Appletree Country Park (holiday park which includes the Boston West golf club) located to the south and west (for both Sections C16 and C17 and Link C16-S8) and the Hubbert's Bridge/Orchard Holiday Park, located south of Hubbert's Bridge (Section C17). These receptors limit routing flexibility towards the south. As with other areas along the Central Corridor between Burgh le Marsh and Weston Marsh, a new overhead line has the potential to result in significant adverse impacts to visual amenity for these receptors, although with careful routing it is considered that the number and severity of these impacts could be materially reduced. Compared to Sections C16 and C17, Link C16-S8 is generally remote from visual receptors.
- 7.2.16 West of Hubbert's Bridge, Sections C18 and C19 contain several A-roads, the Poacher Railway Line and South Forty Foot Drain. These must be crossed here or in Section N11 (discussed in **Paragraph 7.2.98** below). Crossings are likely to require the use of multiple angle pylons as it changes direction from routing west to routing south-east. This change in direction (and use of multiple angle pylons) has the potential for intensified impacts. The key visual receptors for these Sections include scattered settlement and villages at Swineshead Bridge, Hedgehog Bridge (Section C18 only) and North End (Swineshead). With careful routing it is considered that some impacts can be materially reduced however consideration of other mitigation (as described in **Paragraph 4.8.4**) may require further consideration to materially reduce the severity of potential adverse impacts for most of the identified receptors.

#### Sutterton to Weston Marsh

- 7.2.17 South-west of Sutterton where the three Corridors (the Central, Southern and Northern) meet at Section C20, the Central Corridor is near the 400 kV 4ZM overhead line. Routing in parallel to the 400 kV 4ZM overhead line is considered to limit the potential creation of a wirescape within Sections C20, C21A and C21B as this existing overhead line has similar tower heights and spans which could be matched. Routing in parallel would intensify impacts for receptors already impacted by the existing overhead line but limits the potential to create a wirescape. Within these Sections there are scattered receptors, predominantly residential, except for recreational receptors travelling along the Macmillan Way and the River Witham. The key residential receptors within these Sections include scattered settlements and, for Section C20 the villages of Sutterton Dowdyke, Burtoft, Quadring Eaudike, Dowdyke; for Sections C21A and C21B the village of Moulton Sea Ends; and for Section C21B Surfleet Seas End.

#### Ecology

- 7.2.18 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological areas where possible, and there remain few designated and important ecological areas identified within and in proximity to the Central Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified are appraised below.
- 7.2.19 The Central Corridor and associated Links are located over 3 km from the nearest NSN and Ramsar site. Section C21A is located closest, approximately 3.3 km west of The

Wash designated sites. Impacts on The Wash designated sites are predominantly limited to potential pollution pathways and functionally connected habitats and the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA (conducted in the absence of mitigation), as the Project development progresses. However, for the purposes of Options Appraisal, the Corridors and Sections located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routeing and standard construction measures, the Central Corridor is considered capable of being acceptable when considering the potential impacts on identified sites. Should the HRA identify adverse effects on the integrity of the NSN, the emerging preferences identified will be revisited.

- 7.2.20 Other relevant designated ecological sites adjacent to the Central Corridor include Bratoft Meadows SSSI which is between 1 km and 2 km from Sections C8 and C9. This SSSI may be hydrologically connected to the areas within these Sections and therefore may be adversely impacted by development. However, there is considered sufficient space to route further from the SSSI (designated for its neutral grassland habitats and supporting a wide variety of butterflies and terrestrial molluscs), by implementing careful routeing, and following the implementation of standard construction measures to minimise impacts upon the designated site.
- 7.2.21 Other important habitats identified within the Sections of the Central Corridor and its links and Links comprise priority habitats. These are located within or adjacent to all these Sections and cover half of the links (Links C8-S1-C8, C9-S3 and C9/S3-C10/S4). These habitats most commonly take the form of deciduous woodland, coastal and floodplain grazing marsh (and additional habitats) and river priority habitats. Sections C21A and C21B also contain saltmarsh, mudflats and lowland calcareous grassland priority habitat. As such, there is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the extent of the priority habitat areas within these Sections and links is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures.

### Historic Environment

- 7.2.22 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Central Corridor and its links from the Central Corridor between Burgh le Marsh and Weston Marsh. Those identified are appraised below.

#### Burgh le Marsh to Sibsey Northlands

- 7.2.23 Between Burgh le Marsh and Sibsey Northlands the only designated heritage assets located within the Sections and the Links is the Grade II listed building *Bland's Farmhouse*, located in Section C8 (see **Figure 7-9**). Due to the localised nature of these heritage assets, it is considered that direct impacts could be avoided, through careful routeing. Should this occur then impacts on the designated heritage assets are limited to affects upon their setting.
- 7.2.24 There are numerous designated heritage assets within 1 km of the Central Corridor and links, the majority of which comprise scattered Grade II listed buildings at the boundaries. There are also small clusters of other designated heritage assets located at

the villages of Burgh le Marsh, Thorpe St Peter and Stickney. Those most notable in proximity (see **Figure 7-9**) are:

- The Grade I listed churches (*Church of All Saints* and *Church of St Peter*) located approximately 300 m south of Section C9. The *Church of St Peter* is also located to the north of Link C9-S3-C10-S4 and to the east of Link C9-S3; and
- *Wainfleet Conservation Area* to the east of Link C9-S3.

7.2.25 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb buried archaeology due to an assumed greater presence. However due to the width of these Sections and Links there is sufficient flexibility to materially reduce impacts through careful routeing and the implementation of standard construction measures.

#### Frithville to Swineshead

7.2.26 Between Frithville and Swineshead there are no designated heritage assets located within the Central Corridor and its links (see **Figure 7-9**) and therefore impacts on designated heritage assets are limited to affects upon their setting.

7.2.27 There are numerous designated heritage assets within 1 km of the Central Corridor and its links, the majority of which comprise scattered Grade II listed buildings at the boundaries. There are also small clusters of other designated heritage assets located at the villages of Stickney and Hubbert's Bridge. Those most notable, (see **Figure 7-9**) in proximity are:

- *Church of St Luke* – Grade II\* Listed Building
- *Sibsey Trader Mill* – Grade I Listed Building
- *Langrick War Memorial* – Grade II Listed Building
- *Brothertoft Hall* – Grade II Listed Building
- *Hubbert's Bridge Farmhouse* – Grade II listed building
- *Barn at Elms Farm* - Grade II listed building

7.2.28 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb buried archaeology due to an assumed greater presence. However due to the width of these Sections and Links there is sufficient flexibility to materially reduce impacts through careful routeing and the implementation of standard construction measures.

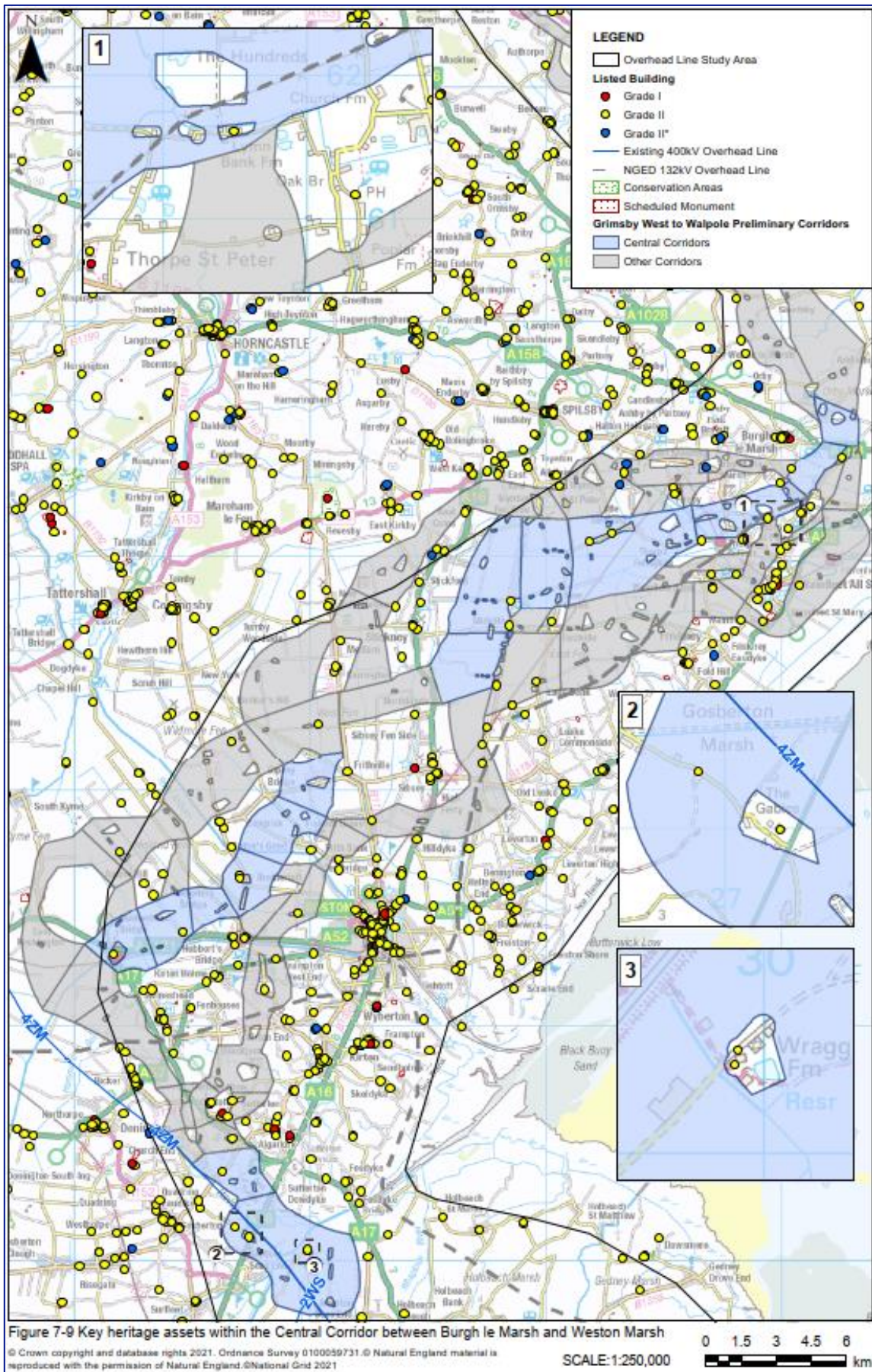
#### Sutterton to Weston Marsh

7.2.29 Between Sutterton and Weston Marsh the only designated heritage assets located within the Central Corridor and its links are Grade II listed buildings; a *Milepost South of Green Lane* (Section C20) and *Ivy House* (Section C21B), see **Figure 7-9**. Due to the localised nature of these heritage assets, it is considered that direct impacts could be avoided through careful routeing. Should this occur then impacts on designated heritage assets would be limited to affects upon their setting.

7.2.30 There are numerous designated heritage assets within 1 km of the Central Corridor and its links, the majority of which comprise scattered Grade II listed buildings at

boundaries. There are also small clusters of other designated heritage assets located at the villages of Sutterton and Wykeham. Those most notable, see **Figure 7-9** in proximity are *The Wykeham Chapel: a moated monastic grange and retreat house* Scheduled Monument and Grade I listed building *The Wykeham Chapel of St Nicholas* located approximately 350 m south-west of Section C21B.

Figure 7-9 – Key heritage assets within the Central Corridor between Burgh le Marsh and Weston Marsh



- 7.2.31 There are numerous designated heritage assets within 1 km of the Central Corridor and its links, the majority of which comprise scattered Grade II listed buildings at boundaries. There are also small clusters of other designated heritage assets located at the villages of Sutterton and Wykeham. Those most notable, see **Figure 7-9** in proximity are *The Wykeham Chapel: a moated monastic grange and retreat house* Scheduled Monument and Grade I listed building *The Wykeham Chapel of St Nicholas* located approximately 350 m south-west of Section C21B.
- 7.2.32 There is likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb buried archaeology due to an assumed greater presence. However due to the width of these Sections and Links there is sufficient flexibility to materially reduce impacts through careful routeing and the implementation of standard construction measures.

### Socio-economics

- 7.2.33 There are few socio-economic constraints located within or near the Central Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified include the Hollies Solar Park and the existing Hollies wind turbines located to the south of the solar park. These are located within Section C9.
- 7.2.34 Additionally, the Outer Dowsing offshore windfarm ('Outer Dowsing OWF') onshore cables route through Section C8 and Link C9-S3 and terminate in Sections C21A and/or C21B. However, they could be avoided in Section C8 through careful routeing.
- 7.2.35 In addition, there are numerous navigable waterways within the Overhead Line Study Area, some of which cross or are within proximity to the Sections and links. These include:
- Bell Wayer Drain navigational waterway to the north of Link C9-S3-C10-S4;
  - East Fen Catchwater Drain which crosses the north of Section C12 and is along the western boundary of Section C13;
  - Hobhole Drain which passes through Sections C13, C12 and C11;
  - The River Witham which passes through the north-west of Section C16 and through the south of Section C15;
  - Castle Dyke Drain and Newham Drain which cross Section C15;
  - Newham Drain and West Fen Drain which pass through Section C14;
  - South Forty Foot Drain / Black Sluice Navigation which passes through both Sections C19 and C18 and the south of Link C16-S8; and
  - The River Welland (Statutory Main River) which passes through Sections C21A and C21B.
- 7.2.36 Given the nature of these constraints and their distribution, predominantly at the boundaries of the Sections, implementation of careful routeing will minimise, and where possible avoid, the receptors and as such, significant adverse impacts are considered unlikely.

## Other Considerations

- 7.2.37 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.
- 7.2.38 Residential receptors are predominantly located outside the Central Corridor and its links. Within the Corridor and Links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrow nature of certain areas (the east of Sections C9 and C10, the west of Section C9 and at Link C9-S3) further careful investigation of infrastructure placement (at a later stage) would be required to avoid adverse residual impacts on residential properties immediately adjacent.
- 7.2.39 As outlined in **Chapter 5**, all of the Central Corridor is almost completely covered by areas of Flood Zone 2 and 3. All Sections and the links C9-S3 and C9/S3-C10/S4 contain field drains and all, with the exception of Sections C8, C16, C17 and C20, contain either a Statutory Main River and / or a WFD river waterbody, see **Figure 7-10**. In addition to field drains, the watercourses present within each Section or Link comprise:
- Section C8 – one IDB watercourse.
  - Link C8-S1 – Five WFD river waterbodies and one IDB watercourse.
  - Section C9 – Two statutory main rivers (River Lymm and Steeping River), five WFD river waterbodies, and three IDB watercourses.
  - Link C9-S3 - One statutory main river (River Lymm), five WFD river waterbodies, and 14 IDB watercourses.
  - Link C9/S3-C10/S4 - Five WFD river waterbodies, and 18 IDB watercourses.
  - Section C10 – One statutory main river (Steeping River), five WFD river waterbodies, and 41 IDB watercourses.
  - Section C11 – Six WFD river waterbodies, and 27 IDB watercourses.
  - Link C11/C12 – C13/S5 - Four WFD river waterbodies, and three IDB watercourses.
  - Section C12 – One statutory main river (East Fen Catchwater Drain), four WFD river waterbodies, and 27 IDB watercourses.
  - Section C13 – One statutory main river (East Fen Catchwater Drain), three WFD river waterbodies, and 21 IDB watercourses.
  - Section C14 – Two WFD river waterbodies, nine IDB watercourses.
  - Section C15 – One statutory main river (River Witham), two WFD river waterbodies, and 22 IDB watercourses.
  - Link C15/S7 – S7/C13 – Five WFD river waterbodies, and one IDB watercourse.
  - Section C16 – One statutory main river (River Witham), and two IDB watercourses.
  - Link C16-S8 – Two WFD river waterbodies, one IDB watercourse.
  - Section C17 – One IDB watercourse.



- Section C18 – One statutory main river (South Forty Foot Drain), five WFD river waterbodies, and one IDB watercourse.
- Section C19 – One statutory main river (South Forty Foot Drain), three WFD river waterbodies, and four IDB watercourses.
- Section C20 – Two IDB watercourses.
- Section C21A – One statutory main river (River Welland), five WFD river waterbodies, and one IDB watercourse.
- Section C21B – One statutory main river (River Welland), four WFD river waterbodies, and one IDB watercourse.

7.2.40 There are no constraints which are considered to have potential adverse impacts to the extent that they would significantly hinder routeing, however the extent of Flood Zones 2 and 3 coverage within the Corridor and its links means that the location of infrastructure in this area cannot be avoided and will present a constraint to construction.

### Summary

7.2.41 Most of the environmental features relevant to the Central Corridor and its Links between Burgh le Marsh and Weston Marsh are scattered. In this area those features which exert most influence on a new overhead line are:

- The proximity to residential receptors, particularly at narrower areas in Sections C9 and C10 and Link C9-S3;
- The presence of the existing 132 kV overhead line in Section C9 and the 400 kV 4ZM overhead line in Sections C20, C21A and C21B; and
- the Hollies Wind Farm and Solar Farm; and
- the settings of scattered designated heritage assets.

7.2.42 When considering receptors outside of the Central Corridor and its Links, there are scattered residential properties, recreational receptors and designated heritage assets which may be impacted visually or on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. However, most of these adverse impacts can be avoided, or reduced, through careful routeing due to the width of, and therefore flexibility within, the Central Corridor.

7.2.43 Overall, there are few significant constraints to overhead line routeing the Central Corridor.

Figure 7-10 – Distribution of statutory main rivers and WFD river waterbodies between Burgh le Marsh and Weston Marsh



## Engineering and System Factors

- 7.2.44 There are several constraints located throughout the Central Corridor that are considered likely to reduce routeing flexibility and / or increase technical complexity and constraints which would all have associated construction and delivery impacts.
- 7.2.45 Throughout the Central Corridor, there are scattered constraints including residential properties, industrial and agricultural buildings, blocks of woodland and watercourses. Almost all the Central Corridor, associated Links and vast swathes of the surrounding area are covered by Flood Zone 2 and 3 and it is therefore unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction may not be able to take place.

### Burgh le Marsh to Sibsey Northlands

- 7.2.46 The Triton Knoll underground cable ('Triton Knoll') routes along the Central Corridor which will require sufficient stand-off distances (specific stand-off distances subject to detailed engineering studies), including through multiple crossings, and may limit the position of pylons. It runs along the western edge of Section C8 and then crosses Section C9 from north-east to south-west where Hollies Solar Farm and Wind Turbines is already located within Section C9. Sufficient stand-off distances are required from Triton Knoll. Triton Knoll then continues to route through the centre of Section C10 into Sections C11 to C13.
- 7.2.47 Additionally, the Outer Dowsing OWF routes through the centre of Section C8. Sufficient stand-off distances would be required which may require use of multiple crossings. Routeing west of Darley Dale within Section C8 could avoid most, if not all, interaction.
- 7.2.48 At the north of Section C8, the A158 routes east to west across the Corridor. A perpendicular crossing of this A-road could be achieved however protection of this crossing during construction and maintenance ('crossing protection') would be required. Three NGED 33 kV overhead lines are present within Section C8, connecting into the NGED 132 kV substation; one routes along the east, one crosses the south-east corner, and another crosses at the boundary of Sections C8 and C9. The first two could be avoided with the latter requiring crossing, and therefore modification prior to construction of the Project, in Section C9 or in Section C8.
- 7.2.49 In this area Link C8-S1/S1-C8 could be used to either route east or west between Sections C8 and S1. Middle Marsh Farm, which constrains Section S1 is also partially present within this Link and reduces routeing flexibility. There are also four NGED 33 kV overhead lines within this Link, of which three transition to underground cable in the south-western corner. The fourth crosses in the south of the Link. A new overhead line could route in the south-western corner to avoid crossing these existing overhead lines, otherwise crossing all these existing overhead lines may be required. Crossings of these existing overhead lines would require modification prior to construction of the Project. A NGED 33 kV underground cable is also present in the south of the Link, however this could be avoided or be oversailed.
- 7.2.50 Moving south-west there is limited flexibility for routeing at the east of Section C9 where it narrows in multiple locations to avoid residential and commercial properties along Low Lane, Church Lane, and Croft Lane. In this area, even with careful routeing, the oversail of property curtilages may be required if not crossing the Hollies Solar Farm and Wind Park.

- 7.2.51 A NGED 132 kV overhead line crosses the south of Section C9 at Church Lane and Croft Lane. It could be avoided within the Section by routing to the north. As mentioned in **Paragraph 7.2.48**, a NGED 33 kV overhead line is present along the boundary of Sections C8 and C9 and would require crossing in this Section or in Section C8 and requires modification prior to construction of the Project.
- 7.2.52 An opportunity to utilise the existing route of the NGED 132 kV overhead line for the Project has been considered, however it was not taken forward due to the presence of properties and other constraints directly adjacent the existing overhead line route leaving little flexibility for routing a new parallel 400 kV overhead line. There are approximately 16 properties within 100 m of the existing NGED 132 kV overhead line (five of which are directly oversailed by this line). It is likely that these properties may be directly oversailed by a new 400 kV overhead line route. As explained in **Chapter 5**, oversailing of properties is not the preferred approach. The increased construction cost and technical difficulty which results from the deconstruction and realignment of the NGED 132 kV overhead line and utilisation of its heavily constrained route, negates any benefits from a technical perspective.
- 7.2.53 Within Sections C9 and C10 are the Poacher Railway line and the Steeping River both of which would require crossing. Perpendicular crossings of both are feasible but crossing protection would be required. The Steeping River, its tributaries and drains within Section C9 and at the boundary of Section C10 would limit routing flexibility.
- 7.2.54 An alternative is considered here to connect Section C9 to Section S3 (via Link C9-S3) or an alternative route to connect Section C9 to C19 (via Links C9-S3 and C9/S3 – C10/S4). Link C9-S3 is a large Link crossed by the Wainfleet Relief Channel, Poacher Railway line and Wainfleet Haven. All these features can be crossed perpendicularly (requiring crossing protection) but their combined presence restricts routing flexibility and would increase the complexity of access for construction and maintenance. A NGED 33 kV overhead line also crosses the Link from north-east to south-west and would require modification prior to construction of the Project.
- 7.2.55 To reach Link C9/S3 – C10/S4, an alternative route is required through Link C9-S3 and therefore most of complexities within Link C9-S3 would be encountered before reaching Link C9/S3 – C10/S4. Those features within Link C9/S3 – C10/S4 are the Poacher Railway line, the Steeping River, two NGED 33 kV overhead lines, and areas of peaty soils. All these features cross the Link at an oblique angle and additional angle pylons would be required to facilitate perpendicular crossings. The existing overhead lines would both require modification prior to construction of the Project. Areas of peaty soils (implications of routing within peaty soils are described below) are present in the west of the Link; however, these could be avoided through careful routing.
- 7.2.56 Peaty soils are unavoidable within Sections C10 to C13 and Link C11-C12/C13/S5 as they cover almost the entire area of these Sections and links to the west of Steeping River. Routing within peaty soils can result in ground subsidence and waterlogging, which will need to be factored into specific foundation designs, such as piled foundations. Geotechnical investigations will be required to determine ground conditions and to inform foundation and access designs. Access across peaty soils may require additional designs (such as those outlined above) if superficial deposits are weak. If present reinstatement would be required following construction to ensure the peat is returned to its previous health.
- 7.2.57 Sections C11 and C12 provide good flexibility for routing following consideration of scattered constraints comprising residential properties, farmsteads, and drains. Bell Water Drain at the south of Section C11 could be avoided, however Hobhole Drain,

which is between Sections C11 and C12, and Fodder Dike Bank, within Section C12, will require crossing. Perpendicular crossing of these drains could be achieved without the need for additional angle pylons. However, these drains are navigable and as such require crossing protection.

- 7.2.58 An alternative connection between Sections C11 and C12 or C13 or S5 is present in this area, Link C11-C12/C13/S5. Within this Link are peaty soils are present (as described in **Paragraph 7.2.56**) and Triton Knoll runs through the Link's north-western extent. Sufficient stand-off distance would be required from Triton Knoll, and it could be avoided if routeing to the east of the Link, however it does constrain a potential route into Section C12.
- 7.2.59 A NGED33 kV overhead line crosses Sections C12 and C13 and would therefore likely require modification prior to construction of the Project. Continuing into Section C13, Hobhole Drain is present which can be avoided but would require additional angle pylons to facilitate a perpendicular crossing.

#### Frithville to Swineshead

- 7.2.60 South and west of Frithville, Triton Knoll continues to route along the Central Corridor through Sections C14 to C19 and will constrain routeing flexibility within these Sections where crossings or parallel routes may be required.
- 7.2.61 The River Witham (a navigable waterway) is present within Section C15 and will require crossing. In addition, a NGED 33 kV overhead line crosses Section C15 and would require modification prior to construction of the Project. An alternative connection from Section C15 to Section S7 is available in this area (Link C15-S7/S7-C15), this Link is relatively unconstrained and provides good routeing flexibility.
- 7.2.62 At the north of Section C16 routeing flexibility is reduced due to the presence of multiple properties either side of the B1192. To avoid oversailing the curtilages of these properties, additional angle pylons may be required. Continuing into Section C17, residential properties are present but are scattered and could be avoided with careful routeing.
- 7.2.63 Within Section C18, constraints include Clay Dike, scattered residential properties, the Poacher Railway line and South Forty Foot Drain. In addition, a commercial property (Fountain Plants) is located at the south of this Section restricting routeing flexibility. The crossing of Clay Dike would be required in this Section, and crossings of the Poacher Railway line and South Forty Foot Drain would also be required in this Section or Section C19. In Section C19, the Poacher Railway line and South Forty Foot Drain are paralleled by the A1121 and A17. The crossings of the Poacher Railway line and South Forty Foot Drain would require additional angle pylons or more extensive crossing protection.
- 7.2.64 Within Section C19 routeing flexibility is additionally reduced along the A17 to the north of Swineshead due to the presence of residential properties, Triton Knoll and Viking Link Interconnector. This would likely require additional angle pylons and add complexity to the construction and delivery of the Project.

#### Sutterton to Weston Marsh

- 7.2.65 Within Section C20, routeing should be considerate of scattered constraints including farm complexes, residential buildings, a listed building, minor drains and a gas valve compound site. Routeing will also need to be mindful of the approved planning

application for a commercial warehouse facility (B/22/0401) at its eastern boundary. The Hatton to Gosberton gas pipeline is also present within the Section and may require crossing, with sufficient standoff distances applied, with additional angle pylons to facilitate perpendicular crossings and detailed cathodic protection studies (if routeing in parallel to the gas pipeline).

- 7.2.66 Constraints within Section C21A including farm complexes, scattered residential properties and woodland blocks. The Gosberton to Tydd St. Giles gas pipeline routes through the corridor, however this asset can likely be avoided. Nevertheless, appropriate standoff distances are to be implemented and cathodic protection studies may be required in close proximity to the pipeline. Additionally, crossings of the River Welland and A16 road would also be required, necessitating additional angle pylons and crossing protection. The 4ZM 400 kV overhead line is also located on the western boundary of this Section. Finally, routeing in Section C21B would need to be cognisant of scattered residential properties, a holiday park, and a historic landfill site. As with Section C21A, crossings of the River Welland and A16 road would be required, necessitating additional angle pylons and crossing protection. The Surfleet Bank Historic Landfill Site constrains routeing between the A16 crossing and a large farm complex. Due to constraining residential properties to the north, it is likely this site will have to be crossed. Whilst the site itself can likely be spanned, the flexibility for the routeing of an overhead line in the area is reduced further due to residential properties located to the east. Crossing of the 4ZM 400 kV overhead line is required in this Section increasing technical complexity.

### Summary

- 7.2.67 Overall, there is a sufficient flexibility for routeing within the Central Corridor. Constraints present which influence routeing comprise scattered residential properties, woodland, watercourses, existing underground infrastructure, overhead lines and the road and rail network. Peaty soils and Flood Zones 2 and 3 are also notable constraints throughout the Corridor as these areas are unavoidable and may have implications for design and construction.

### Holford Rules

- 7.2.68 The Central Corridor and its links have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 7.2.69 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded for the Central Corridor and its Links. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its Links comprise listed buildings and conservation areas. Where there are smaller areas of high amenity value, sufficient space has been included within the Corridor and its Links to enable routeing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 7.2.70 The Central Corridor follows a largely direct route, in line with **Holford Rule 3**, between Burgh le Marsh and Weston Marsh, routeing south-west. However, by routeing into Sections C11 and C12 a marginally less direct route is taken. Routeing through Sections C17, C18 and C19 from Section C16 is marginally a less direct route is followed. Using Links from the Central Corridor would result in a direction change from a main corridor and may result in the increased use of angle pylons. The use of Links C9/S3, C11-C12/C13/S5 and C16-S6 may result in a more direct route compared to the

main corridor. The use of Link C9-S3 to Link C9/S3-C10/S4 would add further direction changes and result in a considerably less direct route.

- 7.2.71 The Central Corridor and its Links were developed to avoid highly constrained areas, and specific constraints including settlements such as Burgh le Marsh, Croft, New Leake, Keal Cotes, Stickford, Stickney and Boston (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in each area, with narrow sections because of specifically excluded areas where constraints are present within Sections C9 and C10 and at Swineshead Bridge in Section C19, and wide sections where the space is unconstrained.
- 7.2.72 The Central Corridor, particularly Sections C10 to C13, C21A and C21B, includes more land than is needed for the construction of an overhead line which provides flexibility and optionality when undertaking more detailed routeing, following consultation feedback, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 7.2.73 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 7.2.74 The Central Corridor may not require the crossing of existing 132 kV or 400 kV overhead lines (**Holford Rule 6**) unless Section C21B or the Link C9/S3-C10/S4 are taken forward. Should this Section or this Link be taken forward it is likely that adverse landscape and visual impacts may be experienced. In addition, there is the potential for a wirescape to be created if an overhead line routes near NGED 132 kV overhead lines within Links C9-S3, C9/S3-C10/S4 and Sections C9, C10, C18 and C19. Unless properly mitigated this is likely to result in intensified adverse landscape and visual impacts.
- 7.2.75 No industrial zones exist within the Central Corridor and therefore **Holford Rule 7** is not considered applicable.

## Conclusion

- 7.2.76 The Central Corridor follows a mostly direct route and routeing flexibility is considerable due to scattered environmental features and the size of the Central Corridor and Links. Those Sections most likely to be constrained are Sections C9 and C10 and Links C9-S3, C9/S3-C10/S4 due to the presence of narrower areas and the potential for cumulative impacts with existing above ground infrastructure. Technical constraints are scattered except for the linear features, such as the presence of existing gas pipelines, overhead lines and the transport network, especially within Section C19 which will limit routeing flexibility. Unavoidable Flood Zones 2 and 3, and peaty soils within Sections C10 to C13, present a notable constraint to routeing and would have implications for design and construction. It is noted however that Flood Zones 2 and 3 are present across almost all the overhead line Corridors between Burgh le Marsh and Weston Marsh and in the wider area.
- 7.2.77 A tabulated summary of the appraisal of the Central Corridor (between Burgh le Marsh and Weston Marsh) is provided in **Table 7-1**.

Table 7-1 Summary of Central Corridor Options Appraisal between Burgh le Marsh and Weston Marsh

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• The sensitivity of the local landscape within the corridor is reduced in places due to the presence of existing above ground electrical infrastructure.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of scattered caravan parks, Steeping River, River Witham, the NCN Route 1, and the Macmillan Way.</li> <li>• Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• There is potential for the Central Corridor to have functionally connected habitats and pollution pathways to The Wash designated sites.</li> <li>• Coastal and floodplain grazing marsh, deciduous woodland, river habitat, saltmarsh, mudflats and lowland calcareous grassland priority habitats are within and adjacent to the Central Corridor.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Several listed buildings and scheduled monuments are scattered within or adjacent to the Corridor and its Links. Most of these can be avoided with careful routeing, however, impacts on setting are likely to arise should the overhead line be developed where the Corridor is closest to these heritage assets.</li> </ul>
	Socio-economics	<ul style="list-style-type: none"> <li>• The Hollies Solar Park – Skegness extension and existing Hollies wind turbines are located within Section C9.</li> <li>• Numerous navigable waterways fall within or are crossed by the overhead line Corridor.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>• Almost all the Central Corridor is covered by Flood Zones 2 and 3 which presents a constraint. Almost all the Corridor Sections contain field drains and either a Statutory Main River, WFD river waterbody, or IDB watercourses.</li> </ul>

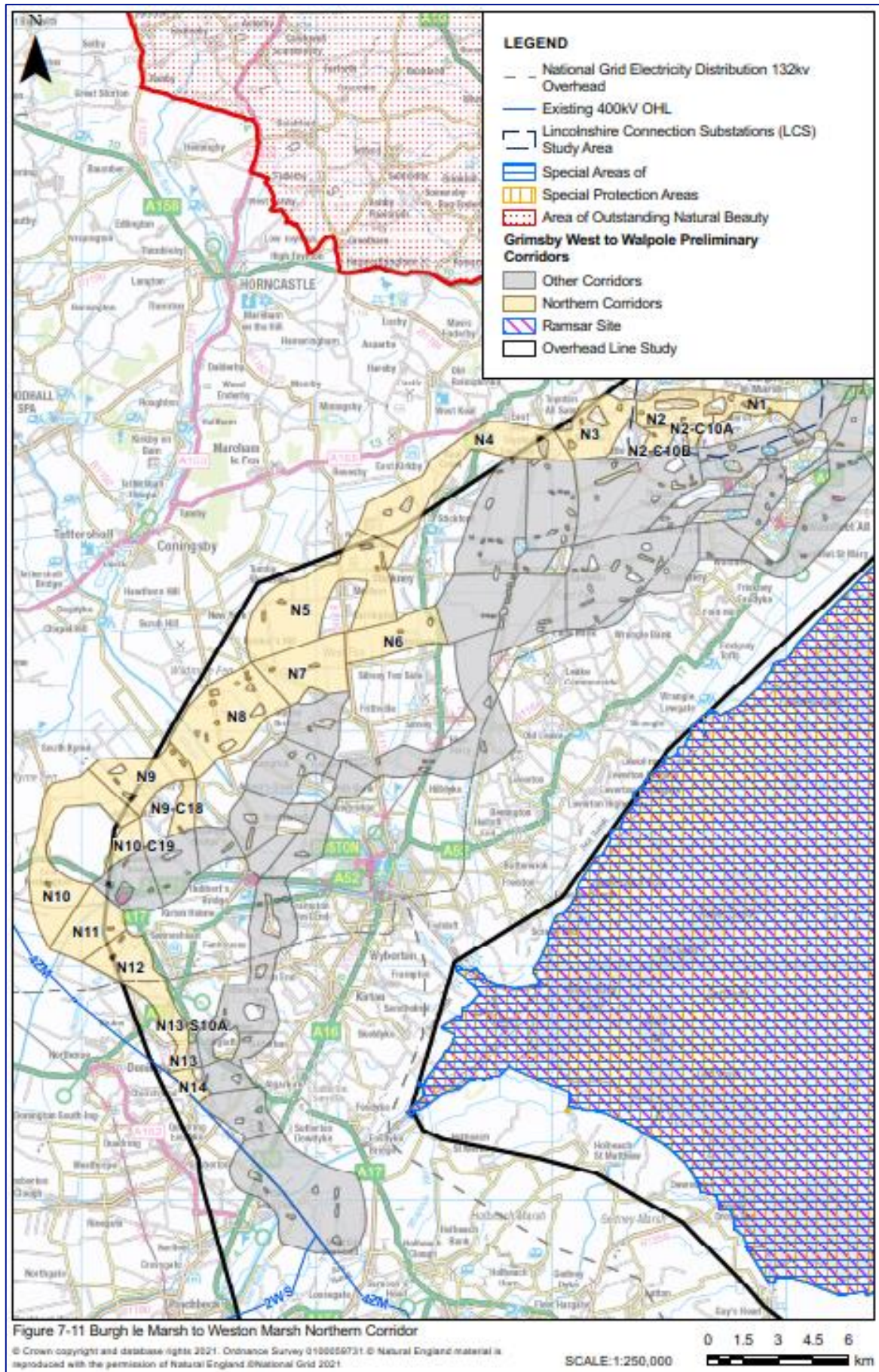


Theme	Topic	Summary
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• Three NGED 33 kV overhead lines are present in the northern most section of the Corridor and there may be a requirement to mitigate these, such as through their removal or undergrounding, to ensure there is sufficient space for the proposed new overhead line.</li> <li>• A Link to the Southern Corridor at the northern end of the Central Corridor contains four NGED 33 kV overhead lines which transition to underground cables presenting an opportunity for a crossing without needing to cross the overhead lines.</li> <li>• A NGED 132 kV overhead line is present at Church Lane and Croft Lane (Section C9) which presents an opportunity for utilising the existing overhead line route for the new 400 kV overhead line and removing the existing one. Within this area is a NGED 33 kV overhead line which would need to be crossed and may need to be modified prior to construction of the Project.</li> <li>• Should the Links C9-S3 or C9/S3-C10/S4 be utilised, existing NGED 132 kV and 33 kV overhead lines would need to be modified prior to construction.</li> <li>• NGED 33 kV overhead lines are present within C12, C13 and C15 which would all require modification prior to construction of the project.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• Triton Knoll routes along the Central Corridor and will require sufficient stand-off distances and may limit the position of pylons.</li> <li>• Peaty soils are present within the central region of the Central Corridor which may pose a risk to pylon foundations through ground subsidence and waterlogging. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings, such as of the Poacher Railway line, Wainfleet Relief Channel, Wainfleet Haven and Steeping River.</li> <li>• Infrastructure will be required within Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>

## Northern Corridor Sections (Sections N1 to N14)

- 7.2.78 The Northern Corridor (Sections prefixed with 'N') (see **Figure 7-11**) starts south of Burgh le Marsh and to the west of the Central Corridor (Section C8). The Corridor routes west towards, and around, Irby in the Marsh and residential areas along the B1195 before crossing the Steeping River to the south of Great Steeping. At this point (Section N3) the Corridor routes south-west to the west of Little Steeping before routing west, south of Toynton St Peter. The Northern Corridor then continues west (in Section N4) crossing the A16 north of Keal Cotes before continuing south-west parallel to the A16, avoiding the villages of Keal Cotes, Stickford and Stickney, and crossing the West Fen Catchment Drain to the north-west of Stickney.
- 7.2.79 It is noted that Section N4 routes outside the Overhead Line Study Area (developed at Step 1). This occurs as during the corridor identification and development (Steps 4, 5 and 6) it was identified that the East Kirby Airstrip and the residential area of West Keal did not extend as far as previously identified. Therefore, it was considered that the Corridor could extend further than previously anticipated.
- 7.2.80 West of Stickney and south of New Bolingbroke, in Section N5, the Northern Corridor splits into legs to the east and west to avoid Carrington and Medlam. The eastern leg connects into Section N6 which routes west from the Central Corridor (and A16) south of Stickney and continues to the B1183. The western leg connects into Section N7 which continues west from Section N6 to the west of the B1183.
- 7.2.81 From Section N7 the Northern Corridor routes west, crossing the B1192 and River Witham north-west of Langrick before looping around to avoid the proposed Heckington Fen Solar Farm NSIP and to avoid a scheduled monument (*Settlement site 650yds (600 m) East of Holme House*). It is noted that in avoiding the Heckington Fen Solar Farm NSIP Section N10 routes outside the Overhead Line Study Area.
- 7.2.82 The Northern Corridor then crosses the Poacher Railway line and South Forty Foot Drain west of Swineshead Bridge (in Section N11). From here the Northern Corridor routes south-east towards Swineshead, crossing the A17 between Swineshead and Bicker, before continuing south to cross the B1181. Once across the B1181, the Northern Corridor routes south-east, parallel to the 4ZM 400 kV overhead line and connecting to the Central Corridor at Section C20.
- 7.2.83 In addition to the Northern Corridor itself, there are five links between the Northern and Central Corridor. These links have been provided where it would be possible to avoid constraints or pinch points associated with a particular Section by transferring from one corridor or section to another and are as follows:
- Link N2-C10A, which connects the Northern and Central Corridors to the south-east of Firsby.
  - Link N2-C10B, which connects the Northern and Central Corridors to the south-west of Firsby.
  - Link N9-C18, which connects the Northern and Central Corridors to the east of Amber Hill.
  - Link N10-C19, which connects the Northern and Central Corridors to the east of East Heckington.
  - Link N13-S10A, which connects the Northern and Southern Corridors at Hoffleet Stow.

Figure 7-11 Burgh le Marsh to Weston Marsh Northern Corridor



## Environmental Factors

### Landscape and Visual

- 7.2.84 The Northern Corridor and its Links passes through two different NCAs; Sections N1 and N2 are located within NCA 42 which is characterised by a wide coastal plain which extends from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. Sections N3 and N4 are located at the transition between NCA 42 and NCA 46 The Fens, Sections N5 to N14 are located within NCA 46 which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The characteristics of the different NCAs are similar and therefore not considered to materially affect the potential impacts of an overhead line in the different Sections of the Corridor.
- 7.2.85 The Northern Corridor and its Links (continuing from Section C8) between Burgh le Marsh and Weston Marsh are located within an open landscape. The open landscape has a level topography that therefore offers considerable routeing flexibility, subject to individual constraints and receptors located within and surrounding specific Sections and Links. The scattered pattern of development, wide corridors, open landscape, and scattered nature of receptors is such that routeing should seek a more direct line where feasible. This will considerably reduce the potential for landscape impacts, especially angle pylons or larger pylons for crossing rivers or infrastructure. The use of any Links may require additional angle pylons, increasing the potential for landscape and visual impacts. Across the Northern Corridor, significant adverse impacts upon some individual receptors are unavoidable but can be reduced through careful routeing. However, the narrow nature of many Sections within the Northern Corridor means that there are areas where these are unlikely to be reduced through careful routeing.

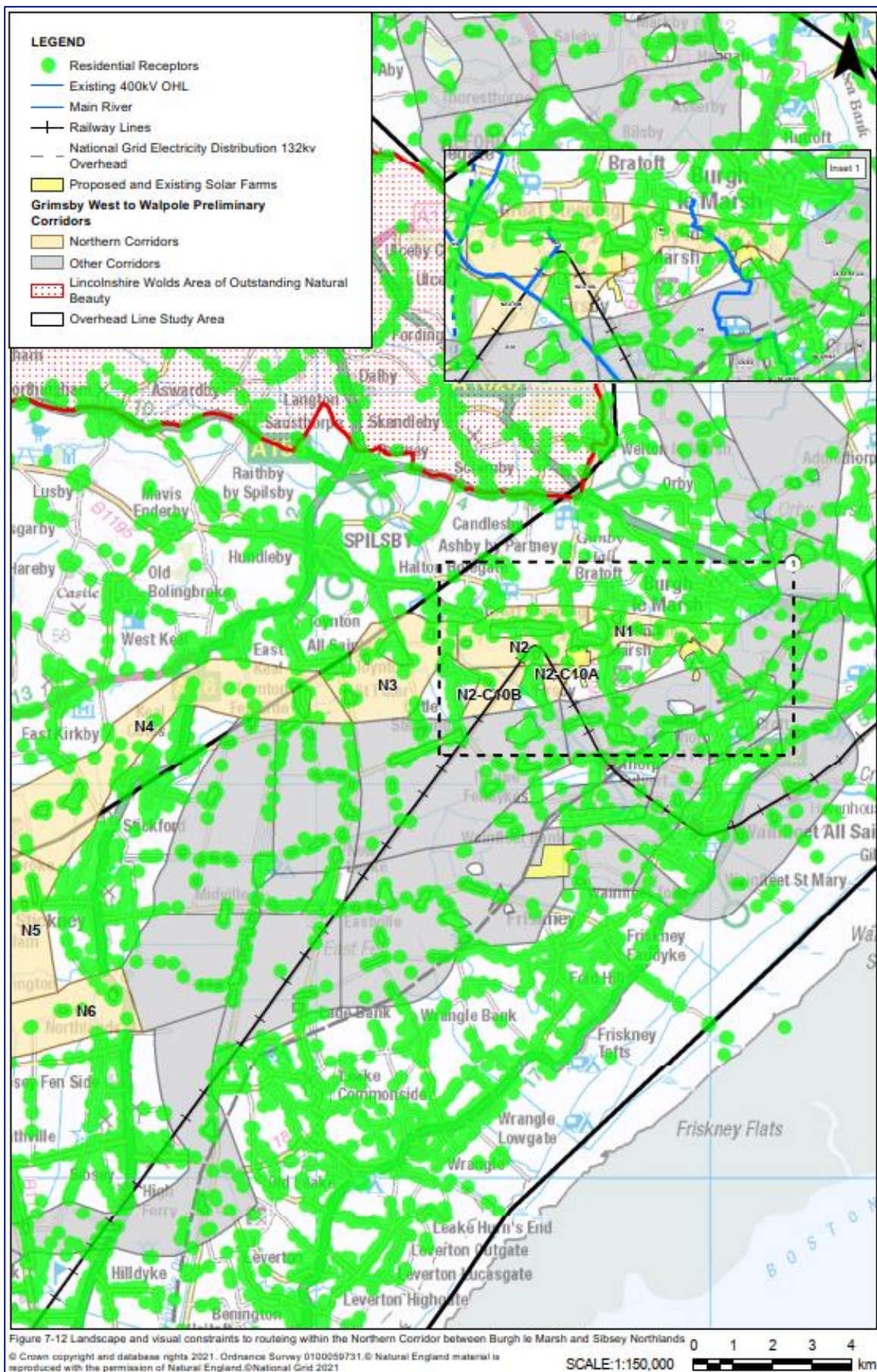
#### Burgh le Marsh to Toynton St Peter

- 7.2.86 The AONB is located approximately 2.8 km north of the Northern Corridor at its closest point in Sections N1 and N2. The AONB is split into four LCAs, the Ridges & valleys of the south-west LCA is of relevance to the Northern corridor. The Ridges & valleys of the south-west LCA (north of Gunby to east of Horncastle and south of Ludford), key features include:
- *“Dramatic views south Bluestone Heath Road and Nab Hill – Hoe Hill ridge”* – enables wide open views of the landscape.
  - *“Mixed pattern of arable and pastoral farming”* – typical features of a rural landscape evident in views.
  - *“Old mixed hedgerows” and “Herb rich roadside verges”* – provides an opportunity to improve the connectivity of green infrastructure assets as part the mitigation.
- 7.2.87 A new overhead line within Section N1 would not be considered incongruous in the context of the valued landscape of the AONB as it would be seen in the context of the urban fringes of Burgh le Marsh, distant wind turbines and a NGED 132 kV overhead line. However, as the overhead line routes into Section N2 it routes into an area of less dense settlement pattern with fewer existing above ground infrastructure. Here a new overhead line could be incongruous, especially to the north of Section N2. Routeing south within Section N2 or using Links N2-C10A and N2-C10B will increase the distance from the AONB (by between 1 km and 1.5 km), will route closer to existing above ground infrastructure and reduce the potential for significant adverse effects on

its setting and views. Should routeing north of Section N2 be required, other mitigation (as described in **Paragraph 4.8.4**, such as consideration of low height pylons) may be required. As the Corridor and its Links continue towards Weston Marsh the distance from the AONB increases and the potential for adverse impacts upon its setting and views reduces.

- 7.2.88 Starting south of Burgh le Marsh, Sections N1 and N2 are comparatively narrower than many other Sections. This is due to the denser pattern of settlement at Burgh le Marsh, Irby in the Marsh, Bratoft, Great Steeping and Little Steeping, the Kelsey Wood Country Park (Section N2), and the presence of the Hollies Solar Park and the Heath Meadows Nature Reserve (which includes Bratoft Meadows SSSI) (see **Figure 7-12**). The narrowness of these Sections reduces routeing flexibility; especially around Irby in the Marsh (both Sections N1 and N2), the Heath Meadows Nature Reserve (Section N1) and Great Steeping (Section N2). Routeing flexibility here is further reduced by the presence of woodland belts. The presence of the Hollies Solar Park to the south of Section N1 limits routeing flexibility and a new overhead line here is likely to intensify landscape and visual impacts.
- 7.2.89 In addition to the residential areas and recreational areas listed above, key visual receptors include the users of local cycle routes (one crosses Section N1, and one is immediately west of Section N2). Larger structures, and potentially multiple angle pylons, would be required to cross the Steeping River and the Poacher Railway Line which require crossing in either Section N2 or Section N3 or Links N2-C10A and N2-C10B. These crossings may result in widespread impacts, and an intensification of impacts at receptors in proximity. In Sections N1, N2 and as the Northern Corridor routes into Section N3, even with careful routeing the proximity of a larger number of visual receptors and limited routeing flexibility would mean potentially significant adverse visual effects on many of the identified receptors. Therefore, the consideration of other mitigation measures should be considered to materially reduce the severity of potential adverse impacts.
- 7.2.90 Once past the Steeping River within Section N3 the Corridor widens and the density of settlement begins to lessen increasing routeing flexibility. Here the key visual receptors consist of residential and recreational receptors. The residential receptors include scattered residential properties and the villages of Halton Fenside, Toynton St Peter, Halton Holdgate and Little Steeping, and the key recreational receptor is users along a local cycle route. A new overhead line has the potential to result in significant adverse impacts on visual amenity for these receptors, although with careful routeing it is considered that the number and severity of impacts can be materially reduced.

Figure 7-12 – Landscape and visual constraints to routing within the Northern Corridor between Burgh le Marsh and Sibsey Northlands



7.2.91 Once past the Steeping River within Section N3 the Corridor widens and the density of settlement begins to lessen increasing routeing flexibility. Here the key visual receptors consist of residential and recreational receptors. The residential receptors include scattered residential properties and the villages of Halton Fenside, Toynton St Peter, Halton Holdgate and Little Steeping, and the key recreational receptor is users along a local cycle route. A new overhead line has the potential to adversely impact visual amenity for these receptors, although with careful routeing it is considered that most impacts can be materially reduced.

#### Toynton St Peter to Howbridge Drain

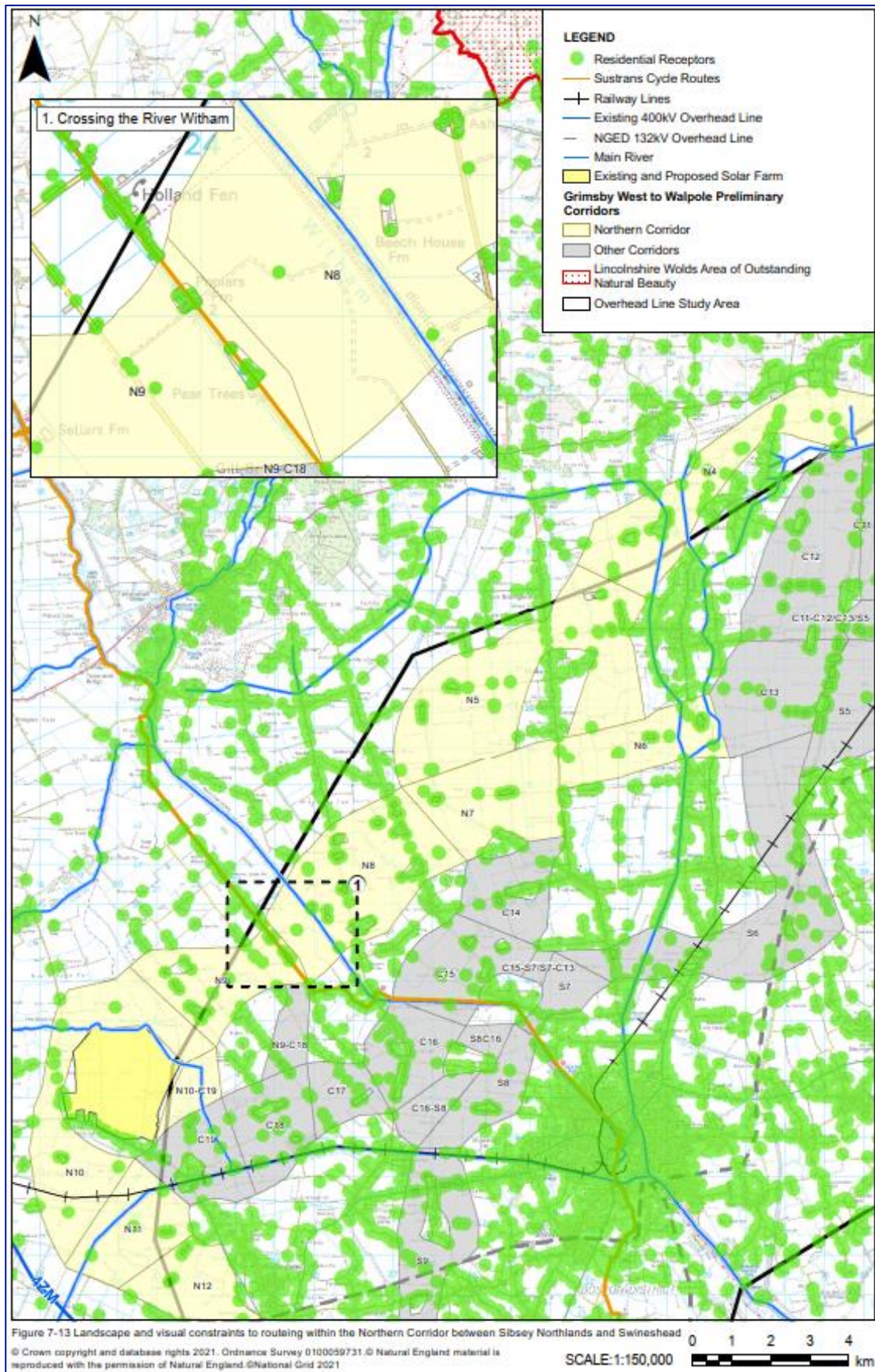
7.2.92 Continuing west from Toynton St Peter into Section N4, the Corridor narrows towards West Keal then widens again. The land rises towards East Keal and West Keal (see **Figure 7-13**) such that there is a potential risk of pylons being present within skyline views. Routeing to the south of the Section would potentially reduce more widespread impacts by seeking to reduce the exposure of pylons on prominent ridges and skylines (Holford Rule 5). Given the narrowness of the Section, the extent to which this may be reduced is limited. The key visual receptors within Sections N4 to N5 consist of residential and recreational receptors. The residential receptors include scattered residential properties and the villages of Toynton St Peter, East Keal, West Keal, Toynton Fen Side, Toynton St. Peter, Keal Cotes, Stickford, Fen Side, Stickney, New Bolingbroke, Medlam and Carrington. The key recreational receptors include users of Hagnaby Fen Nature Reserve (Section N4) and of ARK wildlife park and exotic animal sanctuary (Section N5). With the exception the narrow area in Section N4, potential adverse impacts upon visual amenity could be materially reduced with careful routeing. At the narrower area near West Keal, other mitigation may need to be considered.

7.2.93 Either side of the village of Carrington, Section N5 splits. The eastern leg connects to Section N6 and the western leg connections to Section N7. These areas are large and open with few receptors, offering considerable routeing flexibility. Key visual receptors here include scattered residential properties, the village of Carrington, the villages of Northlands (Section N6), Sibsey Fen (Section N6), Harkerley Bridge (Section N7) and Frithville (Section N7), and recreational receptors such as the users of the A16 (Section N6) and the Bridge Farm Caravan Park (Section N6). A new overhead line has the potential to adversely impact the visual amenity for these receptors, although with careful routeing it is considered that most impacts can be materially reduced.

#### Howbridge Drain to Quadring Eaudike

7.2.94 Continuing west across Howbridge Drain, West Fen Drain and Newham Drain the Corridor routes into Sections N8 and N9 or an alternative connection to the Central Corridor via Link N9-C18. Here the landscape continues to be open and level with small blocks of woodland present offering routeing flexibility. However, an increase in the density of linear settlement along roads and drains means routeing is constrained in certain areas. Key residential receptors include the villages of Newham, Langrick, Holland Fen, Sutterton Bridge and Amber Hill. Key recreational receptors comprise users of NCN Route 1, which routes along the boundaries of Section N8 and N9 and those of the River Witham that crosses Section N8 (see **Figure 7-13**). Link N9-C18, is generally remote from visual receptors. A new overhead line has the potential to result in significant adverse impacts to visual amenity for these receptors, although with careful routeing (at a later stage) it is considered that the number and severity of impacts could be materially reduced.

Figure 7-13 - Landscape and visual constraints to routing within the Northern Corridor between Sibsey Northlands and Swineshead



7.2.95 Continuing west, Section N10 starts wide, offering considerable routing flexibility, and then narrows considerably to avoid the proposed Heckington Fen Solar Farm NSIP



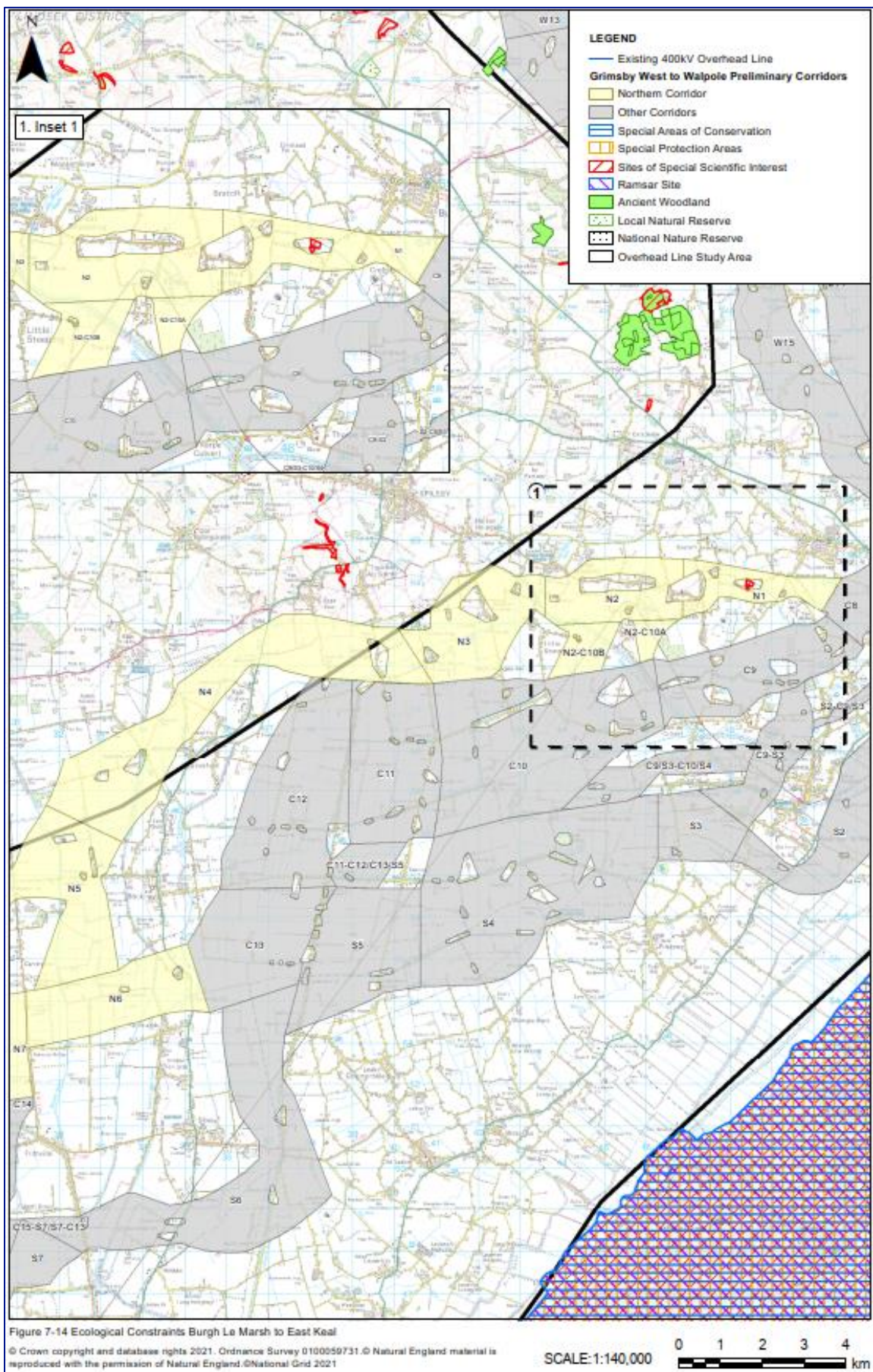
application (currently at examination stage) and linear settlement at East Heckington and along the A17. It then widens again as it routes south towards the Poacher Railway line, East Fen Drain and the 400 kV 4ZM overhead line. An alternative route is offered by Link N10-C19 which is generally remote from scattered residential receptors offering considerable routeing flexibility. The presence of the existing electrical infrastructure means that the landscape here is less sensitive to impacts of new infrastructure, but without careful routeing a new overhead line may intensify impacts and potentially create a wirescape. A new overhead line in either Section N10 or Link N10-C19 has the potential to result in significant adverse impacts to visual amenity for these receptors, although with careful routeing (at a later stage) it is considered that the number and severity of impacts could be materially reduced.

- 7.2.96 Within Sections N11 to N13 and the Link N13-S10A there are few residential areas which predominantly comprise scattered settlements. However, villages flank these Sections to the east and west such as Swineshead, Bicker, Swineshead Bridge, Drayton, Bicker Gauntlet, Bicker Bar, Donnington Eaudike, and Hoffleet Stow. These Sections route parallel to, and in proximity to, the 400 kV 4ZM overhead line as it routes in and out of Bicker Fen Substation and adjacent to Triton Knoll Wind Farm and substation. In addition to this existing electrical infrastructure, a NGED 132 kV overhead line routes between Boston and the Bicker Fen substation across Section N12. The presence of this electrical infrastructure means that the landscape here is less sensitive to impacts of new infrastructure. However, the presence of this infrastructure alongside a new overhead line would likely intensify impacts and without careful routeing and the modification of the NGED 132 kV overhead line would create a wirescape and encircle residential areas such as Bicker. Implementing careful routeing and modification of the NGED 132 kV overhead line would reduce the scale of impacts, however such mitigation would require further consideration at a later stage. The use of low height pylons in this area is unlikely to limit impacts and may even create a wirescape due to different pylon heights and span lengths than those of the 400 kV 4ZM overhead line.
- 7.2.97 As the Northern Corridor nears Weston Marsh within Section N14 it routes closer to the 400 kV 4ZM overhead line. Here key receptors include scattered residential properties and those using the Cross Britain Way. The alignment of the Section to the 400 kV 4ZM overhead line offers the opportunity (due to similar pylon heights and span lengths) to closely parallel the 4ZM 400 kV overhead line which would potentially reduce landscape and visual impacts of a new overhead line. Should this not be achievable, a new overhead line would further intensify landscape and visual impacts and may result in the creation of a wirescape.

## Ecology

- 7.2.98 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological areas where possible, and there remain few designated and important ecological areas identified within and in proximity to the Northern Corridor and its Links between Grimsby West and Burgh le Marsh. Those identified are appraised below and shown in **Figure - 14**.

Figure 7-14 – Ecological Constraints in the Northern Corridor Between Burgh Le Marsh and East Keal



7.2.99 The North Corridor is located over 6 km from the nearest NSN and Ramsar site, with Section N1 located closest, approximately 6.5 km north of The Wash designated sites. Due to this distance, impacts are limited to functionally connected habitats, and the risk of collision, flight path disruption, injury and mortality, for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA, as the Project development progresses. However, for the purposes of Options Appraisal, the corridors, sections and links located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routeing and standard construction measures the Northern Corridor and its Links is considered capable of being acceptable.

7.2.100 Within 2 km of the Northern Corridor are the following SSSIs:

- Bratoft Meadows SSSI, an area designated for the neutral grassland habitats which it contains, and the butterflies and terrestrial molluscs. Located in an area specifically excluded from Section N1 and approximately 1.5 km from Link N2-C10A.
- Jenkins Carr SSSI, a species rich example of alder carr, a habitat now rare in the area, with stream and swamp communities. Located approximately 850 m north of Section N4.

7.2.101 Areas within these Sections may be hydrologically connected to these SSSIs and therefore may adversely impact the SSSI via pollution pathways. In addition, the proximity of Section N1 to the Bratoft Meadows SSSI may result in disturbance to the species within the SSSI during construction. The SSSI may also provide habitat supporting birds such as those protected under the NSN and Ramsar sites identified above. For Jenkins Carr SSSI, there is considered sufficient space to route further east, implementing careful routeing, and following implementation of standard construction measures to reduce the potential for adverse impacts upon the site. For Bratoft Meadows SSSI, careful routeing and the implementation of standard construction measures will reduce the potential for and scale of impacts, however within Section N1 a SSSI assent may be required.

7.2.102 Other important habitats identified within the Sections of the Northern Corridor and its Links comprise priority habitats. Priority habitats fall within all the Sections (except for Sections N13 and N14) and within Links N10-C19 and N2-C10A. Coastal and floodplain grazing marsh priority habitat is particularly abundant and is present within Sections N1 to N12. Deciduous woodland priority habitat is also abundant and only absent from Sections N6, N12, N13 and N14. River priority habitat becomes more frequent further south and west and is present within Section N5, N7 and N8 on approach to the River Witham. As such, there is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access route formation (direct impacts). However, the extent of the priority habitat areas within these Sections is such that potentially adverse impacts could be avoided and materially reduced through careful routeing, oversailing and implementation of standard construction measures.

### Historic Environment

7.2.103 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Northern Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified are appraised below.

## Burgh le Marsh to Toynton St Peter

7.2.104 Between Burgh le Marsh and Toynton St Peter the only designated heritage assets located within the Northern Corridor and its Links are within Section N3 (see **Figure 7-15**). These comprise the *Churchyard cross*, *St Andrew's churchyard Scheduled Monument*, *Churchyard cross*, *Old Church scheduled monument*, *Church of St Andrew Grade II\** listed building and *Church of All Saints Grade II\** listed building. Due to the distribution of these heritage assets, it is considered that direct impacts could be avoided through careful routeing. As such, it is considered that potential impacts on designated heritage assets will be limited to affects upon their setting only.

7.2.105 Between Burgh le Marsh to Toynton St Peter, there are numerous designated heritage assets within 1 km of the Corridor and its Links (see **Figure 7-15**). Most are scattered Grade II listed buildings at the edge of the Corridor and its links. There are also small clusters of other designated heritage assets located at the villages of Burgh le Marsh, Great Steeping, Little Steeping and Irby in the Marsh. Those most notable are:

- The Grade II\* listed building, *Church of All Saints* located at Irby in the Marsh in an area specifically excluded between Sections N1 and N2;
- Grade II\* listed building, *The Cottage* located adjacent to Section N3;
- Scheduled monument the *Churchyard Cross In Churchyard Of Church Of St Peter* located approximately 480 m west of Section N3 (also within Section N2); and
- Grade II\* listed building, *Church of St Helen* located approximately 250 m east of Section N4.

7.2.106 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb buried archaeology due to an assumed greater presence. The width of these Sections and Links allows for sufficient flexibility to materially reduce adverse impacts through careful routeing and the implementation of standard construction measures. However, in Section N3 the crossing of the River Steeping and the presence of designated heritage assets adjacent to the river may mean that impacts upon setting may not be reduced to an acceptable level with careful routeing and standard construction measures alone and other mitigation should be considered.

## Toynton St Peter to Howbridge Drain

7.2.107 Between Toynton St Peter and Howbridge Drain the only designated heritage asset located within the Northern Corridor and its Links is within Section N7; the *Bridge Over Twenty Foot Drain* Grade II listed building. However, it is considered that direct impacts could be avoided through careful routeing. As such, it is considered that impacts on this designated heritage asset would be limited to potential affects upon its setting only.

7.2.108 In this area (Section N7), there are numerous designated heritage assets within 1 km of the Corridor and its Links (see **Figure 7-15**). Most comprise scattered Grade II listed buildings at boundaries. There are also small clusters of other designated heritage assets located at the villages of Stickford, Stickney, New Bolingbroke and East Keal. Those most notable, in proximity to the Northern Corridor include:

- Grade II\* listed building, *Church of St Helen* located approximately 250 m east of Section N4;
- Grade II listed building *The Dairy Farmhouse* located approximately 60 m south of Section N4;

- Grade II listed building *Musgrave Bridge* located approximately 80 m east of Section N4; and
- Grade II listed building *The Cottage About 300 m East of Carrington County Primary School* located 100 m south of Section N5.

7.2.109 There is likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb medieval archaeology due to an assumed greater presence. However, due to the width of these Sections and its Links, it is considered there is sufficient flexibility to materially reduce potential adverse impacts through careful routeing and the implementation of standard construction measures.

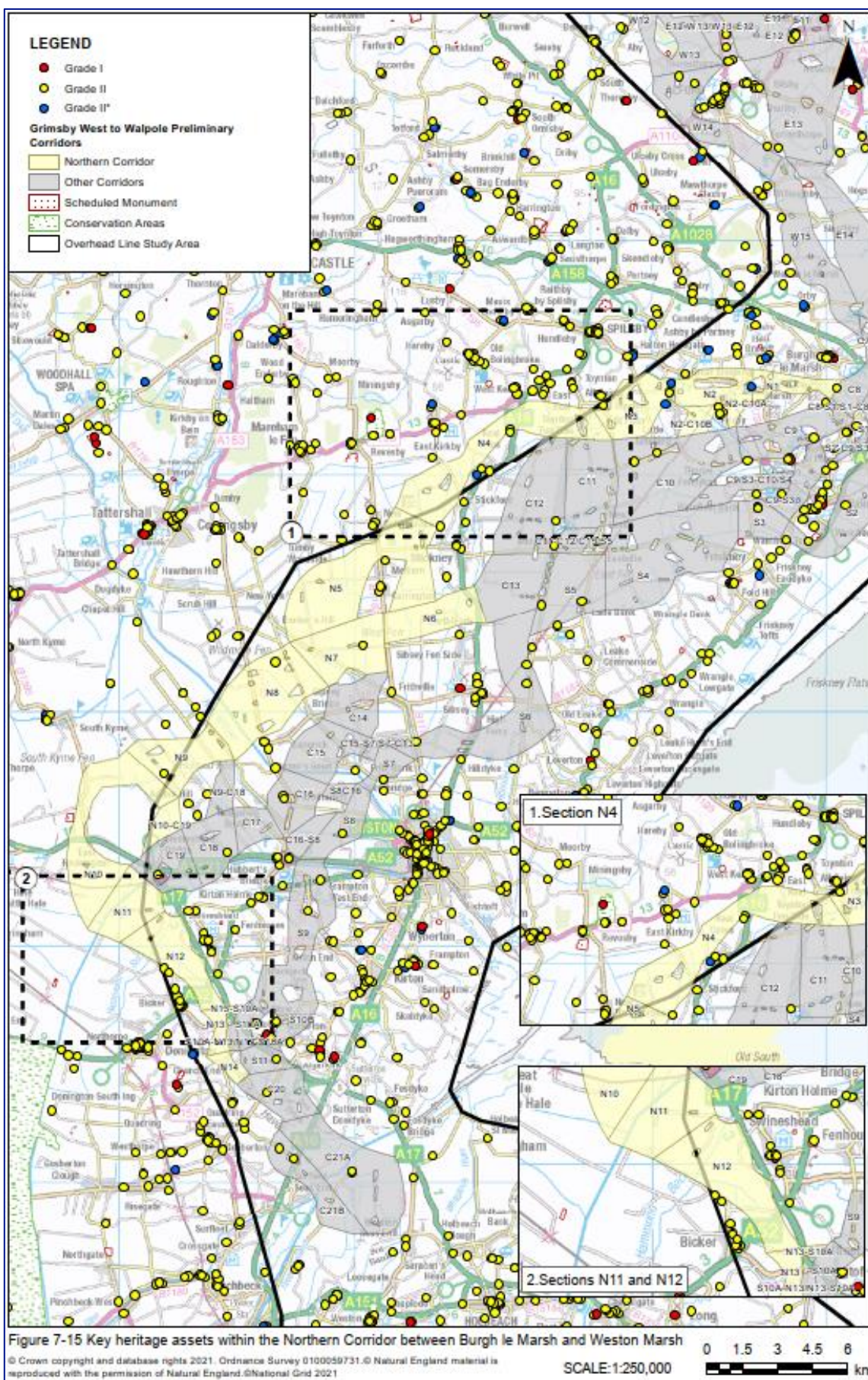
#### Howbridge Drain to Quadring Eaudike

7.2.110 There are no designated heritage assets within the Northern Corridor or its Links between Howbridge Drain to Quadring Eaudike and therefore impacts on designated heritage assets are limited to affects upon their setting only. In this area, there are numerous designated heritage assets within 1 km of the Corridor and its associated Links, which are mainly located at the villages of Swineshead, Bicker, Drayton and Tarry Hill (see **Figure 7-15**). The most notable in proximity are:

- Scheduled Monument the *Settlement site 600 m East of Holme House* located immediately adjacent to the west of Section N10.
- *Gaunlet House* Grade II listed building located 120 m south-west of Section N12.
- *Fore Lane Farmhouse and Stable* Grade II listed building located 100 m south-west of Section N12.
- *Traphouse and pigeoncote to Wykes Manor farm* Grade II listed building located 500 m west of Section N14.

7.2.111 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing in proximity and an increased potential to disturb buried archaeology due to an assumed greater presence. However, due to the width of these Sections and its Links, there is sufficient flexibility to materially reduce potential adverse impacts through careful routeing and the implementation of standard construction measures.

Figure 7-15 – Key heritage assets within the Northern Corridor between Burgh le Marsh and Weston Marsh



## Socio-economics

7.2.112 There are few socio-economic features located within and near the Northern Corridor and its Links. Those identified include:

- The Hollies Solar Park located within Section N1;
- Manor Farm Solar Farm application (reference S/051/00772/17) located within Sections N1, N2 and Link N2-C10A; and
- An airstrip at Keal Cotes located south-east of Section N4.

7.2.113 In addition, there are numerous navigable waterways within the Overhead Line Study Area, some of which cross or are within proximity to the Sections. These include:

- West Fen Catchwater Drain crosses the west of Section N4;
- Medlam Drain crosses through Sections N5 and N6;
- Howbridge Drain and Newham Drain which crosses the west of Sections N5 and N7;
- River Witham crosses through Section N8; and
- South Forty Foot Drain / Black Sluice Navigation crosses through Section N11.

7.2.114 Given the nature of these constraints and their distribution, predominantly at the boundaries of the Sections; it is considered that with the implementation of careful routing, potential impacts on these receptors will be reduced to an acceptable level, and where possible avoided, such that significant adverse impacts upon their operation are unlikely. However, if the Manor Farm Solar Farm application to the south of Irby in the Marsh cannot be avoided i.e., if routing to the north of Sections N1 and N2 is not a viable option, the impacts to the operation of the solar farm are likely.

## Other Considerations

7.2.115 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.

7.2.116 Residential receptors are predominantly located outside the Northern Corridor and its Links. Within the Corridor and Links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrow areas near residential areas at Sections N1, N2, N10, N11, N13 and N14 and Link N2-C10A, further careful investigation of infrastructure placement would be required (at a later stage) to avoid potentially significant adverse residual impacts on residential properties immediately adjacent.

7.2.117 As outlined in **Chapter 5**, most of the Northern Corridor and surrounding areas are covered by Flood Zone 2 and 3. All Sections and the Links contain field drains. All Sections and Links contain either a Statutory Main River and / or a WFD river waterbody and / or IDB watercourses (see **Figure 7-10**). In addition to field drains, the watercourses present within each Section or Link comprise:

- Section N1 – One statutory main river (Cowcroft Drain), three WFD river waterbodies, and two IDB watercourses.

- Section N2 – One statutory main river (Steeping River), two WFD river waterbodies, and three IDB watercourses
- Link N2 – C10A – One statutory main river (Steeping River), two WFD river waterbodies, and one IDB watercourse.
- Link N2 – C10B – Two WFD river waterbodies and nine IDB watercourses.
- Section N3 – Two statutory main rivers (Steeping River and East Fen Catchwater Drain, four WFD river waterbodies, and 29 IDB watercourses.
- Section N4 – Three statutory main rivers (East Fen Catchwater Drain, Hagnaby Beck and West Fen Catchwater Drain), three WFD river waterbodies and 27 IDB watercourses.
- Section N5 – Two WFD river waterbodies and 42 IDB waterbodies.
- Section N6 – Two statutory main rivers (East Fen Catchwater Drain and West Fen Catchwater Drain), Two WFD river waterbodies and 26 IDB watercourses.
- Section N7 – Two WFD river waterbodies and 19 IDB watercourses.
- Section N8 – One statutory main river (River Witham), three WFD river waterbodies and 23 IDB watercourses.
- Section N9 – Three IDB watercourses.
- Link N9-C18 – Two WFD river waterbodies and two IDB watercourses.
- Section 10 – One statutory main river (Holland Dike), three WFD river waterbodies and six IDB watercourses.
- Link N10-C19 – One statutory main river (Skerth Drain), three WFD river waterbodies and two IDB watercourses.
- Section N11 – One statutory main river (South Forty Foot Drain), two WFD river waterbodies and two IDB watercourses.
- Section N12 – One IDB watercourse.
- Section N13 – One IDB watercourse.
- Link N13-S10A – One IDB watercourse.
- Section N14 – Three IDB watercourses.

7.2.118 There are no constraints which are considered to have potential adverse impacts to the extent that they would significantly hinder routeing, however the extent of Flood Zones 2 and 3 coverage within the Corridor and its links means that the location of infrastructure in this area cannot be avoided and will present a constraint to construction.

### Summary

7.2.119 The Northern Corridor between Burgh le Marsh and Weston Marsh is particularly constrained at its most eastern and western extents. Between these areas the Northern Corridor has scattered environmental and socio-economic constraints. At the east of the Corridor those constraints which exert most influence on a new overhead line are:

- The proximity and density of residential receptors, particularly within Sections N1 to N2 where there are narrower areas, and presence of heritage and ecological designated features within or adjacent to the Corridor;



- The presence of the NGED 132 kV overhead line and Hollies Solar Farm and Wind Farm to the south of Section N1;
- The proximity to the AONB in Section N2; and
- The potential interactions with socio-economic features.

7.2.120 At the west of the Corridor those constraints which exert most influence on a new overhead line are:

- The proximity and density of residential receptors, particularly within Sections N10 to N13 where there are narrower areas; and
- The presence of a NGED 132 kV overhead line and proximity to the 4ZM 400 kV overhead line in Sections N11, N12 and N13.

7.2.121 When considering receptors outside of the Northern Corridor and its Links, there are scattered residential properties, recreational receptors and designated heritage assets which may be impacted visually, or experience impacts on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. However, it is considered that most of these adverse impacts can be avoided, or reduced, through careful routeing due to the width of, and therefore flexibility within, most of the Northern Corridor.

### **Engineering and System Factors**

7.2.122 There are several constraints located throughout the Northern Corridor and its links that are considered likely to reduce routeing flexibility and / or increase technical complexity and constraints which would all have associated construction and delivery impacts.

7.2.123 Throughout the Northern Corridor, there are scattered constraints including residential properties, industrial and agricultural buildings, blocks of woodland and watercourses. Almost all the Northern Corridor, associated Links and vast swathes of the surrounding area are covered by Flood Zone 2 and 3 and it is therefore unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction cannot take place.

Burgh le Marsh to Toynton St Peter

7.2.124 Within Section N1, Triton Knoll, the edge of Hollies Solar Farm, Cowcroft Drain, a NGED 33 kV overhead line and small woodland blocks and mature hedgerows present technical challenges which reduce routeing flexibility. Triton Knoll crosses the Section and paralleling the existing infrastructure would be avoided where practicable (to avoid impacting operation of this existing asset). Achieving perpendicular crossings would likely require additional angle pylons, however achieving crossings will be limited by residential properties and the Hollies Solar Farm. The existing 33 kV overhead line will require modification prior to construction of the Project.

7.2.125 In addition to the above constraints, areas adjacent to the Bratoft Meadows SSSI (specifically excluded from Section N1) appear to comprise wetland. Construction and pylon placement within the wetland (subject to geotechnical investigations to determine ground conditions, foundation designs and access designs) would likely increase access and maintenance challenges.

7.2.126 The Poacher Railway line loops through Section N2 around Firsby and could require two crossings. In addition, the proposed Manor Farm Solar Farm covers the south of

Section N2 in its entirety, south of Irby in the Marsh. These features could be avoided by routeing to the north, however in doing so would likely require additional angle pylons. Oversailing the proposed Manor Farm Solar Farm would limit pylon positioning and increase construction and access limitations. A NGED 33 kV overhead line crosses the Section horizontally and would need modification prior to construction of the Project. At the western boundary of the Section is the Steeping River which may require crossing at this location, although there remains an option to route further north and cross the river in Section N3, or route further south and cross in Link N2-C10B.

- 7.2.127 The two alternative Links from Section N2 are Link N2-C10A and Link N2-C10B. Within Link N2-C10A are scattered constraints including blocks of woodland, drains and the Poacher Railway line (a perpendicular crossing of this would require additional angle pylons and crossing protection) which require consideration. Within Link N2-C10B, the Poacher Railway line, Steeping River and peaty soils comprise the key features. A crossing of the Steeping River would be required in this Link, however a route which parallels the Poacher Railway line could be achieved.
- 7.2.128 Peaty soils cover approximately 85% of Link N2-C10B and cannot be avoided. Peaty soils are also present as Section N2 routes into Section N3 and, increase in coverage further west where they become unavoidable. If determined, following geotechnical investigations, that peaty soils are present it would require additional design considerations and reinstatement and would increase complexity of construction.
- 7.2.129 Within Section N3 are the Steeping River and East Fen Catchwater Drain. The former would require crossing here or alternatively in Section N2. The East Fen Catchwater Drain routes through the centre (east to west) of Section N3, reducing routeing flexibility, and into Section N4. The location of this drain may mean multiple crossings (with crossing protection) and additional angle pylons would likely be required.

#### Toynton St Peter to Howbridge Drain

- 7.2.130 The Viking Link Interconnector routes through all Sections between Toynton St Peter and Howbridge Drain (Sections N4, N5, N6 and N7). Its presence reduces routeing flexibility, especially within Section N5, when ensuring sufficient stand-off distances and considering other features present in each Section. In Section N5 it is possible to avoid multiple crossings or paralleling of the Viking Link Interconnector by routeing along its western leg into Section N7.
- 7.2.131 In addition to the Viking Link Interconnector within Section N4, those features which constrain routeing are the former RAF Kirkby, the West Fen Catchwater Drain and the Drain Bank, and a small area of peaty soils to the east of West Fen Drain.
- 7.2.132 RAF Kirkby is at the edge of Section N4 and is still in use as an aviation museum, often hosting air shows. The airfield restricts routeing north of Keal Cotes, as the Section is at the end of the runway and if allowing for a 500 m clearance, this leaves a significantly restricted gap of approximately 50-100 m of corridor. West Fen Catchwater Drain and the Drain Bank route north to south through the Section to the west of Sitckford reducing routeing flexibility. As these drains are also navigable, crossing protection would be required and facilitating a perpendicular crossing would likely require additional angle pylons. The peaty soils are avoidable if routeing to the west of Section N4, however this increases the potential crossings or paralleling of the Viking Link Interconnector.
- 7.2.133 The Viking Link Interconnector, in-combination with a solar farm, reduces routeing flexibility at the north of Section N5 and the presence of these features would likely

require additional angles for crossings. Routeing to the west of Medlam is less technically challenging and provides greater routeing flexibility. In addition, RAF Coningsby is located approximately 3.7 km north-west of this Section and routeing an overhead line should consider potential conflicts with its radar sites. This may limit routeing to the western extent of the Section.

7.2.134 South of the western leg of Section N5 is Section N6. Within this Section are the A16, East Fen Catchwater Drain, West Fen Catchwater Drain and Medlam Drain, all of which require crossing. These features would require crossing protection and may result in the use of additional angle pylons. In addition, Triton Knoll is present at the south-east corner of the Section which would further limit the positioning of new infrastructure whilst ensuring sufficient stand-off distances can be maintained.

7.2.135 South of the eastern leg of Section N5, and west of Section N6, is Section N7. Within this Section (Section N7) are Triton Knoll, the Viking Link Interconnector, Howbridge Drain/West Fen Drain and Newham Drain. All these features require crossing in Section N7, in previous Sections (N6) or in Sections further west (Section N8). These features limit routeing flexibility and, depending on which Section (Section N6 or Section N5) is used to route into Section N7, would likely require the use of additional angle pylons.

#### Howbridge Drain to Quadring Eaudike

7.2.136 The Viking Link Interconnector routes through all Sections, except for Section N13 and N14, between Howbridge Drain and Weston Marsh as it routes into Bicker Fen substation. Its presence reduces routeing flexibility when ensuring sufficient stand-off distances and considering other features present in each Section.

7.2.137 Alongside potentially multiple crossings of Viking Link within Section N8, a NGED 33 kV overhead line, the River Witham and woodland are present within Section N8, which all reduce routeing flexibility. The NGED 33 kV overhead line would require modification prior to construction of the Project. The navigable River Witham crosses the Section north to south. A belt of woodland is adjacent to the River Witham, and together they combine to an area approximately 100 m wide resulting in a large crossing to be undertaken in a single span. Crossing of the River Witham will require protection and would likely have to be to the north of the Section given that the Viking Link Interconnector is present to the south.

7.2.138 Within Section N9, routeing should consider the scattered drains, blocks of woodland and residential properties as well as Gill Syke Drain and the Viking Link Interconnector to the south. There are few features to restrict routeing to the centre and north of the Section. Moving west into Section N10, the density of drains increases (mainly tributaries of including Head Dike) and a gas pipeline (Hatton to Gosberton gas pipeline), two main roads (the B1395 and A17) are present with the Heckington Fen Solar Farm NSIP adjacent to the Section. These features reduce routeing flexibility and crossings of Head Dike, the Hatton to Gosberton gas pipeline, the B1395 and A17 are required. Each of these crossings are likely to require crossing protection and multiple crossings here may increase the number of angle pylons required. Although outside the Section, seeking to avoid impacts upon the proposed Heckington Fen Solar Farm NSIP increases the technical complexity of routeing an overhead line in this Section.

7.2.139 An alternative route from Section N9 is via Link N9-C18. Link N9-C18 is relatively unconstrained, but consideration should be given to Gill Syke Drain (which requires crossing), Triton Knoll (which requires crossing) and scattered residential properties. An alternative route from Section N10 is via Link N10-C19, located west of Section N9-C18. This Link is unconstrained to the east however elsewhere within the Link are many

drains feeding into Heckington Fen and Skerth Drain, as well as the existing infrastructure of the Viking Link Interconnector and Triton Knoll, and proposed infrastructure for the Heckington Fen Solar Farm. Crossings of these features could be avoided however this may increase the complexity of crossings in Sections N9, N10 and C18.

7.2.140 At the south of Section N10 and continuing into Section N11 is the Poacher Railway Line. Crossing of this line can be avoided in Section N10, but if so, would also require crossing in Section N11. Multiple and large drains (including Great Hale Eau, South Forty Foot Drain), the Viking Link Interconnector, Triton Knoll, Hatton to Gosberton gas pipeline and connection infrastructure from the proposed Heckington Fen Solar Farm are in proximity to the railway line. These increase the complexity of a crossing (which would require protection) and would potentially create additional access and construction limitations. The crossing of all these features would likely require additional angle pylons.

7.2.141 The Hatton to Gosberton gas pipeline continues from Section N11 into N12, routing through the centre of these Sections. Depending on detailed routing (at a later stage) multiple crossings of this pipeline may be required. Its presence limits routing flexibility as sufficient stand-off distances are required. As the pipeline routes north to south through the Section, there is the potential for paralleling the pipeline and therefore extensive cathodic protection studies may be required. Except for the Hatton to Gosberton gas pipeline, there are few features to constrain routing in Section N12; a NGED 33 kV overhead crosses the Section and would require modification; crossing of the A52 at the south of the Section would be required.

7.2.142 Once in Section N13 the Hatton to Gosberton gas pipeline routes from the north to the east and outside of the Section. Crossing the pipeline will be required here if not already crossed within Sections N11 or N12. Here crossing of the pipeline may require the use of additional angle pylons. Like Section N12, there are few other features to constrain routing here and a NGED 33 kV overhead line, which crosses the Section, would require modification prior to construction of the Project.

7.2.143 An alternative to Section N13 would be via Link N13-S10A by crossing the A17. Routing into here would require the use of additional angle pylons and crossing protection but due to the limited length of the Link there are no other routing constraints.

7.2.144 Moving further south, Section N14 is relatively unconstrained but routing should consider scattered constraints including farmsteads, residential properties, and drains. The 4ZM 400 kV overhead line runs along the western boundary of the Section and stand-off distances (approximately 85 m) should be considered for routing at a later stage.

## Summary

7.2.145 Overall, routing an overhead line is constrained at the Northern Corridor's most eastern Sections following which, except for individual areas of complexity, there is a good flexibility for routing. The constraints of most prominence in the east are the narrower areas, Hollies Solar Farm, a proposed solar farm, railway and river crossings. Elsewhere there are several constraints to consider including the scattered properties, woodland, drains and existing underground infrastructure and the transport network. Peaty soils and Flood Zones 2 and 3 are also notable constraints throughout the Corridor as these areas are unavoidable and may have implications for design and construction.

## Holford Rules

- 7.2.146 The Northern Corridor and its Links have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 7.2.147 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded for the Northern Corridor and its Links. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its Links comprise scheduled monuments and associated listed buildings within Section N3, and other listed buildings. Where there are smaller areas of high amenity value sufficient space has been included within the Corridor and its Links to enable routeing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 7.2.148 The Northern Corridor initially follows an indirect route to the north-west from Burgh le Marsh heading west towards West Keal. From here it follows a largely direct route (in line with **Holford Rule 3**) south-west towards Langrick where it then diverts north-west then south and then south-east towards Weston Marsh. Links from the Northern Corridor would generally result in a change from a main corridor but may result in a more direct route.
- 7.2.149 The Northern Corridor and its Links were developed to avoid highly constrained areas, and specific constraints including settlements such as Burgh le Marsh, Irby in the Marsh, Great Steeping, Little Steeping, East Keal, Keal Cotes, Stickford, Stickney, Gipsey Bridge, Swineshead and Bicker (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in each area, with narrow sections, particularly because of areas specifically excluded, where constraints are present within Sections N1, N2, N4, and N10 to N14, and wide sections where the space is unconstrained, such crossing the River Witham (Section N8) and Poacher Railway Line (Section N10).
- 7.2.150 The Northern Corridor includes more land than is needed for the construction of an overhead line which provides flexibility when undertaking more detailed routeing, following consultation feedback, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) within the Sections and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 7.2.151 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant. The exception to this is in respect of woodland blocks, and the subtle ridge in within Section N4 where the land rises towards East Keal and West Keal. In Section N4 the width of the Corridor may be sufficient for the subtle ridge to be skirted in the detailed design at a later stage of the Project.
- 7.2.152 The Northern Corridor would require crossing a NGED 132 kV overhead line in Section N11 (**Holford Rule 6**) and this would result in adverse landscape and visual impacts unless the mitigation (in the form of re-routeing, undergrounding or removal) is undertaken. In addition, there is the potential for a wirescape to be created in Sections N10, N11, N12, N13 and N14 and due to the presence of the 400 kV 4ZM overhead line to the west (outside) the Corridor, although with the implementation of careful routeing at a later stage, this is not considered to result in intensified effects and adverse landscape and visual impacts.
- 7.2.153 No industrial zones exist within the Northern Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

7.2.154 The Northern Corridor follows a largely indirect route between Burgh le Marsh and Weston Marsh. Within the Northern Corridor there are areas with considerable routing flexibility, due to scattered environmental features and the size of the Corridor and its Links, and those where it is considerably constrained, due to narrower areas and Sections with numerous constraints. Within Sections N1, N2, N4, N10 and N11 especially, routing flexibility is reduced due to the narrowness of the Corridor combined with multiple constraints within and adjacent to their boundaries. Technical constraints are scattered except for the linear features. The presence of existing underground cables, overhead lines and the transport network, especially within Sections N4 and N10 would limit routing flexibility. Unavoidable areas of Flood Zones 2 and 3 and peaty soils within the Sections present a notable constraint to routing and would have implications for design and construction. It is noted however that Flood Zones 2 and 3 are present across almost all the overhead line Corridors between Burgh le Marsh and Weston Marsh.

7.2.155 A tabulated summary of the appraisal of the Northern Corridor is provided in **Table 7-2**.

Table 7-2 Summary of Northern Corridor Options Appraisal

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• The AONB presents a constraint to the north of Sections N1, N2 and N3 where the potential for adverse visual effects the AONB setting is greatest for the Northern Corridor.</li> <li>• There is the potential for an intensification of landscape and visual impacts to the north due to the presence of the existing Hollies Solar Park and wind turbines.</li> <li>• The sensitivity of the local landscape within the Corridor is reduced in places due to the presence of existing electrical infrastructure within Sections N10, N11, N12, N13 and N14.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of the local cycle network, Hagby Fen Nature Reserve, ARK wildlife park and exotic animal sanctuary, the Cross Britain Way and Bridge Farm Caravan Park.</li> <li>• Scattered residential properties and settlements within and adjacent to the Corridor may experience potential adverse visual impacts.</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• There is potential for the Northern Corridor to have functionally connected habitats and pollution pathways to The Wash designated sites.</li> <li>• The eastern extent of the Corridor surrounds Bratfort Meadows SSSI with the potential for indirect impacts on its habitats and species populations. A SSSI assent may be required for routes through Section N1 should this be used.</li> <li>• Coastal and floodplain grazing marsh, and deciduous woodland priority habitats are within and adjacent to the Northern Corridor.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Several listed buildings and scheduled monuments are scattered within or adjacent to the Corridor and its Links. Most of these can be avoided with careful routeing, however, impacts on setting are likely to arise especially in proximity to designated heritage assets.</li> </ul>
	Socio-economics	<ul style="list-style-type: none"> <li>• The Hollies Solar Park, proposed Manor Farm Solar Farm and an airstrip at Keal Cotes are located within and adjacent to the Corridor.</li> <li>• Numerous navigable waterways fall within or are crossed by the Corridor.</li> </ul>

Theme	Topic	Summary
		<ul style="list-style-type: none"> <li>The Northern Corridor is partially covered by the former RAF Kirkby affect its hosting air shows.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>Almost all the Corridor is covered by Flood Zone 2 and 3 which presents a constraint since this cannot be avoided. All Sections contain field drains and either a Statutory Main River, WFD river waterbody or IDB watercourses.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>Existing NGED 33 kV overhead lines cross the Northern Corridor (in N1, N2, N4, N8, N12 and N13) and would require modification, to ensure there is sufficient space for the proposed new overhead line, prior to construction of the Project.</li> <li>A crossing of a NGED 132 kV overhead line would be required to the west of Swineshead which would require modification prior to the construction of the Project.</li> <li>The 4ZM 400 kV overhead line runs parallel to the western boundary of the Northern Corridor and would require consideration with regards to routeing and stand-off distances.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>The Viking Link Interconnector routes through the majority of the Northern Corridor which will require sufficient stand-off distances and may limit the position of pylons.</li> <li>Wetland habitats adjacent to Bratfort Meadows SSSI are located within the north of the Corridor and may pose a challenge for access and foundation design. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li> <li>Peaty soils are present within the Northern Corridor which may pose a risk to pylon foundations through ground subsidence and waterlogging. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li> <li>Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings, such as the Poacher Railway line, East Fen Catchwater Drain, West Fen Catchwater Frain, Medlam Drain, River Witham, Heads Dike, Skerth Drain, Great Hale Eau, South Forty Foot Drain, A17 and Steeping River.</li> <li>The proposed Manor Farm Solar Farm within Section N2 would greatly reduce routeing flexibility and additional and larger angle pylons will likely be required.</li> </ul>



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Theme	Topic	Summary
		<ul style="list-style-type: none"><li>• The Hatton to Gosberton gas pipeline routes through the centre of the Corridor (Sections N11 to N13) and may present limitations for crossing and access. There is also the potential for paralleling this pipeline. Where this is the case cathodic protection studies would be required.</li><li>• The Northern Corridor is partially covered by the former RAF Kirkby which will restrict routeing flexibility to within a 50-100 m gap due to its use hosting air shows.</li><li>• Infrastructure will be required within Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li></ul>

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## Southern Corridor Sections (Sections S1 to S11)

7.2.156 The Southern Corridor (Sections prefixed with 'S') (**Figure 7-16**) starts at the existing A158 Skegness Road east of Burgh le Marsh. This Corridor routes south-west towards the Lincolnshire Coast and south of Wainfleet All Saints (in Section S2). South of Wainfleet All Saints it routes parallel to the coast before changing direction and heading north-west towards Wainfleet Bank. Prior to reaching Wainfleet Bank the Corridor (in Section S3) routes west, crossing a NGED132 kV overhead line and then travelling parallel to this overhead line. Here it crosses the Poacher Railway line and then crosses Hobhole Drain north of Leake Common (in Section S5). At this point, the Southern Corridor routes south again crossing the Poacher Railway line and the NGED132 kV overhead line, travelling parallel to Hobhole Drain south-east of Sibsey. In Section S6 the Corridor routes west, crossing the Poacher Railway line for a third time at a point south-west of Sibsey, before continuing south-west crossing Firth Bank Drain and the River Witham (north-west of Boston), South Forty Foot Drain (west of Boston) and the Poacher Railway line west of Boston. Following Section S9, the Southern Corridor routes south, avoiding an urban area around the B1192 and splitting into two legs, before crossing a NGED132 kV overhead line and merging north-west of Kirton End. The Corridor continues south-west towards Wigtoft, splitting into two; one to the west (Section S10A) and one to the east (Section S10B), before merging and connecting to the Central Corridor at Section C20.

7.2.157 In addition to the Southern Corridor itself, there are two Links between the Southern and either Central or Northern Corridors. These Links have been provided where it would be possible to avoid constraints or pinch points associated with a particular Section by transferring from one corridor or section to another and are as follows:

- Link S2-C9/S3, which connects the Southern Corridor to Link C9/S3-C10/S4 between the Southern and Central Corridors to the south of Croft.
- Link S10A-N13/N13-S10A, which connects the Northern and Southern Corridors to the south of Hoffleet Stow.

Figure 7-16 - Burgh le Marsh to Weston Marsh Southern Corridor

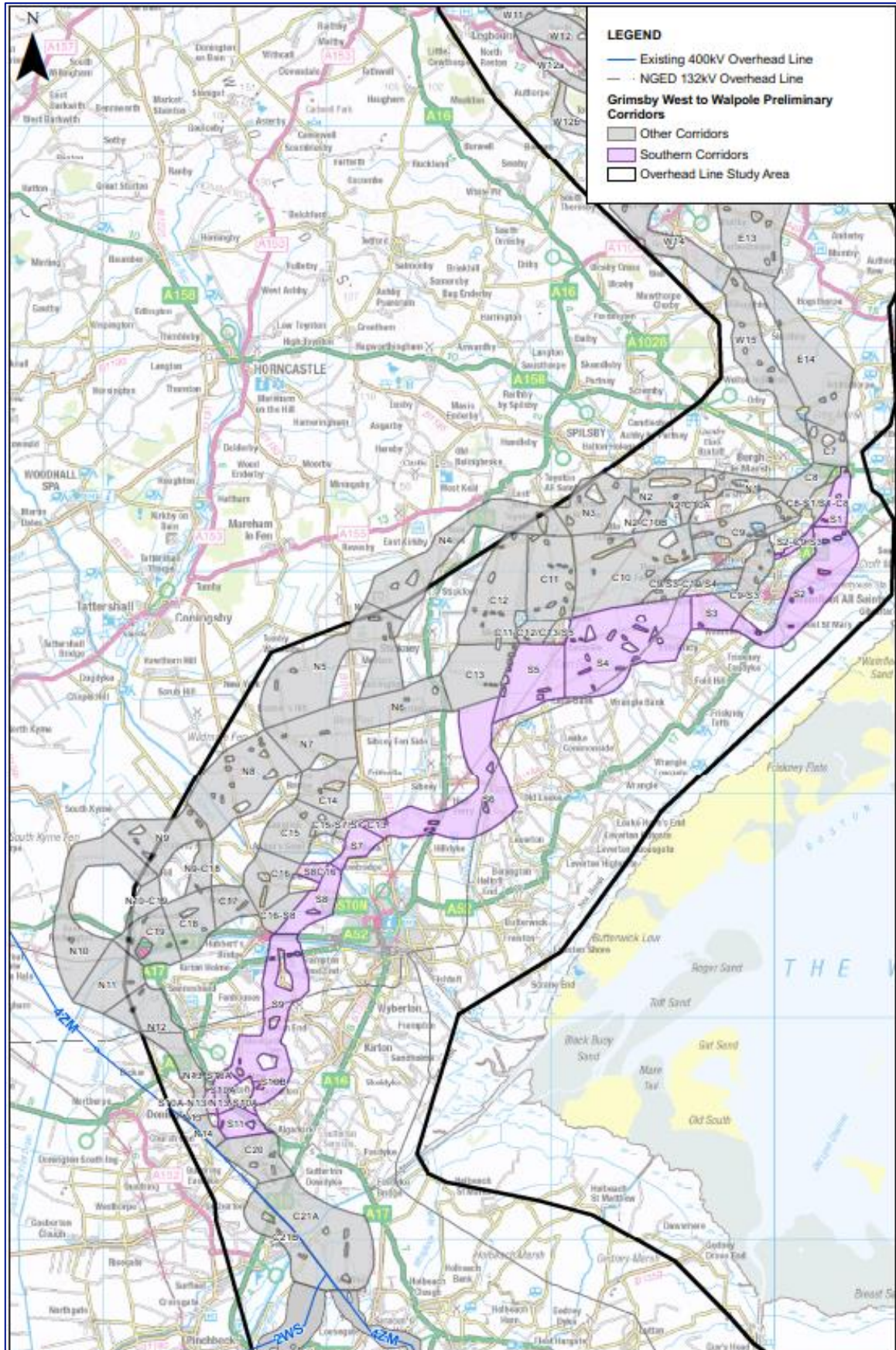


Figure 7-16 Burgh le Marsh to Weston Marsh Southern Corridor

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0 2 4 6 8  
SCALE: 1:270,000 km

## Environmental Factors

### Landscape and Visual

7.2.158 The Southern Corridor and its Links pass through two different NCAs; Section S1 is located within NCA 42 Lincolnshire Coast and Marshes which is characterised by a wide coastal plain which extends from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. Section S2 is located at the transition between NCA 42 and NCA 46 The Fens. Sections S3 to S11 are located within NCA 46 which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The characteristics of the different NCAs are similar and therefore are not considered to materially affect the potential impacts of an overhead line in different Sections of the Corridor. The key landscape and visual features between Burgh le Marsh and Weston Marsh are the greater density of settlement between Burgh le Marsh and Wainfleet All Saints, the expansive views to the coast, the NGED 132 kV overhead lines, and the linear settlement pattern between Burgh le Marsh and Weston Marsh.

7.2.159 Continuing from Section C7 (detailed in **Chapter 60**), the Southern Corridor Sections and its Links between Burgh le Marsh and Weston Marsh are located within an open landscape. The open landscape has a level topography that therefore offers considerable routing flexibility, subject to individual constraints and receptors located within and surrounding specific Sections and Links. The scattered pattern of development and features, wide Sections and Links, and open landscape is such that routing should seek a more direct line where feasible. This will considerably reduce the potential for landscape impacts, especially angle pylons or larger pylons for crossing rivers or infrastructure are required. Use of Links may require additional angle pylons, increasing the potential for landscape and visual impacts. Across the Southern Corridor, impacts upon individual receptors are unavoidable but could be reduced through careful routing.

#### Burgh le Marsh to Hobhole Drain

7.2.160 The AONB is located approximately 6.8 km north-west of the Southern Corridor, at its closest point in Section S1. A new overhead line here would not be considered incongruous in the context of the valued landscape of the AONB due to its distance, and as it would be seen in the context of the urban fringes of Burgh le Marsh and Skegness. The AONB is split into four LCAs, the Ridges & valleys of the south-west LCA is of relevance to the Northern corridor. The Ridges & valleys of the south-west LCA (north of Gunby to east of Horncastle and south of Ludford), key features include:

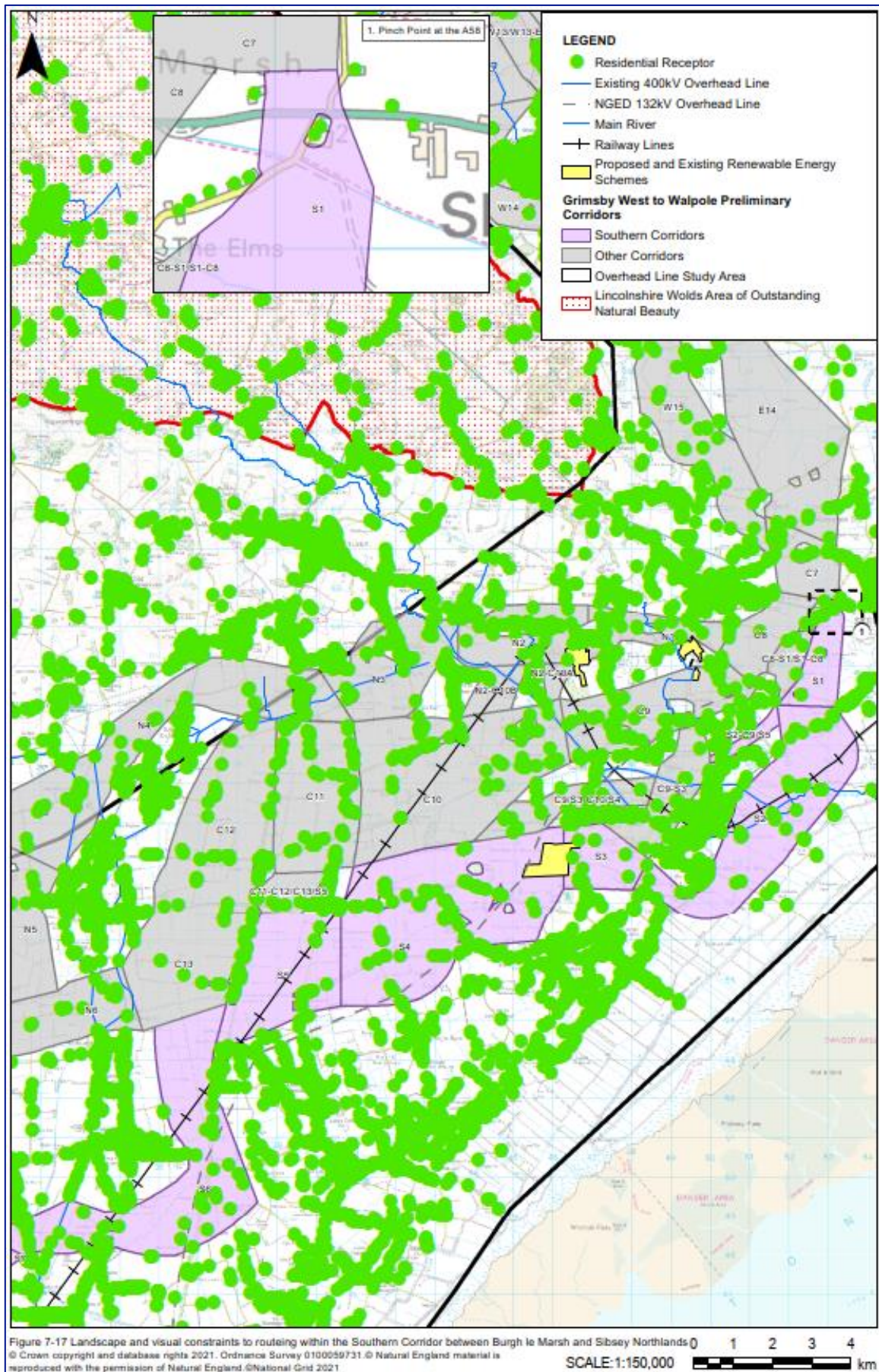
- *“Dramatic views south Bluestone Heath Road and Nab Hill – Hoe Hill ridge”* – enables wide open views of the landscape.
- *“Mixed pattern of arable and pastoral farming”* – typical features of a rural landscape evident in views.
- *“Old mixed hedgerows” and “Herb rich roadside verges”* – provides an opportunity to improve the connectivity of green infrastructure assets as part the mitigation.

7.2.161 Continuing from Section C7 (detailed in **Chapter 6**) east of Burgh le Marsh, Section S1 routes through a narrower area at the A58 (see **Figure 7-17**) before widening as it routes south. Here it is in proximity to existing above ground infrastructure. A solar farm (Skegness Solar Park) is located east of the Section and an existing NGED 132 kV

substation with connecting overhead lines are located approximately 800 m west. The presence of this existing electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. However, its presence also constrains routing and may result in intensified impacts should a wirescape (with the existing overhead line) be created. The main visual receptors in this area include residential receptors scattered along the A58 and A52, those at the east of Skegness, Croft and Burgh le Marsh, and the recreational receptors include users of holiday parks such as Cherry Lea Holiday Park, Pinetrees Leisure Park, Croft Bank Holiday Park and Belvedere Lakes. However, with careful routing to the east of the Section it is considered that significant adverse visual effects on identified receptors could be materially reduced, except for those at the narrow crossing (approximately 150 m) of the A158.

- 7.2.162 An alternative corridor is provided into Section C8 via Link C8-S1-C8 and would therefore affect many of the same visual receptors. There is potential that for this Link, even with careful routing, significant adverse visual effects on identified receptors may not be avoided due to the proximity of the NGED 132 kV overhead line and therefore consideration of modification of the NGED 132 kV overhead line (via re-routing, undergrounding or a GSP substation) should be considered to materially reduce the severity of potential adverse impacts.
- 7.2.163 Continuing south-west towards the coast, Sections S2 to S5 widen considerably, except for a narrower area south of Wainfleet St Mary within Section S2. Scattered woodland blocks within these Sections, except for Section S2, have the potential to provide localised screening of an overhead line. Within these Sections an alternative connection is provided via Link S2-C9/S3. The key visual receptors here are scattered residential and recreational receptors that include settlements and the villages of Croft, Wainfleet All Saints, Wainfleet St Mary, Wainfleet Tofts, Wainfleet Bank, Friskney, Eastville, Dickon Hills and Midville, and the users of Belvedere Lake, Top Yard Farm Caravan Site and Riverside Caravan Park, and users of the A52 and users of Decoy Wood Nature Reserve. Within this Section are multiple features that will require crossing including the Steeping River, Wainfleet Relief Channel, the Poacher Railway line (twice), a NGED 132 kV overhead line and Hobhole Drain.
- 7.2.164 The open views from the A52, Croft, Wainfleet All Saints and Wainfleet St Marys towards The Wash are such that an overhead line in Section S2 would likely be incongruous, especially where larger or multiple pylons may be required to cross the River Witham, Wainfleet Relief Channel, Poacher Railway line, Outer Dowsing OWF and where angle pylons would be required at a narrower area to the south of Wainfleet St Marys (to route into Section S3). There is potential that, even with careful routing, significant adverse landscape and visual effects on identified receptors may not be avoided. Therefore, other mitigation (as described in **Paragraph 4.8.4**) should be considered to reduce the severity of potential adverse impacts in this area.
- 7.2.165 An alternative connection from Section S2 to Link C9-S3 is provided in this area. However due to a combination of a narrower area, the proximity of visual receptors at Croft, the requirement for a watercourse crossing and proximity of the NGED 132 kV overhead line. A technical solution to avoid the 132 kV overhead line should be considered at this location to reduce the number and severity of potential adverse impacts.

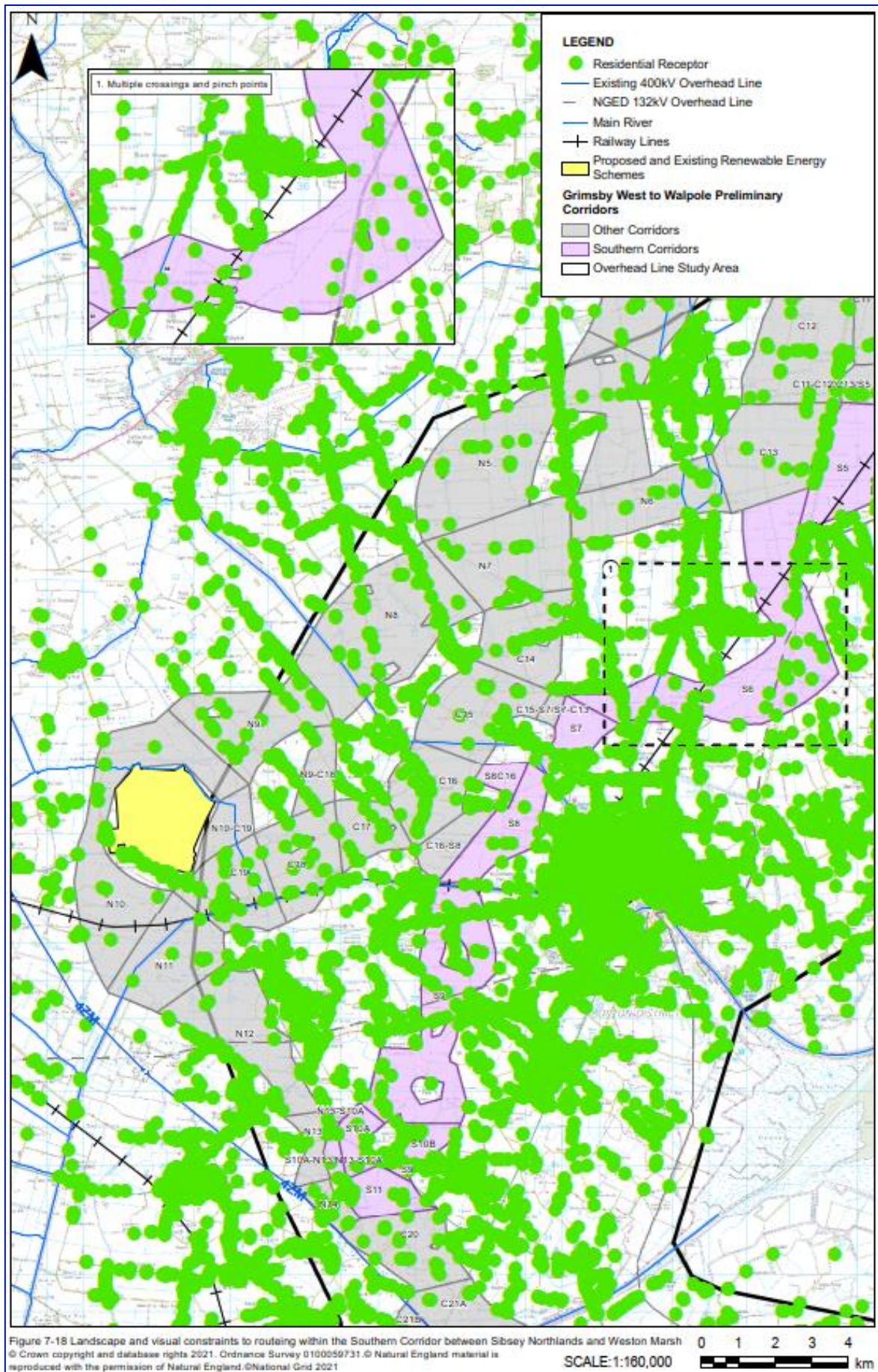
Figure 7-17 – Landscape and visual constraints to routing within the Southern Corridor between Burgh le Marsh and Sibsey Northlands



7.2.166 Continuing into Section S3 and onto Section S4 and S5, the presence of the NGED132 kV overhead line (see **Figure 7-17**) means that the landscape here is less sensitive to adverse impacts from new infrastructure. However, its presence also constrains routing and may result in intensified impacts should a wirescape (with the existing overhead line) be created. Routing to the north of these Sections will help to limit the potential for a wirescape. However, given the proximity and alignment of the NGED 132 kV overhead line, and the scattered clusters of properties, there is potential that, even with careful routing, significant adverse visual effects on identified receptors may not be avoided. Therefore, this is a location where other mitigation should be considered to reduce the potential severity of adverse impacts.

7.2.167 Continuing towards Sibsey Northlands, Section S5 routes into Section S6 after it crosses the Poacher Railway line and Hobhole Drain. A new overhead line has the potential to adversely impact the visual amenity for scattered receptors, especially those along Hobhole drain and more widespread impacts are possible due to infrastructure crossings. However, with careful routing, south of the Section, it is considered that most impacts can be materially reduced.

Figure 7-18– Landscape and visual constraints to routing within the Southern Corridor between Sibsey Northlands and Weston Marsh





## Hobhole Drain to Hubbert's Bridge

- 7.2.168 Moving into Section S6 the Corridor turns south. The key visual receptors here include the settlements of Leake Commonsides, Sibsey, Boston Long Hedges, Cowbridge, and Fishtoft Drove and the users of Boston Golf Club and the A16. Here an overhead line would have to cross the Poacher Railway Line and either cross or travel near Hobhole Drain and a NGED 132 kV overhead line before routing west and crossing the Poacher Railway line and West Fen Drain. The presence of this infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. However, its presence also constrains routing and may result in intensified and widespread impacts due to multiple crossings and should a wirescape (with the existing overhead line) be created. This would be most likely to occur in proximity to a narrow area adjacent to West Fen Drain and at the B1184, where a crossing of the railway line, potentially Hobhole Drain and the NGED 132 kV overhead line, and a change or direction (west) would occur. In this area it is considered careful routing and modification of the existing 132 kV overhead line would be required to reduce the number and severity of impacts. However, given the multiple crossings and change of direction this may still not be sufficient to limit widespread adverse landscape and visual impacts.
- 7.2.169 West of West Fen Drain Section S7 routes south-west. A crossing of Firth Bank Drain and the River Witham would be required before continuing into Section S8 at South Forty Foot Drain. Here the Corridor narrows due to the density of settlement. The key visual receptors comprise the settlements of Cowbridge, Anton's Gowt, Frith Bank, Hubbert's Bridge as well as settlement along the north-western edge of Boston and users of the River Witham, Witham Way Country Park, NCN1 and the A1121. The requirement for crossing these three watercourses in quick succession in-combination with the proximity and density of settlements has the potential to result in widespread adverse landscape and visual impacts. In this area it is considered careful routing is not likely to materially reduce the number and severity of potential impacts and other mitigation should be considered.
- 7.2.170 An alternative is present here through using the Link S7-C15 which is generally remote from visual receptors. Use of this Link would route an overhead line away from denser settlement patterns at the edge of Boston and remove the requirement to cross West Fen Drain, Firth Bank Drain and the River Witham within quick succession. Therefore, it may negate the need for other mitigation potentially required for routing within Section S7
- 7.2.171 Continuing into Section S8 the main visual receptors are scattered settlement patterns at Hubbert's Bridge, Wyberton Fen and those at the western edge of Boston, and users of NCN Route 1 and the River Witham. Here a crossing of South Forty Foot Drain is required. The increased height of the pylons to cross this watercourse may result in more widespread adverse landscape and visual impacts.
- 7.2.172 Once south of South Forty Foot Drain and within Section S9, key visual receptors for an overhead line comprise the settlements of Hubbert's Bridge, Kirkton End, Asperton and Chain Bridge, and users of Kirkton Holme Golf Club, the A1121 and the A53. Here an overhead line would require crossing New Hammond Beck at narrower areas (east and west of the B1192) and a NGED 132 kV overhead line. The NGED 132 kV overhead line will require crossing and therefore mitigation which would materially reduce potential impacts. The narrower areas limit routing flexibility, particularly in the eastern leg, and larger pylons for crossings may result in more widespread landscape and visual impacts. At the south of Section S9 there is also the presence of two solar farms (Nowhere Farm and Kirton Farm), which reduce the sensitivity of the landscape in the

area. A new overhead line has the potential to adversely impact the visual amenity for these receptors, although with careful routing it is considered that most impacts can be materially reduced.

#### Hubbert's Bridge to Quadring Eaudike

7.2.173 Moving south along each of the two legs around Wigtoft (Sections 10A and 10B) and into the shorter Section 11, the key visual receptors comprise the residential areas of Wigtoft, Hoffleet, Sutterton and Burtoft and users of the Cross Britain Way and A17. Except for a narrower area along Main Road/Wigtoft Road within Section S10B, this area is generally open and contains few visual receptors. Impacts upon some individual receptors are considered unavoidable but could be reduced through careful routing. An alternative is also provided from Section S10A at this location, via Link S10A-N13-S10A, which contains few visual receptors.

#### Ecology

7.2.174 As described in **Chapter 5**, the Southern Corridor was developed to avoid designated ecological areas where possible, and there remain few designated and important ecological areas identified within and in proximity to the Southern Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified are appraised below.

7.2.175 The Southern Corridor and its Links are located within 2 km from the Lincolnshire coast, along which the NSN and Ramsar sites are present. Those located along the coast are:

- The Wash designated sites, located approximately 2 km south of Section S2;
- The Gibraltar Point SPA and Ramsar Site which also overlap with a SSSI and NNR ('the Gibraltar Point designated sites'), is located approximately 2 km south of Section S2. Gibraltar Point is an actively accreting dune system which forms extensive sand dunes on the Lincolnshire coast. Dune ridges representing all stage of dune development (stages of colonisation and stabilisation) have formed roughly parallel and between these are salt marshes. Older dunes are extensively colonised by scrub and there are freshwater pools, freshwater marshland and grassland. It supports nationally important breed population of little terns and internationally or nationally important wintering populations of migratory waterfowl (bar-tailed godwit, sanderling and grey plover) and supports red knot. It also supports an assemblage of wetland invertebrate species of which eight species are listed as rare in the British Red Data Book and a further four species listed as vulnerable.
- The Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC, is located approximately 2 km south of Section S2.

7.2.176 Sections S4 to S11 are located between approximately 5.5 km and 9 km from these sites, with Sections S1 and S3 within 5 km.

7.2.177 Impacts on the designated sites identified along the Lincolnshire coast are predominantly limited to potential pollution pathways and functionally connected habitats and the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA, as the Project development progresses. However, for the purposes of Options Appraisal, the corridors, sections and links Corridors and Sections located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. With the implementation of careful routing and standard construction measures, Sections S1, S3 and S4 to S11 are considered

capable of being acceptable. Given the proximity of Section S2 the need for further mitigation and / compensation measures should be considered (following detailed ecological assessments) to ensure the impacts of an overhead line are acceptable.

7.2.178 No other SSSIs, except those identified above, are within 2 km of the Southern Corridor.

7.2.179 Other important habitats identified within the Southern Corridor and its Links comprise priority habitats and traditional orchards. These are present within all Sections and Links except for Section S10B and Link S10A-N13/N13-S10A. Given the proximity of the Lincolnshire coastline, coastal and floodplain grazing marsh priority habitat is particularly abundant throughout the length of the Southern Corridor and is present within Sections S1, S2, S3, S6, S8 and S9 and Link S2-C9/S3. Deciduous woodland priority habitat is also abundant throughout the Southern Corridor and is present within Sections S3, S4, S5, S7, S8, S9, S10A and S11. Traditional orchards are within Section S4. As such, there is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the extent of the priority habitat areas within these Sections is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures.

### Historic Environment

7.2.180 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Southern Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified are appraised below.

#### Burgh le Marsh to Hobhole Drain

7.2.181 Between Burgh le Marsh and Hobhole Drain the only assets located within the Southern Corridor and its Links are a Grade II listed building *Pigeoncote East Of Merrifield's Farmhouse* within Section S2 and the *Churchyard cross, St Mary's churchyard* Scheduled Monument, *Church Of St Mary* Grade II\* listed building, *Cross 9 Metres South Of Nave Of Church Of St Mary* Grade II listed building and *Wainfleet St Mary War Memorial Cross* Grade II listed building within Section S3. Due to the distribution of these heritage assets, it is considered that direct impacts could be avoided through careful routeing. Should this occur then impacts on designated heritage assets are limited to affects upon their setting only.

7.2.182 In this area, there are numerous designated heritage assets within 1 km of the Corridor and its Links (see **Figure 7-19**). The majority of which are scattered Grade II listed buildings at the boundaries. There are also clusters of other designated heritage assets located at the villages of Wainfleet All Saints, Wainfleet St Mary and Friskney. Those most notable are:

- The *Magdalen College School* Scheduled Monument and Grade II\* listed building and the *Medieval salt workings* Scheduled Monument and *Wainfleet* conservation area located within 400 m of Section S2;
- The *Church Of All Saints* Grade I listed building, located north of Link S2-C9-S3; and
- *Decoy Wood decoy pond* Scheduled Monument located adjacent to the south of Sections S3 and S4.

7.2.183 There is the potential for significant adverse impacts upon the setting of these designated heritage assets and an increased potential to disturb buried archaeology due to an assumed greater presence. The width of these Sections and Links allows for sufficient flexibility to materially reduce these impacts through careful routeing and the implementation of standard construction measures. However, at the south of Section S2 (where multiple angle pylons are likely to be required) other mitigation may be required to ensure impacts to setting are acceptable.

#### Hobhole Drain to Hubbert's Bridge

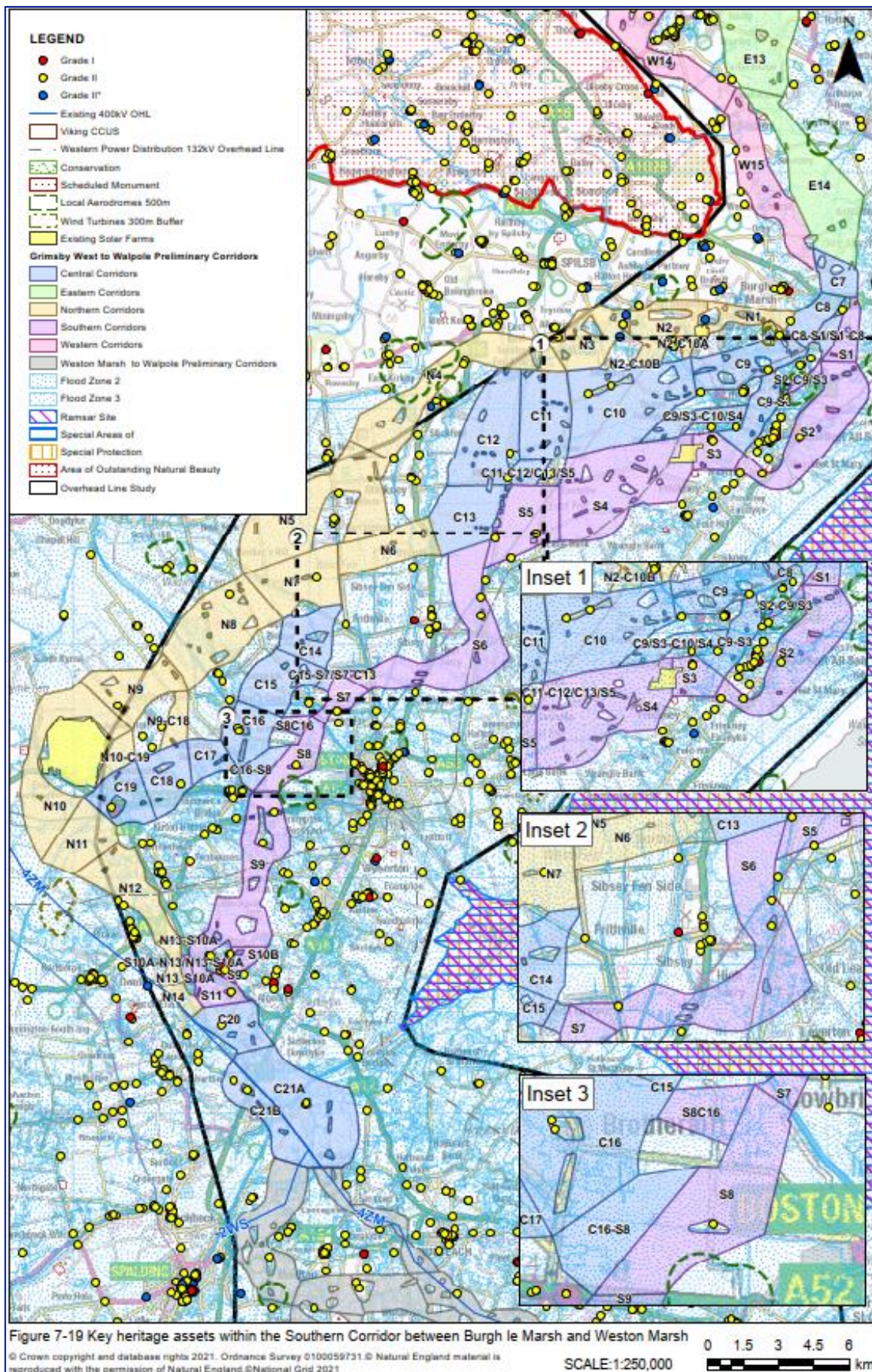
7.2.184 Between Hobhole Drain and Hubbert's Bridge the only asset located within the Corridor and its Links is the Grade II listed building *Bridge Number 9* that is located within Section S6. As this asset is a bridge, it is considered that direct impacts could be avoided through careful routeing. Should this occur then impacts on this designated heritage asset are limited to affects upon its setting.

7.2.185 In this area, there are numerous designated heritage assets within 1 km of the Corridor and its Links (see **Figure 7-19**). The majority of which are scattered Grade II listed buildings at the boundaries. There are also clusters of other designated heritage assets located at the villages of Sibsey, Cowbridge and Hubbert's Bridge. Those most notable are:

- *Bridge Number 8* Grade II listed building, located approximately 100 m from Section S6 within an area specifically excluded; and
- *Pigeoncote at Dovecote Farm* Grade II listed building, located approximately 50 m from Section S9 within an area specifically excluded.

7.2.186 There is the potential for significant adverse impacts upon the setting of these designated heritage assets and an increased potential to disturb medieval archaeology due to an assumed greater presence. However, the width of these Sections and Links allows for sufficient flexibility to materially reduce these impacts through careful routeing and the implementation of standard construction measures.

Figure 7-19 – Key Heritage Assets within the Southern Corridor between Burgh Le Marsh and Weston Marsh



## Hubbert's Bridge to Quadring Eaudike

7.2.187 Between Hubbert's Bridge and Quadring Eaudike there are no designated heritage assets located within the Corridor and its Links. Therefore, impacts on designated heritage assets are limited to affects upon their setting.

7.2.188 In this area, there are numerous designated heritage assets within 1 km of the Corridor and its Links (see **Figure 7-19**). The majority of which are scattered Grade II listed buildings at the edge of the corridor. There are also clusters of other designated heritage assets located at the villages of Kirton End, Wigtoft and Burtoft. Those most notable are:

- Grade I listed building the *Church Of St Peter And St Paul* and *Wigtoft* conservation area located within 200 m of Section S10B and 400 m of Section S10A; and
- *Burtoft Manor Farmhouse* Grade II Listed Building located 60 m west of Section S11 within an area specifically excluded from the corridor.

7.2.189 There is the potential for significant adverse impacts upon the setting of these designated heritage assets and an increased potential to disturb medieval archaeology due to an assumed greater presence. However, the width of these Sections and Links allows for sufficient flexibility to materially reduce these impacts through careful routing and the implementation of standard construction measures. However, due to the proximity of the assets at the narrow area in Section S10B, other mitigation may be required to ensure impacts are acceptable.

## Socio-economics

7.2.190 There are few socio-economic constraints located within or near the Southern Corridor and its Links between Burgh le Marsh and Weston Marsh. Those identified comprise:

- Outer Dowsing OWF cables which route through Sections S1, S2, S3, S4, S6 and Links S2-C9/S3 and C9-S3. It is unlikely that multiple crossings of the cables could be avoided;
- Poplar Farm Airstrip located south of Croft, adjacent to Link S2-C9/S3;
- Low Farm Solar Farm planning application (S/195/02340/20 – approved) within Section S3;
- The Boston Aerodrome located east of Sections S8 and S9; and
- Nowhere Farm solar farm located adjacent to Section S9.

7.2.191 In addition, there are numerous navigable waterways within the Overhead Line Study Area, some of which cross or are within proximity to the Sections and Links. These include:

- Hobhole Drain which passes through the western extent of Section S5 and the eastern half of Section S6;
- Stonebridge Drain and West Fen Drain cross the western half of Section S6;
- River Witham and Frith Bank Drain cross the south-west of Section S7;
- River Witham navigational waterway to the north of Link S8-C16; and
- South Forty Foot Drain / Black Sluice Navigation passes through the northern extent of Section S9.

7.2.192 Given the nature of these constraints and their distribution, predominantly at the boundaries of the Sections, implementation of careful routing will minimise, and where possible avoid, the receptors and significant adverse impacts are unlikely. The exception to this is Poplar Farm Airstrip due to its proximity (and the potential for interaction with flight paths) to Link S2-C9/S3 and due to the narrow nature of the Link.

### Other Considerations

7.2.193 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.

7.2.194 Residential receptors are predominantly located outside the Southern Corridor and its Links. Within the Corridor and Links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrow nature of certain areas (within Sections S1, S2, S6, S7, S9, S10A and S10B and Link S2-C9/S3) further careful investigation of infrastructure placement would be required at a later stage to avoid adverse residual impacts on residential properties immediately adjacent.

7.2.195 As outlined in **Chapter 5**, all the Southern Corridor and immediate area is almost completely covered by areas of Flood Zone 2 and 3. All Sections and Links contain field drains and all except for Sections S3, S4, S10A/ S10B and S11, contain either a statutory main river and / or a WFD river waterbody and/or a IDB watercourse. In addition to field drains, the watercourses present within each Section or Link comprise:

- Section S1 – Two WFD river waterbodies and one IDB watercourse.
- Section S2 – Two statutory main rivers (Wainfleet Haven and Wainfleet Relief Channel), five WFD river waterbodies and five IDB watercourses.
- Link S2-C9/S3 – One statutory main river (The Lymm), Two WFD river waterbodies and one IDB watercourse.
- Section S3 – 24 IDB watercourses.
- Section S4 – 39 IDB watercourses.
- Section S5 – Five WFD river waterbodies and 13 IDB watercourses.
- Section S6 - One statutory main river (Stone Bridge Drain), four WFD river waterbodies, and 61 IDB watercourses.
- Section S7 – One statutory main river (River Witham), three WFD river waterbodies, and 11 IDB watercourses.
- Section S8 – Two WFD river waterbodies and three IDB watercourses.
- Link S8-C16 – One WFD river waterbody and one IDB watercourse
- Section S9 – One statutory main river (South Forty Foot Drain), four WFD river waterbodies and four IDB watercourses
- Section S10A – One IDB watercourse.
- Section S10A-N13 – Three WFD river waterbodies and one IDB watercourse.
- Section S10B – Two IDB watercourses.

- Section S11 – Two IDB watercourses.

7.2.196 There are no constraints which are considered to have potential adverse impacts to the extent that they would significantly hinder routeing, however the extent of Flood Zones 2 and 3 coverage within the Corridor and its links means that the location of infrastructure in this area cannot be avoided and will present a constraint to construction.

### Summary

7.2.197 The Southern Corridor between Burgh le Marsh and Weston Marsh contains scattered environmental and socio-economic constraints however there are certain Sections with a dense concentration of constraints. Those constraints which exert most influence on a new overhead line are:

- the proximity to the NSN and Ramsar sites along the Lincolnshire Coast in Sections S1, S2, and S3;
- the open nature of views towards the coast within Section S2;
- proximity and density of residential receptors at narrower areas, particularly within Sections S1 and S2 and then as an overhead line would route around Boston in Sections S6, S7, S9 and S10A/B.
- the presence of a NGED 132 kV overhead line and the potential for wirescape, especially at Sections S3 to S6 and Section S9.

7.2.198 When considering receptors outside of the Southern Corridor and its Links, there are scattered residential properties, recreational receptors and designated heritage assets which may be impacted visually, or experience impacts on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. However, most of these adverse impacts can be avoided, or reduced, through careful routeing due to the width of, and therefore flexibility within, most of the Southern Corridor.

### Engineering and System Factors

7.2.199 There are several constraints located throughout the Southern Corridor and its Links that are considered likely to reduce routeing flexibility and / or increase technical complexity and constraints which would all have associated construction and delivery impacts.

7.2.200 Throughout the Southern Corridor, there are scattered constraints including residential properties, industrial and agricultural buildings, blocks of woodland and watercourses. Almost all the Southern Corridor, its Links and vast swathes of the surrounding area is covered by Flood Zone 2 and 3 and is therefore considered unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction cannot take place.

#### Burgh le Marsh to Hobhole Drain

7.2.201 The Outer Dowsing OWF route along the Southern Corridor will require sufficient stand-off distances, including through multiple crossings, and may limit the position of pylons. Between Burgh le Marsh and Hobhole Drain it runs through Sections S1, S2, S3 and the Outer Dowsing OWF alternative corridor runs across the south edge of Sections S4 and S6. Within Section S1 the Outer Dowsing OWF could be avoided by routeing west



of Middlemarsh Farm at the south-east of the Section and routeing further east in Section S2 (where it routes west to the south of Croft). A crossing is required in Section S3 where Outer Dowsing OWF crosses the centre of the Section. It also passes through Links S2-C9/S3 and C9/S3. Multiple crossings would likely be required if routeing west in Section S1 and S2 or using the links. Crossing the cables could be avoided within S4 by routeing further north of Friskney Fen.

- 7.2.202 Middlemarsh Farm, which includes a large wetland area to the west, covers the entire central area of Section S1 reducing routeing flexibility, especially with Outer Dowsing OWF located to the west. Due to the presence of Outer Dowsing OWF, pylons may need to be placed within the wetland area. Geotechnical investigations would determine ground conditions and inform foundation and access designs. Construction within the wetland would likely increase access and maintenance challenges. There is an opportunity to avoid this area by routeing through Link C8-S1/S1-C8 to the west, but this would introduce a crossing of Outer Dowsing OWF and the use of additional angle pylons. The A158 routes across the Section east to west and a crossing would be required which is likely to be perpendicular.
- 7.2.203 In addition to the challenges of Middlemarsh Farm and Outer Dowsing OWF, there are five NGED 33 kV overhead lines running through Section S1 from east to west. One of these existing overhead lines also crosses into Section S2. Crossing would be required for four of these existing overhead lines and where this is required, they would have to be modified prior to construction of the Project.
- 7.2.204 Overall routeing flexibility is high in Section S2, however there are discreet areas where complexity of routeing is increased. At the east, the A52 crosses the Section and then again to the west; both crossings will require crossing protection. Crossing to the east will be particularly constrained due to the presence of the Outer Dowsing OWF and a narrower corridor. Further south-west within Section S2 a combination of the Poacher Railway line, Steeping River and the Wainfleet Relief Channel create isolated parcels of land which may limit access. Additional angle pylons would likely be required to cross these features and facilitate perpendicular crossings. At the west of the Section the crossing of the A52 and the alignment of the Section will require additional angle pylons.
- 7.2.205 Link S2-C9/S3 provides an alternative route, connecting to Link C9-S3. Within this Link is a NGED 33 kV overhead line, The Lymm Drain and narrower areas in proximity to The Lymm Drain. The NGED 33 kV overhead line could be avoided by routeing to the north of this Section, however if this is not possible it will require modification prior to construction of the Project. In proximity to The Lymm Drain are narrower gaps which are less than 100 m in width with properties located either side. Here a crossing of Croft Lane, The Lymm Drain and East End could be undertaken in one span of a new overhead line. However, given the narrowness of the area there is no flexibility for routeing and oversailing properties is likely to be required. In addition to the features within the Link, the Poplar Farm Airstrip is parallel to the south of the Section and may limit onward routeing towards Weston Marsh.
- 7.2.206 West of Wainfleet St Mary in Section S3, there are scattered residential properties, farmsteads, drains and woodland blocks that require consideration and routeing flexibility is considered high. A NGED 33 kV overhead line crosses the Section and would require modification prior to construction of the Project. At the boundary of Sections S3 and S4 is the proposed Low Farm Solar Farm. Avoiding the proposed solar farm would require additional angle pylons and would likely introduce additional technical considerations for construction and challenges during delivery including possible access and construction limitations.

- 7.2.207 Within Section S4, routeing flexibility is further reduced due to several clustered linear and scattered properties and a NGED 132 kV overhead line (between the NGED132 kV substation and Boston) that routes north-east to south-west across the Section. Routeing to the northern edge of the Section may be preferable to reduce the number of angle pylons required. However, modification of the 132 kV overhead line would be required prior to construction of the Project.
- 7.2.208 Peaty soils are unavoidable within Sections S4 and S5, covering approximately 75% of each. If determined, following geotechnical investigations, that peaty soils are present it would require additional design considerations and reinstatement which would increase the complexity of construction.
- 7.2.209 In addition to the peaty soils within Section S5 is the Poacher Railway line and Hobhole Drain. The crossing of both these features (including associated crossing protection) is required as the Section continues west and would likely require the use of additional angle pylons to facilitate perpendicular crossings. The presence of both these features may result in additional access limitations within this Section.

#### Hobhole Drain to Hubbert's Bridge

- 7.2.210 As the Southern Corridor routes south within Section S6, both the Poacher Railway line and Hobhole Drain continue to route through the Section. The Poacher Railway line crosses the Section in two separate places requiring additional angle pylons in order to achieve perpendicular crossings. Hobhole Drain may also require crossing in this section but is dependent upon detailed routeing within the Section further south. A NGED132 kV overhead line is also present within Section S6, continuing from Section S5 towards Boston. It routes north to south and could be avoided by routeing through a narrow area to the west of the Section. If routeing west is not achievable, then two crossings of this existing overhead line (and Hobhole Drain) would be required. The NGED 132 kV overhead line would need to be modified prior to construction of the Project.
- 7.2.211 South of High Ferry within Section S6, the overhead line would need to cross the A16 in proximity to a second crossing of the Poacher Railway line. Crossing these features in quick succession would potentially also result in additional access limitations within this Section. As Section S6 continues west it would require crossing Stone Bridge Drain and West Fen Drain within approximately 1 km of one another, but could be crossed without the need for additional angle pylons. However, crossing both in proximity would potentially result in additional access limitations within this Section. In addition, several residential properties are located adjacent to West Fen Drain further reducing routeing flexibility.
- 7.2.212 The north of Section S7 is generally unconstrained with considerable routeing flexibility. However, to the south, an overhead line would require crossings (with crossing protection provided) of the Frith Bank Drain and the River Witham. In addition, a linear section of the Witham Way Country Park runs along the northern bank of the River Witham featuring an elevated viewing platform and mature vegetation which increase the complexity of this crossing. A NGED 33 kV overhead line also routes across Section S7, north of Frith Bank Drain and would require modification prior to construction of the Project.
- 7.2.213 Section S8 is generally unconstrained with considerable routeing flexibility. A crossing of the North Forty Foot Drain would be required and may require additional angle pylons to achieve a perpendicular crossing. Boston Aerodrome is located south-east of Section S8, which comprises a small runway aligned west to east and therefore flight paths may

cross these Sections. Routeing to the west of Section S8 or using Link S8-C16 would improve routeing flexibility around the aerodrome. Should routeing intersect flight paths, this may result in further design work and discussions with the airfield operator at the later stages of Project development to achieve an acceptable solution.

#### Hubbert's Bridge to Quadring Eaudike

- 7.2.214 The Southern Corridor continues into Section S9 were crossing the A1121, the Poacher Railway line and South Forty Foot Drain (which route parallel to each other) would be required within 1 km. Crossings would then be required (within 1 km) of the B1192, the A52 and New Hammond Beck. Perpendicular crossings of all these features (with crossing protection) would be feasible without the need for additional angle pylons. However, the crossings taller pylons are likely to be required given the requirement to span the full combined width of these features at each crossing. In addition, at the A52, Section S9 narrows and splits into two legs to avoid residential properties, thereby reducing routeing flexibility. Crossing the A52 along the eastern leg of Section S9 may require oversailing of property curtilages in the gap between Holmes Lane and commercial properties on Swineshead Road. In comparison, routeing is generally more open in the western leg.
- 7.2.215 Once Section S9 merges again a NGED 132 kV and NGED 33 kV overhead line are present within Section S9, with both requiring modification prior to construction of the Project. A crossing of the B1391 would then be required before splitting S9 splits again to connect into Sections S10A and S10B.
- 7.2.216 Section S10A and S10B situated either side of Wigtoft and, provide good flexibility for routeing. The A17 and a NGED 33 kV overhead line route through Section S10A in an open area of farmland with sufficient room for a perpendicular crossing without the need for additional angle pylons, although the NGED 33 kV overhead line would require modification prior to construction of the Project. The A17 and a NGED 33 kV overhead line crosses the north of Section S10B. Section S10B narrows to less than 100 m to the east of Wigtoft due to residential and commercial properties, thereby reducing routeing flexibility which may result in the oversail of commercial units within this area.
- 7.2.217 An alternative from Section S10A is available via Link S10A-N13/N13-S10A. In this Link a NGED 33 kV overhead line and the Hatton to Gosberton gas pipeline are present and crossings would likely be required. Crossing the overhead line would require modification prior to construction of the Project and the gas pipeline may limit infrastructure placement through achieving sufficient stand-off distances. Cathodic protection studies of the gas pipeline would be required.
- 7.2.218 Routeing within Section S11 would have to consider scattered constraints including a watercourse, minor drains and farm buildings. In addition, the Hatton to Gosberton gas pipeline continues into this Section and would require sufficient stand-off distances. A crossing of the gas pipeline would be required if routeing from Section S10A but not if routeing from Section S10B.

#### Summary

- 7.2.219 Overall, there is a good flexibility for routeing within the Southern Corridor and its links. There are several constraints to consider including the scattered properties, woodland and drains throughout the Corridor, in addition to the linear constraints, including existing gas pipelines, overhead lines and the transport network. There are also several NGED overhead lines (of varying voltage) which are present within the Southern

Corridor and its links. Both peaty soils and Flood Zones 2 and 3 are present throughout the Corridor and its links. These areas are unavoidable and may have implications for design and construction.

## Holford Rules

- 7.2.220 The Southern Corridor and its Links been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 7.2.221 The Southern Corridor and its Link have generally avoided smaller areas of high amenity. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its Links comprise scheduled monuments within Section S2, S3 and S4 and scattered and listed buildings. Where there are smaller areas of high amenity value sufficient space has been included within the Corridor and its Links to enable flexible routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 7.2.222 The Southern Corridor follows a generally indirect route as it initially routes south, within Section S2, before routing north and west into Section S3. It then routes directly south then west introducing changes in direction. Once past Section S6 the Corridor follows a direct route (in line with **Holford Rule 3**) towards Weston Marsh. Links from the Southern Corridor would generally result in a change from a main corridor but may result in a more direct route.
- 7.2.223 The Southern Corridor and its Links were developed to avoid highly constrained areas, and specific constraints including settlements such as Croft, Wainfleet All Saints, Wainfleet St Mary, Eastville, Sibsey Northlands, Sibsey, Boston, Hubbert's Bridge, Wigtoft and Sutterton (Holford Supplementary Note 1). The width of the Corridor reflects the constraints in each area. Narrow sections where features have been specifically excluded and where constraints are present, such as within Sections S2 [S2-C9/S3], and Links [S7, S9, S10A and S10B], and wider sections where the corridor is generally less constrained, such as crossing the Wainfleet Relief Channel and Steeping River (Section S2) and Poacher Railway line (Section S4).
- 7.2.224 The Southern Corridor includes more land than is required for the construction of an overhead line which provides flexibility when undertaking more detailed routing, following consultation feedback, later in the project development process. This also provides the opportunity to implement the most direct route (avoiding constraints) within Sections and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 7.2.225 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 7.2.226 The Southern Corridor will require crossing two NGED 132 kV overhead lines (**Holford Rule 6**), one of which would have to be crossed at least twice, and therefore it is likely that adverse landscape and visual impacts may be experienced unless the mitigation (re-routing, removal or undergrounding) is undertaken. In addition, there is the potential for a wirescape to be created if a new overhead line routes near NGED 132 kV overhead line within Section S3, S4, S5 and S6 although with the implementation of careful routing at a later stage, this is not considered to result in intensified effects and adverse landscape and visual impacts.

7.2.227 No industrial zones exist within the Central Corridor and therefore **Holford Rule 7** is not applicable.

### **Conclusion**

7.2.228 The Southern Corridor follows a largely indirect route between Burgh le Marsh and Boston. Within the Southern Corridor there are areas with considerable routing flexibility due to scattered environmental features and the size of the Sections and its Links, and those where it is considerably constrained, due to narrower areas and Sections with numerous constraints. Within Sections S1, S2, S6, S7, S9 and S10B routing flexibility is reduced due to the narrowness of the Sections combined with multiple constraints within and adjacent to their boundaries. Technical constraints are scattered except for the linear features. The presence of existing and proposed underground cables, overhead lines and the transport network, especially within Sections S4, S6 and S9 would limit routing flexibility. Unavoidable areas of Flood Zones 2 and 3 and peaty soils within the Sections and links present a notable constraint to routing and would have implications for design and construction. It is noted however that Flood Zones 2 and 3 are present across almost all the overhead line Corridors between Burgh le Marsh and Weston Marsh.

7.2.229 A tabulated summary of the appraisal of the Southern Corridor is provided in **Table 7-3**.

Table 7-3 Summary of Southern Corridor Options Appraisal

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• To the north, in proximity to Wainfleet All Saints and Wainfleet St Marys, it is considered that routing of the overhead line would be intrusive as larger or multiple pylons may be required to cross the River Witham, Wainfleet Relief Channel, and Poacher Railway line.</li> <li>• Where the Southern Corridor is in proximity to Hobhole Drain and a NGED 132 kV overhead line is present (Sections S5 and S6), the required crossing in-combination with a potential for a wirescape could result in widespread visual impacts.</li> <li>• Within the Southern Corridor the sensitivity of the local landscape is reduced in places due to the presence of existing electrical infrastructure.</li> <li>• The presence of an existing solar farm and the requirement for infrastructure to cross the River Witham by Frith Bank (Section S7) has the potential to result in widespread landscape and visual impacts should an overhead line be routed here and therefore an alternative Link (S7-C15) may be preferable.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of local holiday parks, the A52, Decoy Wood Nature Reserve, Boston Golf Club, the A16, the River Witham, Witham Way Country park, the NCN Route, Kirkton Holme Golf Club and the Cross Britain Way.</li> <li>• Scattered residential properties and settlements within and adjacent to the Corridor may experience potential adverse visual impacts.</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• There is potential for the Southern Corridor to have functionally connected habitats and pollution pathways to The Wash designated sites, Gibraltar Point and Saltfleetby-Theddlethorpe Dunes &amp; Gibraltar Point designated sites. Its proximity to these designated sites may require consideration of further mitigation and compensation measures.</li> <li>• Coastal and floodplain grazing marsh, deciduous woodland, and traditional orchard priority habitats are within and adjacent to the Southern Corridor.</li> </ul>

Theme	Topic	Summary
	Historic Environment	<ul style="list-style-type: none"> <li>Several listed buildings and scheduled monuments are scattered within or adjacent to the Corridor and its Links, including areas specifically excluded. Most of these can be avoided with careful routing, however, impacts on setting are likely to arise should the overhead line be developed where the Corridor is closest to these heritage assets.</li> </ul>
	Socio-economics	<ul style="list-style-type: none"> <li>Poplar Farm Airstrip, Low Farm Solar Farm, the Boston Aerodrome, Nowhere Farm Solar Farm, and Outer Dowsing OWF are located within and/or adjacent to the Corridor.</li> <li>Numerous navigable waterways fall within or would have to be crossed by the Corridor.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>Almost all the Corridor is covered by Flood Zones 2 and 3 which presents a constraint since infrastructure within this cannot be avoided. Nearly all Sections contain field drains and either a Statutory Main River, WFD river waterbody or IDB watercourse.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>Within the northernmost Section of the Southern Corridor there are five NGED 33 kV overhead lines which would require modification to ensure there is sufficient space for the proposed new overhead line, prior to construction of the Project.</li> <li>Within the rest of the Southern Corridor, three NGED 33 kV and three NGED 132 kV overhead lines would also require a degree of modification prior to construction of the Project.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>The presence of Outer Dowsing OWF within large areas of the corridor may limit the positioning of towers and require multiple crossings.</li> <li>At the northern end of the Corridor there is a large wetland area which may pose a challenge for pylon placement and positioning. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li> <li>Peaty soils are present to the south-east and south-west of Eastville (Sections S4 and S5) which may pose a risk to pylon foundations through ground subsidence and waterlogging. Geotechnical investigations, specific foundation designs and specialised accesses may be required in these areas.</li> </ul>

Theme	Topic	Summary
		<ul style="list-style-type: none"> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road, railway and watercourse crossings, such as the A158, Poacher Railway line, Steeping River, Wainfleet Relief Channel, A52, Hobhole Drain, Stone Bridge Drain, West Fen Drain, Frith Bank Drain, River Witham, and North Forty Foot Drain.</li> <li>• The use of Link S2-C9/S3 would restrict routeing flexibility to a gap of 100 m with no flexibility.</li> <li>• The Hatton to Gosberton gas pipeline is present at the southern end of the Southern Corridor and may limit the placement of pylons, require sufficient stand-off distances, and present access limitations.</li> <li>• Infrastructure will be required within Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>



## 7.3 Comparative Appraisal and Conclusions

7.3.1 Following the above Options Appraisal, the appraisal findings were considered and the relative merits of the different options for the 400 kV overhead line between Burgh le Marsh and Weston Marsh were compared. The corridor was broken down into smaller components (listed below) for the purposes of comparative appraisal as each of the sections and links has localised constraints which could be avoided through alternative routing. Therefore, it was likely that a combination of Sections and Links, rather than a single corridor would be used. The defined components of the route between Burgh le Marsh and Weston Marsh were considered in isolation (i.e., without consideration of the emerging preferences for the Weston Marsh siting zones) and broadly approached in a sequential manner routing north to south:

- Stage 1 – Consider the best performing Sections and Links between Burgh le Marsh and Frithville;
- Stage 2 – Consider the best performing Sections and Links between Frithville and the B1397 Spalding Road; and
- Stage 3 - Consider the best performing Sections and Links between the B1397 Spalding Road and Weston Marsh.

7.3.2 The steps are graphically shown in **Appendix A**.

7.3.3 The need to use underground cables in any part of the route will be reviewed as the design process progresses, in response to survey findings to obtain baseline data and stakeholder and community feedback.

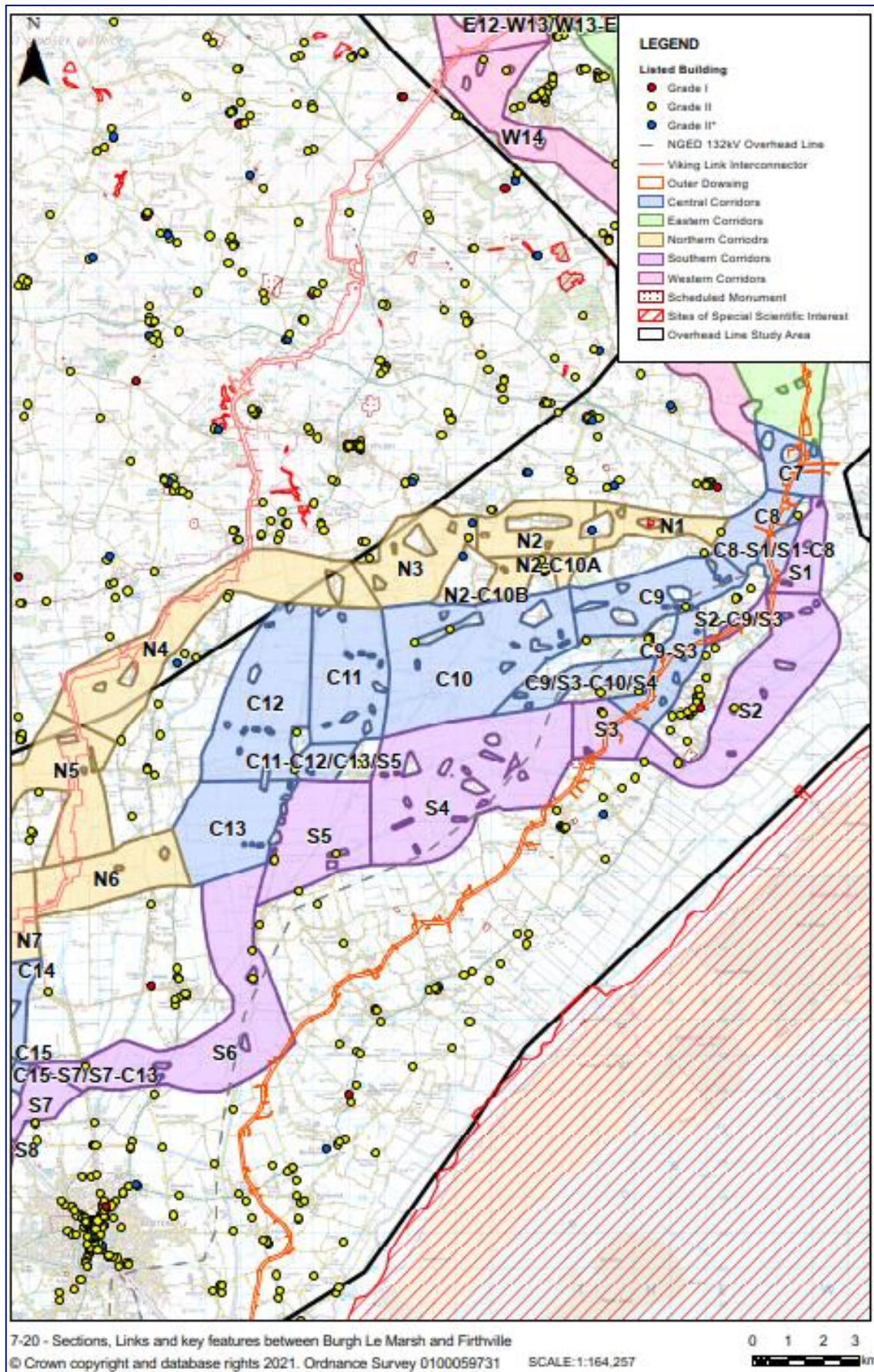
7.3.4 This section presents the factors considered to influence the decision-making process for determining the emerging preferred corridor between Burgh le Marsh and Weston Marsh. As the design progresses, regular reviews will be undertaken to ensure the emerging preferred corridor taken forward at this stage remains the optimum corridor when all environmental, socio-economic and technical aspects are considered.

### Stage 1 - 4ZM 400 kV overhead line to the A46

7.3.5 This area runs from Section C7 (considered in **Chapter 60**) and the A158 in the east, to Frithville, the B1183 and West Fen Drain in the west. It includes the following sections and links:

- Northern Corridor (Sections N1 to N7);
- Central Corridor (Sections C8 to C13);
- Southern Corridor (Sections S1 to S16);
- Northern Corridor to Central Corridor Links (Link N2-C10A and Link N2-C10B); and
- Central Corridor to Southern Corridor Links (Link C8-S1, Link S2-C9/S3, Link C9-S3, Link C9/S3-C10/S4 and Link C11/C12/C13/S5).

Figure 7-20 – Sections, Links and Key Features between Burgh Le Marsh and Frithville



7.3.6 The primary material factors for routeing an overhead line in this area are the landscape and visual impacts (also driven by the directness of an overhead line route), proximity to The Wash (and its associated ecologically designated sites) and technical complexity of construction. At the most eastern extent of these Corridors the choices available are to route within the:

- Southern Corridor (Sections S1 to S3) which is near The Wash, where an overhead line would be more intrusive in views (primarily those towards The Wash), would route south-west and then north-west, and where overhead line routeing would have an increased level of complexity due to narrower areas, crossing linear features and the presence of wetland areas associated with Middlemarsh Farm. In addition, an overhead line here would likely result in routeing across the proposed Low Farm Solar farm to avoid encircling linear settlement at Wainfleet Bank (with the NGED 132 kV overhead line to the north) or near to the *Decoy Wood decoy pond* Scheduled Monument.
- Northern Corridor (Sections N1 and N2) which is in an area with a denser settlement pattern (and therefore routeing near numerous residential properties and local road network), is closer to the AONB (and therefore has a greater potential to impact upon its setting) and is adjacent to the Meadows Nature Reserve (which includes Bratoft Meadows SSSI). This Corridor also takes a less direct route towards Weston Marsh (by routeing directly west), and where overhead line routeing would have an increased level of complexity due to narrower areas, crossing linear features (local roads) and either avoiding or oversailing existing and proposed solar farms.
- Central Corridor (Section C8 and C9) which has pockets of denser settlement (and therefore routeing near some residential properties). Should this Corridor seek to avoid the Hollies Wind Farm and Solar Park it would route nearer to the NGED 132 kV overhead line (increasing the potential for a wirescape) and through narrower areas, whilst crossing linear features (local roads).
- Links N2-C10A, N2-C10B, C8-S1, C9-S3, C9/S3-C10/S4, S2-C9/S3 could be routed through to either limit the potential for environmental effects of less preferred Sections or increase routeing flexibility. The Links are comparatively narrow and would be required to route through the Sections identified (Sections N1, N2, S1, S2, S3, C8 or C9) and therefore avoid the features within each of these main corridors.

7.3.7 Given the potential for comparatively greater visual impacts and potential impacts upon ecologically designated sites, in addition to a less direct route and several areas of significant technical complexity in Sections S1 and S2, a route utilising the Southern Corridor (Sections S1, S2 and into Section S3) is considered the least preferred. Use of the Links which connection from Sections S1, S2 and into S3 (Link C8-S1/S1-C8 and Link S2-C9/S3) are also significantly constrained and therefore not preferred.

7.3.8 When comparing the other Corridors (Northern and Central), the Northern Corridor takes a comparatively less direct route than the Central Corridor. The Northern Corridor would potentially have greater impacts upon ecological receptors (due to the proximity of Meadows Nature Reserve (which includes Bratoft Meadows SSSI). It is also likely to have potentially greater heritage impacts because of a need to route across the Steeping River in proximity to two scheduled monuments (*Churchyard cross, St Andrew's churchyard* and *Churchyard cross, Old Church*) and associated listed buildings. Comparing the potential landscape and visual impacts between the two Corridors, the Northern Corridor is in an area of denser settlement and would potentially result in routeing an overhead line closer to a larger number of residential properties, whereas the Central Corridor is in an area with less dense settlement (except for small

clusters, especially in proximity to the Hollies Wind Farm and Solar Park) but is in closer proximity to the NGED 132 kV overhead line and therefore has an increased potential for a wirescape. A route in the Central Corridor has the potential to limit the potential for creating a wirescape by routeing at the north of Section C8, C9 and into C10. Routeing through the Northern Corridor (Section N1 and into N2) would necessitate the oversail of existing and proposed solar farms to reduce potential landscape and visual impacts, however even by doing so, an overhead line route through Sections N1 and N2 would still require multiple angle pylons in narrower areas (therefore closer to residences) and may require multiple crossings of the Poacher Railway Line.

- 7.3.9 From a technical perspective, if taking a preferred technical route considering the environmental and socio-economic features as described above, the Northern Corridor would be more technically complex due to crossing of Triton Knoll, the wetland habitat (potentially associated with Meadows Nature Reserve), the likely requirement for additional changes in direction (and therefore a greater number of angle pylons) and/or potentially multiple crossings of the Poacher Railway Line. Therefore, a route utilising the Central Corridor (Sections C8 and C9) is preferred over the Northern Corridor (Sections N1 and N2).
- 7.3.10 Considering the potential alternative Links from the Northern Corridor and Central Corridor (Link C9-S3, Link N2-C10A and Link N2-C10B) there is no overriding requirement or preference to utilise these Links compared to the Central Corridor. Those Links (Link N2-C10A and Link N2-C10B) from the Northern Corridor would still require overcoming the constraints associated with routeing through Section N1 and into Section N2 and would also introduce additional crossings of linear features. The Link (Link C9-S3) from the Central Corridor would route the overhead line in closer proximity to the NGED 132 kV overhead line (which would require crossing through a narrow area).
- 7.3.11 As a result of the above, the emerging preference at the eastern extent of Corridors between Burgh le Marsh and Weston Marsh is for Sections C8 and C9 to continue routeing into Section C10.
- 7.3.12 Further west, the choices for routeing an overhead line are to use the Southern Corridor (Sections S4 to S6), the Northern Corridor (Sections N3 to N7), the Central Corridor (Sections C10 to C13 and onto Sections N6 and N7) or use Link C11/C12/C13/S5 to take a more direct route from Section C11.
- 7.3.13 The Southern Corridor (Sections S4 to S6) is the least preferred. This is primarily due to a combination of comparatively greater visual impacts and increased technical complexity for routeing an overhead line. The comparatively greater visual impacts arise due to the proximity and multiple crossings of the NGED 132 kV overhead line. Changes in direction of an overhead line (south) would be required to allow a route into Section S6, in addition, this section is also comparatively constrained due to the narrow nature of the corridor and the intervening and adjacent settlement pattern. The comparatively greater levels of technical complexity arise from crossing the NGED 132 kV overhead line (potentially multiple times), two crossings of the Poacher Railway Line, main road crossings and multiple road and navigable drain crossings. Avoiding some of these crossings in Section S6 could be possible but would be technically complex as it would require routeing through a narrow area (west of Hobhole Drain and south of the B1184) and may result in oversailing property curtilages.
- 7.3.14 To avoid routeing into the heavily constrained Section S6, an overhead line could route into Section C13, however this would still require crossing of the NGED 132 kV overhead line (in Section S4), the Poacher Railway Line (in Section S5) and routeing

between properties along Hobhole Drain (between Section S5 and Section C13). This route would also be less preferred.

- 7.3.15 When comparing the other Corridors (Northern and Central) the Northern Corridor takes a comparatively less direct route than the Central Corridor. There is little to differentiate between Section N3 and Section C10, routing an overhead line through both would need to be considerate of clusters of linear settlement and the crossing of linear features, although routing into Section N3 may have greater impacts upon two scheduled monuments (as described in **Paragraph 7.3.8**). Further west, an overhead line routing into Section N4 would be closer to residences (due to a narrower area between West Keal and Keal Cotes) and requires multiple crossings of or paralleling the Viking Link Interconnector. An overhead line in Section N4 is also likely to result in pylons with sky backgrounds near West Keal and East Keal and either impact (or increase complexity of routing in proximity of) the East Kirkby Airfield. In comparison, Sections C11, C12 and into Section C13 are greater in width and provide flexible opportunities for routing an overhead line with few material constraints. Therefore, an overhead line routing through Sections C10 to C13 is considered the emerging preference.
- 7.3.16 An alternative route, using Link C11-C12/C13/S5, from Section C11 may result in a more direct route (in line with Holford Rule 3), however due to the narrower areas between linear settlement along Hobhole Drain, use of this Link over Sections C12 and C13 is less preferred.
- 7.3.17 Routing for the Northern Corridor and Central Corridor into Sections N6 and N7 are similar and, as described above, is a more preferred route when compared to routing an overhead line through Section S6.
- 7.3.18 Overall, from an environmental, technical and Holford Rule compliance perspective the emerging preference between Burgh Le Marsh and Frithville utilises Sections C8 to C13, N6 and N7.

### Summary of Decision

- 7.3.19 The following Sections are more preferred and therefore selected to progress at this stage:
- Central Corridor Sections C8 to C13 - Using Sections C8 to C13 were preferred provided that the route through Sections C8 and C9 route further from the NGED 132 kV overhead line (seeking to limit potential landscape and visual impacts), as they avoid a route in proximity to the AONB and denser settlement pattern further north and the NSN and Ramsar sites and expansive views further south. These Sections would connect well to the previous emerging preference of Section C7.
  - Northern Corridor between Sections N6 and N7 - Use of Sections N6 and N7, have few material constraints to routing an overhead line and allow for a more direct route (in line with Holford Rule 3).
- 7.3.20 The following are less preferred and therefore not progressed at this stage:
- Northern Corridor Sections N1 to N5 - Using Sections N1 to N5 would result in an overhead line being nearer the AONB, in an area of denser settlement, near a SSSI, near two scheduled monuments, through an area that may result in the skylining of pylons, and near East Kirkby airfield and RAF Coningsby.

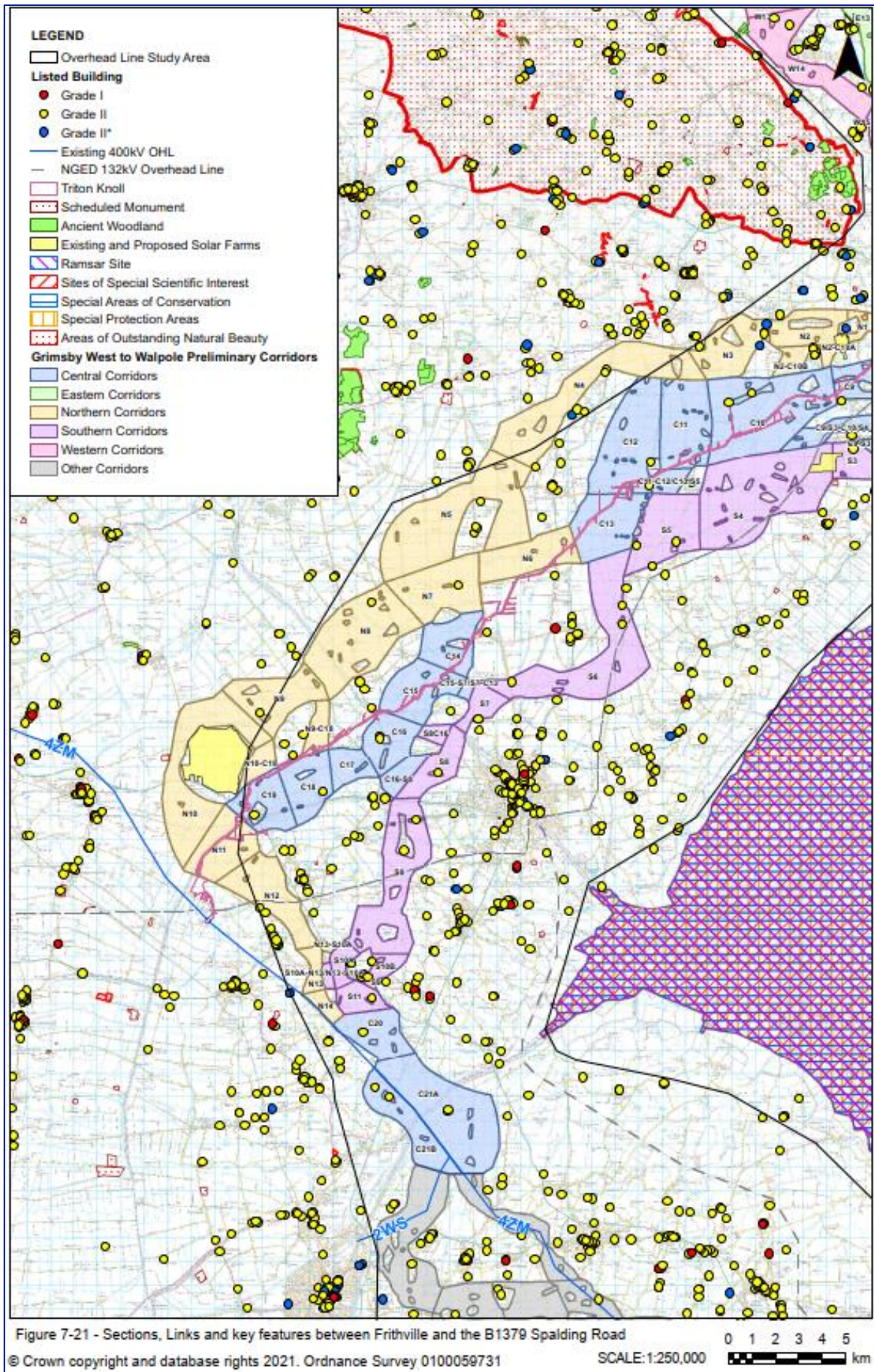
- Southern Corridor Sections S1 to S6 – using A route utilising Sections S1 to S6 would result in an overhead line being nearer the NSN and Ramsar sites and expansive views at/towards the coast. It would also require routeing near scheduled monuments, a NGED 132 kV overhead line within multiple Sections, and multiple crossings of linear features (NGED 132 kV overhead line, navigable drains, Poacher Railway Line and main roads).
- Northern Corridor to Central Corridor Links (N2-C10A and N2-C10B) - N2-C10A and N2-C10B required routeing through Section N2 which presented notable constraints and issues. These Links also introduce crossings of railway, road and drains and therefore were not progressed.
- Central Corridor to Southern Corridor Links (C8-S1, S2-C9/S3, C9-S3, C9/S3-C10/S4 and C11-C12/C13/S5) - Links between the Central and Southern Corridors would generally require the use of more constrained and less preferred Sections of the Southern Corridor. Use of these Links may also result in a less direct route and more angle pylons and therefore would be less compliant with Holford Rule 3.

## Stage 2 – Frithville to B1397 Spalding Road

7.3.21 This area runs from Frithville and the North West Drain to the north-east to the Weston Marsh Zone and Spalding Tee to the south-west. It includes the following sections:

- Northern Corridor (Sections N8 to N14);
- Central Corridor (Sections C14 to C19);
- Southern Corridor (Sections S7 to S11);
- Northern Corridor to Central Corridor Links (Link N9-C18 and Link N10-C19);
- Central Corridor to Southern Corridor Links (Link C15-S7/S7-C15, Link S8-C16 and Link C16-S8);
- Northern Corridor to Southern Corridor Links (Link N13-S10A and Link S10A-N13/N13-S10A).

Figure 7-21 – Sections, Links and Key Features between Frithville and the B1397 Spalding Road



- 7.3.22 When comparing the Corridors heading south-west from Frithville, Southern Corridor (Section S7 routeing into Section S8) was less preferred due to a narrow area and watercourse crossing in proximity, compared to the Northern and Central Corridors (C14 and C15 with N7 to N8).
- 7.3.23 Further west, Section N10 was not preferred from a heritage perspective due to the potential to cause impacts upon the setting of a scheduled monument. Use of Links N9-C18 and N10-C19 would avoid using Section N10 and contain few material constraints to routeing, thereby providing an alternative route to reach Section N11 (via Sections C18 and C19). However, Section N10 and Section C19 connect into Section N11 where technical complexity, and the potential for landscape and visual impacts are comparatively greater due to a change in direction (from Section C19) in proximity to (and crossing) the A17, the Poacher Railway Line and South Forty Foot Drain. In combination with routeing via a less direct route to Weston Mash, routes that use Section N11 were less preferred.
- 7.3.24 There was little to differentiate the other Sections of the Northern (Sections N8 and N9), Central (C14 to C19) and Southern Corridors (Sections S9 to S11); all require the crossings of drains, roads and contain scattered visual, recreational and heritage receptors.
- 7.3.25 A route utilising Sections C14 to C16 and into Section S8 (via Link C16-S8) is considered the emerging preference. It takes the most direct route towards the Weston Marsh siting zones and contains few significant constraints to routeing an overhead line. At Section S8 and into Section S9 there are multiple crossings of linear features (the A1121, A52, South Forty Foot Drain, New Hammond Beck, Old Hammond Beck and Poacher Railway Line), however all these features run perpendicular to an overhead line route and therefore technical complexity associated with these crossings is not significant. A more direct overhead line route will also help to limit the potential for spreading landscape and visual impacts. An overhead line route here would have to overcome a narrow area at the A52, although routeing west (within Section S9) would reduce the technical complexity and help to limit potential visual impacts.
- 7.3.26 Comparing the remaining Sections (N12, N13, N14, S10A, S10B and S11) south towards the Weston Marsh siting zones, routeing an overhead line in Section N12 and N13 would result in 400 kV overhead lines (the 400 kV 4ZM overhead line and the proposed overhead line) either side of the village of Bicker with close paralleling only achievable once within Section N14. Therefore, Sections N12 and N13 are less preferred than Sections S10A, S10B and S11 which are further separated (at route here could be at least 400 m further east) from the 4ZM 400 kV overhead. When comparing Sections S10A and S10B, Section S10B included additional residential properties, a narrower area for routeing (at its southern extent) and passes closer to listed buildings. Sections S10A and Section S11 are therefore considered the emerging preference.
- 7.3.27 Overall, from an environmental, technical and Holford Rule compliance perspective the emerging preference between Frithville and the B1397 Spalding Road uses Sections C14 to C16, Link C16-S8, and Sections S8, S9, S10A and S11.

### **Summary of Decision**

- 7.3.28 The following Sections are more preferred and therefore selected to progress at this stage:



- Central Corridor Sections C14 to C16 – A route using Sections C14 to C16 were preferred as they provide a more direct route and contain few features that significantly constrain the routing of an overhead line.
- Southern Corridor between S8 and S11 (utilising S10A) - Routing through Section S8 into Section S9 would allow an overhead line route to be more direct (and therefore in greater compliance with Holford Rule 3). Routing via the western leg of Section S9 is preferred. Sections S10A and S11 are less likely to create a wirescape with the 4ZM 400 kV overhead line or result in encircling settlements.
- Central Corridor to Southern Corridor via Link C16-S8 - Use of Link C16-S8 would allow the most direct route to be taken between the preferred Sections C16 and S8.

7.3.29 The following are less preferred and therefore not progressed at this stage:

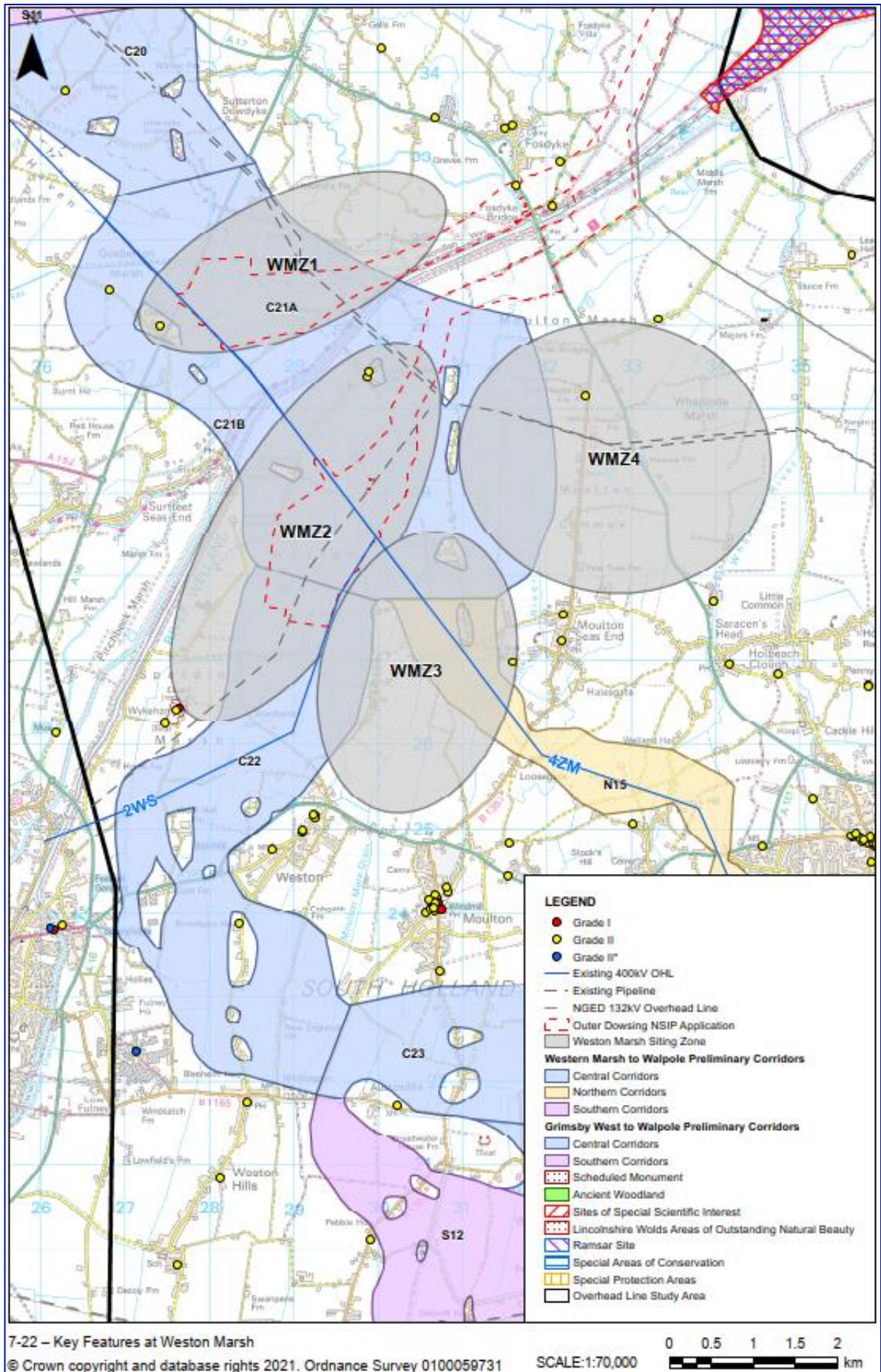
- Central Corridor between C17 and C19 - A route utilising the Central Corridor between these Sections would have to be considerate of scattered constraints but would require a route into Sections N11 and N12 which is constrained when compared to the Southern Sections within this area and is overall less direct (not in line with Holford Rule 3).
- Northern Corridor Sections N8 to N14 - Sections N8 to N14 would require an increased length of overhead line and has the potential to create a wirescape and encircle the village of Bicker.
- Southern Corridor Sections S7 and S10B - Sections S7 has a narrow area at its southern extent where there is a watercourse crossing. As a result, it is a less preferred route into Section S8. Section S10B contains a narrow area at its southern extent and has the potential to impact on more residential receptors, listed buildings and a Conservation Area.
- Northern Corridor to Central Corridor via Links N9-C18 and N10-C19 - Links N9-C18 and N10-C19 connected less well to the previous emerging preference of Section C15 and, although they would help to avoid a narrower area around the Heckington Fen Solar Farm and nearby scheduled monument, they would result in onward routing to Sections N11 and N12 (which are less preferred and result in a less direct route).
- Central Corridor and Southern Corridor Links C15-S7/S7-C15 and S8-C16 - Links between the Central and Southern Corridors would require a less direct route and a greater number of angle pylons and therefore were considered less compliant with Holford Rule 3.
- Northern Corridor to Southern Corridor via Links N13-S10A and S10A-N13/N13-S10A - Link N13-S10A would be a less direct route and require the use of additional angle pylons and was therefore considered less compliant with Holford Rule 3. The use of Link S10A-N13/N13-S10A would be more technically complex due to the presence, and crossing, of the Hatton to Gosberton gas pipeline.

## Stage 3 - Weston Marsh

7.3.30 Stage 3 considered the Sections C20, C21A and C21B between the B1397 and Moulton Seas End which would overlap with the Weston Marsh siting zones.

7.3.31 The defined components of the Weston Marsh siting zones and the Sections are shown on **Figure 7-22**.

Figure 7-22 – Key Features at Weston Marsh



7.3.32 Both the Northern and Southern Corridors merge to the Central Corridor within Section C20 and therefore this must be used. When comparing Sections C21A and C21B, both would require crossing the River Welland and the A16, and have the potential to result in adverse effects upon heritage receptors. They also have the potential to result in a wirescape with the 4ZM 400 kV overhead line without careful routeing (closely parallel). Whilst Section C21A contains the Hatton to Gosberton gas pipeline, Section C21B would require crossing the 4ZM 400 kV overhead line. Overall, there is a preference for Section C21A as this would avoid crossing and offer the opportunity to parallel the 4ZM 400 kV overhead line.

### Summary of Decision

7.3.33 The following Sections are more preferred and therefore selected to progress at this stage:

- Central Corridor Sections C20 and C21A – There are few material constraints to routeing within Section C20 and use of Section C21A is preferred as it would avoid crossing the 4ZM 400 kV overhead line.

7.3.34 The following are less preferred and therefore not progressed at this stage:

- Central Corridor Sections C21B – A route using this Section would require crossing the 4ZM 400 kV overhead line which is less preferred.

7.3.35 Overall, siting zones WMZ2 and WMZ3 are considered the emerging preference subject to onward routeing from Weston Marsh to Walpole. Overall, there is a preference for Section C21A as this would avoid crossing and offer the opportunity to parallel the existing 4ZM 400 kV overhead line.

### Conclusion

7.3.36 Overall, when considered in isolation, the emerging preferred corridor between Burgh le Marsh and Weston Marsh is an overhead line in Sections C8 to C13, N6 to N7, C14 to C16, Link C16-S8, Sections S8 to S10A, and Sections S11, C20 and C21A. This however will be subject to the identification of the emerging preferences for the Weston Marsh siting zones (set out in **Chapter 11**). The emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14**.

# 8. Options Appraisal – Weston Marsh to Walpole

## 8.1 Introduction

- 8.1.1 This Chapter outlines the Options Appraisal (Step 7 as described in **Chapter 4**) for the corridors between Weston Marsh and Walpole (see **Figure 8-1**). The preliminary corridors have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6). The Options Appraisal for the Weston Marsh siting zones is set out in **Chapter 11** and the Options Appraisal for the Walpole siting zones is set out in **Chapter 12**.
- 8.1.2 As described in **Chapter 5**, the corridor identification exercise identified three preliminary corridors between Weston Marsh and Walpole and 14 connection links these include the:
- Northern Corridor – Sections of which are denoted with the prefix “N” e.g., northern corridor section 1 is known as Section N1;
  - Central Corridor – Sections of which are denoted with the prefix “C” e.g., central corridor section 1 is known as Section C1;
  - Southern Corridor - Sections of which are denoted with the prefix “S” e.g., southern corridor section 1 is known as Section S1; and
  - Connection links - Named according to the sections they join, e.g., Section N1-C10 provides a link from section 1 of the Northern Corridor to section 10 to the Central Corridor.
- 8.1.3 The corridors and their associated sections are shown on **Figure 8-1**, **Figure 8-2**, **Figure 8-3**, and **Figure 8-4**.
- 8.1.4 Key constraints for the corridors between Weston Marsh and Walpole are shown on **Figure 8-5**.

Figure 8-1 - Corridors between Weston Marsh and Walpole

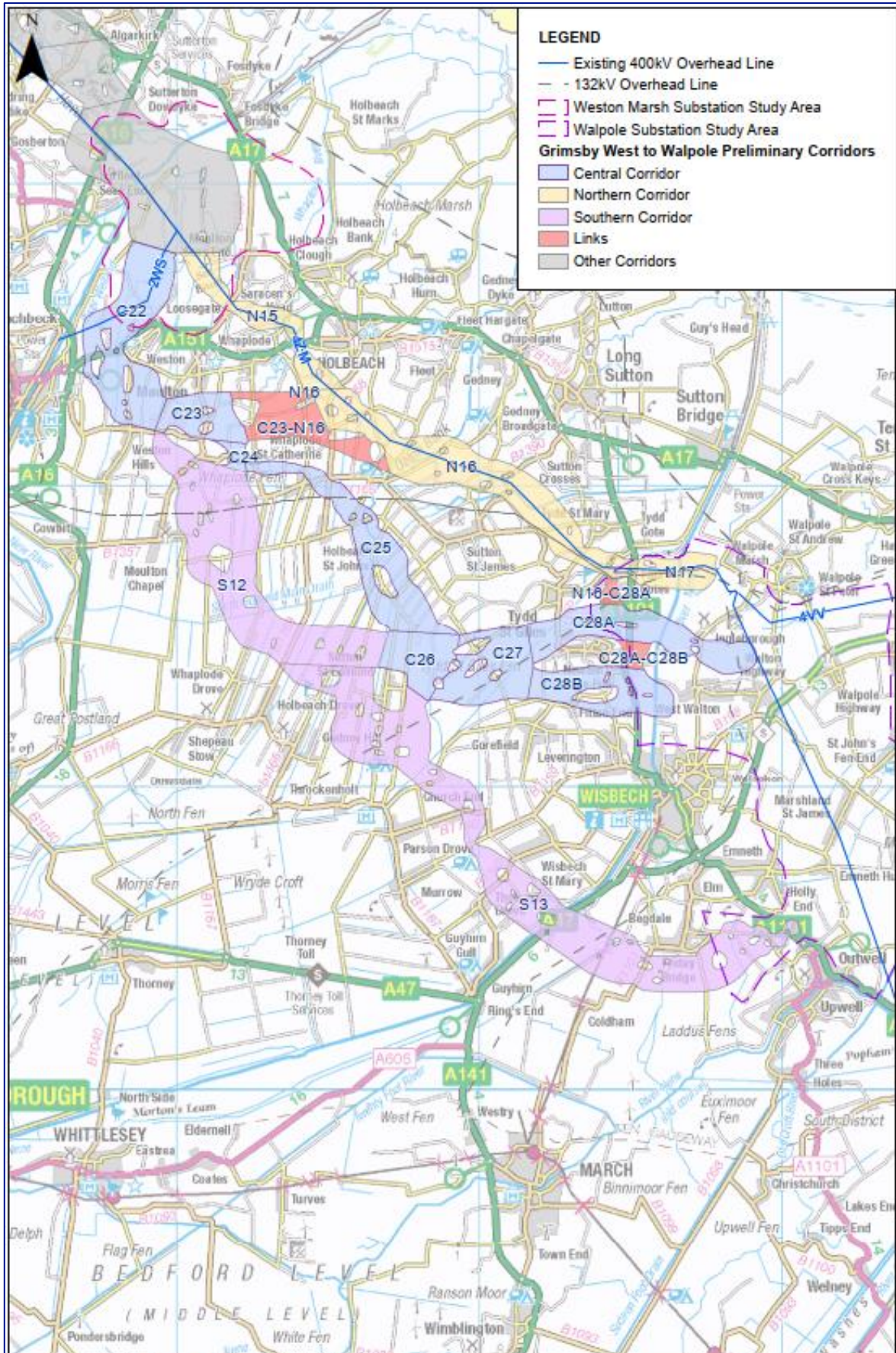


Figure 8-1 - Corridors between Weston Marsh to Walpole

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SCALE: 1:200,000 0 1 2 3 4 km

Figure 8-2 - Corridors between Weston Marsh and Whaplode St Catherines

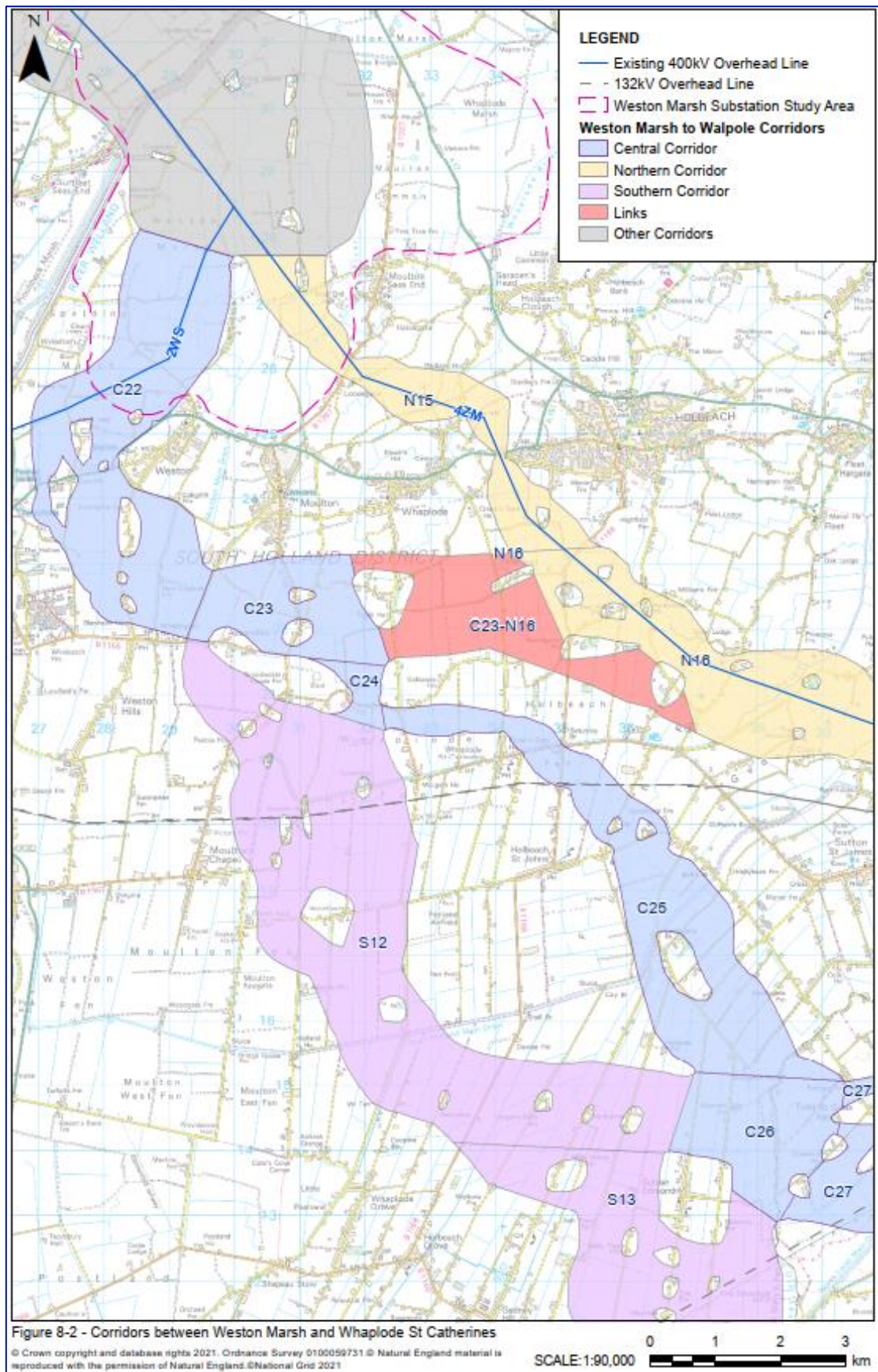


Figure 8-3 – Corridors between Whaplode St Catherines to Walpole

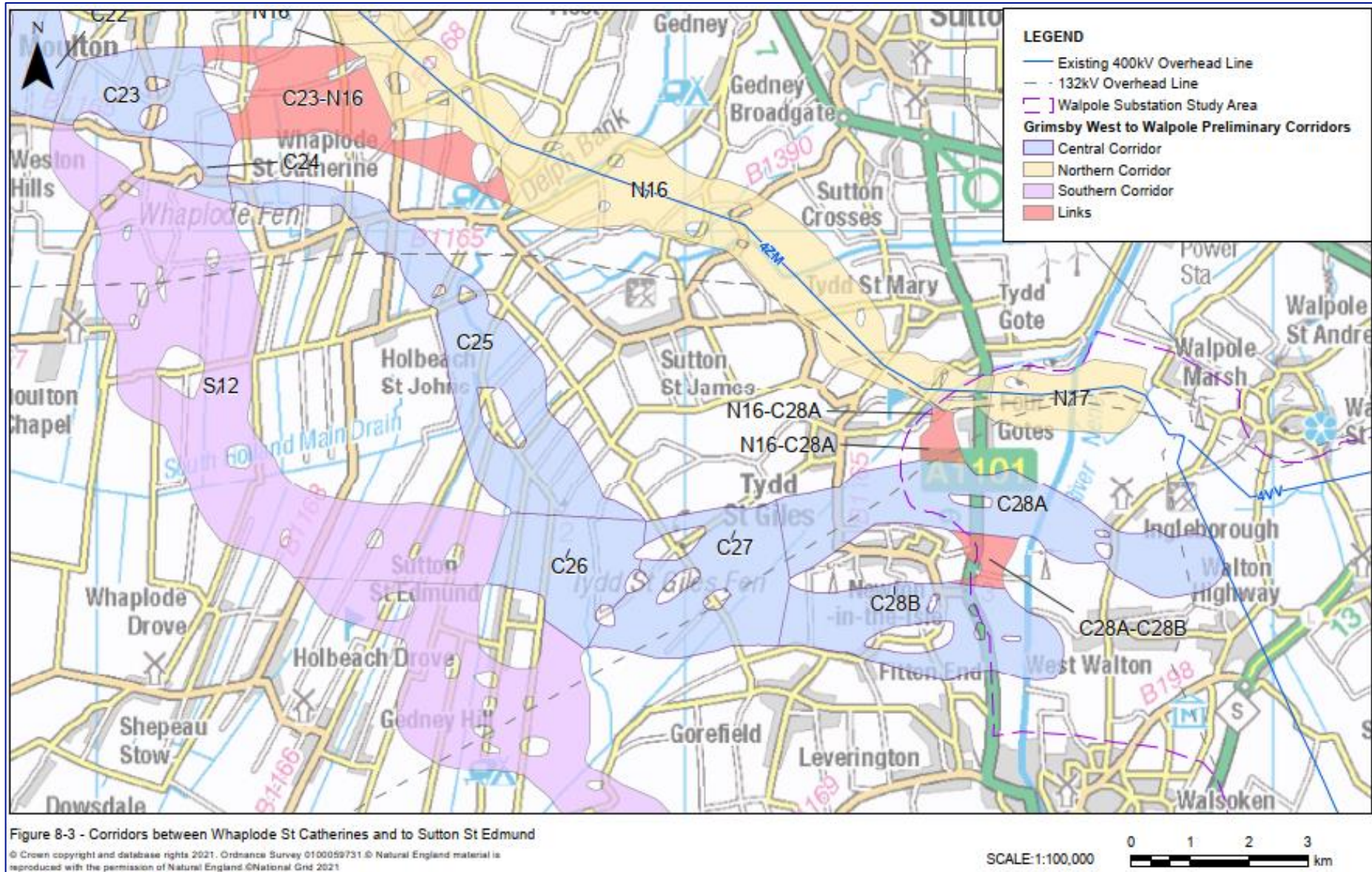


Figure 8-4 - Corridors between Sutton St Edmund and Emneth

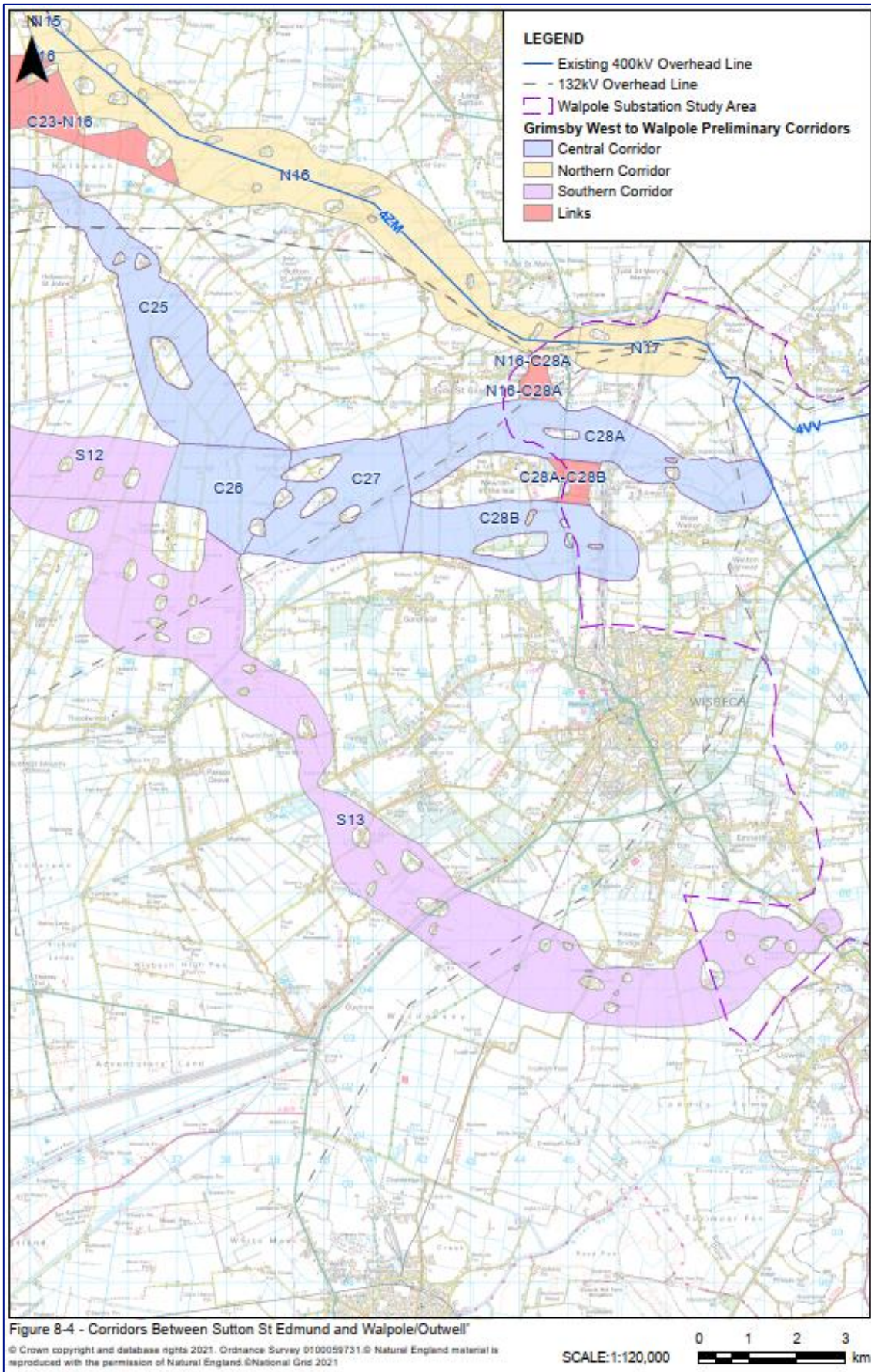
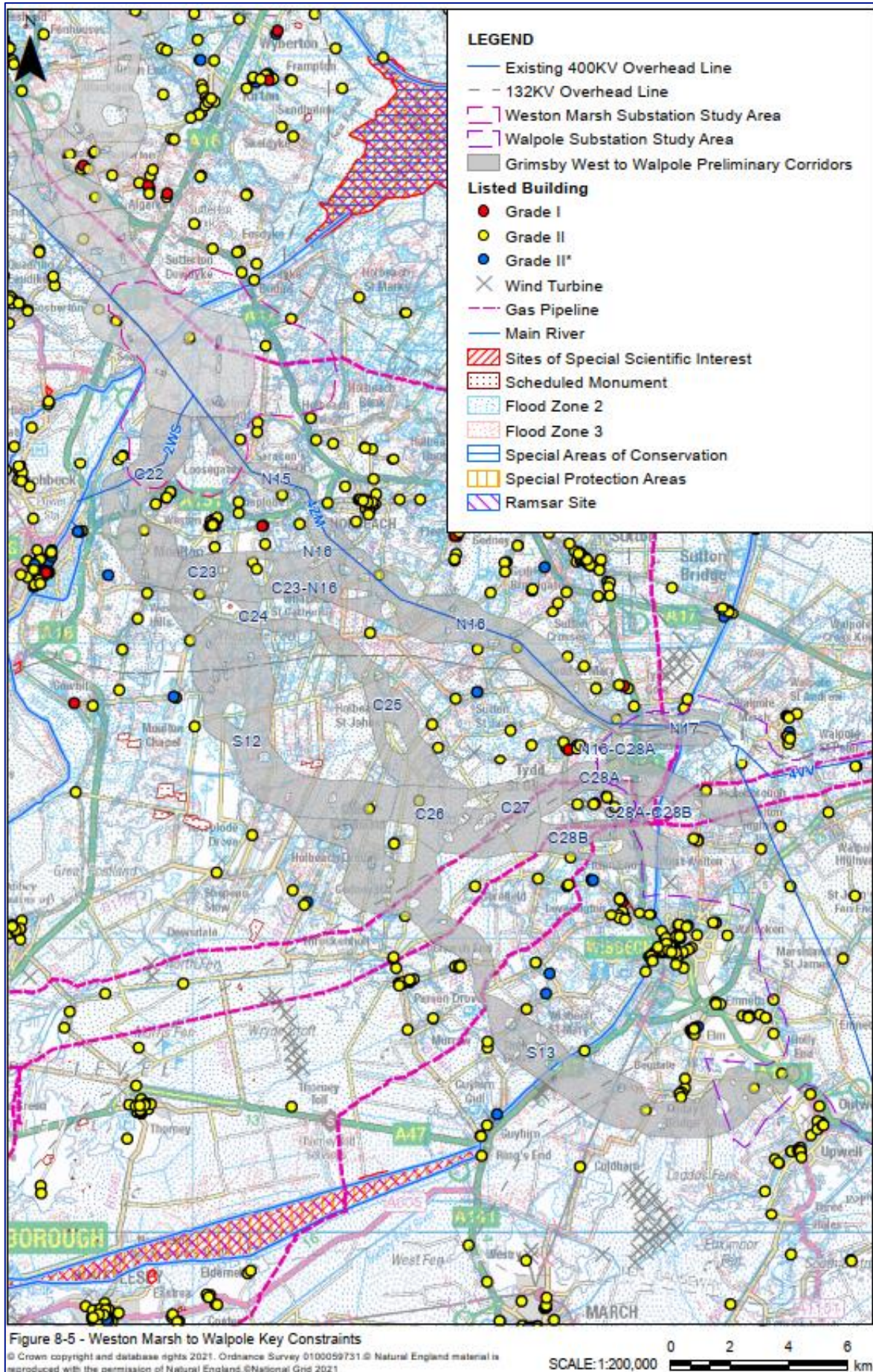




Figure 8-5 – Weston Marsh to Walpole Key Constraints



## 8.2 Options Appraisal

- 8.2.1 The Options Appraisal below has considered environmental, socio-economic and technical topics for each Link and each Section within each of the corridors. The appraisal was informed by the data gathered as outlined in **Table 5-1** and **Table 5-2**. For the current Project stage, relevant data comprises desk study information, supplemented by a site visit to select locations, on important receptors.

### Northern Corridor (Sections N15 to N17)

- 8.2.2 The Northern Corridor (Sections prefixed with 'N') is shown in Figure 8-6. It starts immediately west of Moulton-Seas-End from the southern end of Sections C21A and C21B. From here the Corridor follows the route of the 4ZM 400 kV overhead line, which routes through the centre of the Corridor, ending to the west of the existing Walpole 400 kV substation. From its start at Section N15, the Corridor routes south-east, crossing the B1357 south of Moulton-Seas-End and then A151 between Holbeach and Whaplode. Here it continues south-east into Section N16 where it crosses the B1168 south of Holbeach and the B1390 north-east of Sutton St James. The Corridor then continues south-east crossing South Holland Main Drain and routes near a NGED 132 kV overhead line between Tydd St Giles and Tydd St Mary. The Corridor then routes directly east, crossing North Level Main Drain and the A1101 into Section N17. From Section N17 it overlaps with the Walpole siting zone WLP1 where two DNO (one NGED and one UKPN) 132 kV overhead lines are present.
- 8.2.3 The Northern Corridor is located furthest north of the corridors appraised between Weston Marsh and Walpole. Notable constraints for this corridor include the 4ZM 400 kV overhead line, residential properties, priority habitats, designated heritage assets such as listed buildings and scheduled monuments, Tydd St Giles Golf and Country Club, areas of Flood Zones 2 and 3 and watercourses. These constraints are shown on **Figure 8-7**.
- 8.2.4 In addition to the corridor itself, there is a Link between the Northern Corridor and the Central Corridor which is located to the east of the North Level Main Drain and the west of Four Gotes. The N16-C28A Link has been provided to allow potential routes into alternate Walpole siting zones.

### Northern Corridor Close Parallel Alignment

- 8.2.5 The Northern Corridor between Weston Marsh and Walpole has been defined to explore the potential benefits (described in **Paragraph 5.6.24**) which could arise from seeking a close parallel route alongside existing electricity transmission infrastructure. The 4ZM 400 kV overhead line which runs in this corridor as existing overhead lines assets, has similar pylon heights and spans which could be closely matched by the new Grimsby to Walpole circuits (in line with Holford Rule 6 – wherever practicable, parallel routes are planned to form a coherent appearance).

Figure 8-6 - Weston Marsh to Walpole Northern Corridor – Key Constraints

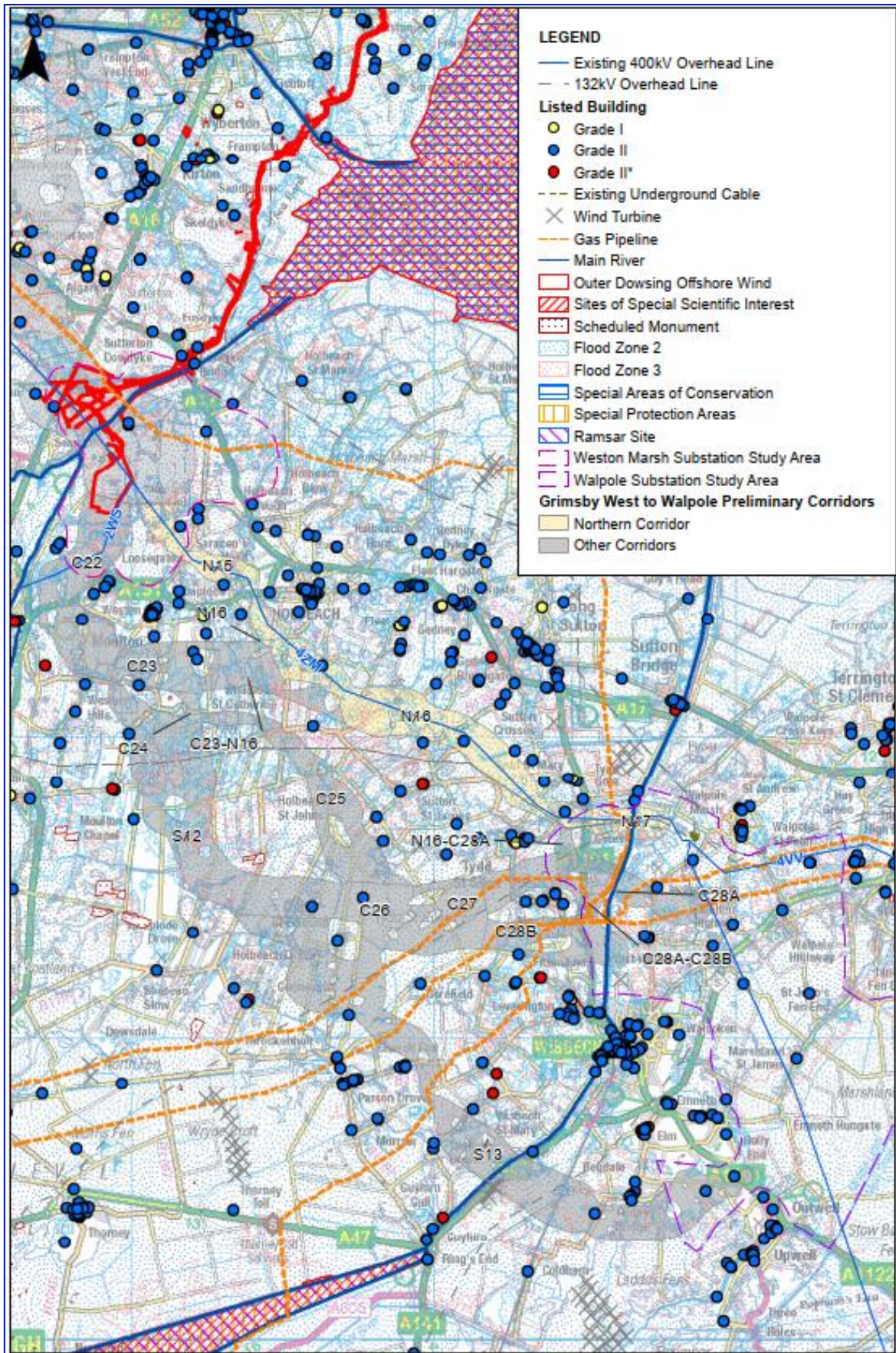


Figure 8-6 - Weston Marsh to Walpole Northern Corridor – Key Constraints

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SCALE: 1:200,000 0 2 4 6 km

- 8.2.6 As detailed in **Chapter 5**, it is not always feasible to site pylons adjacent to each other if there are constraints present alongside the existing pylons. Where these constraining features impede a close parallel alignment, there may be a need to cross the existing overhead line. A preliminary review of potential different close parallel solutions was undertaken by the FEED Contractor to identify the feasibility of a close parallel solution, and to inform the appraisal of the Northern Corridor. Ordinarily this level of design detail would not be undertaken at this stage of a project but in this instance, it was considered beneficial in terms of being able to appraise the optimal solution for the Northern corridor. The initial options are for a full (i.e., no deviations) close parallel alignment to the:
- North of the 4ZM 400 kV overhead line (Option 1) that utilises no overhead line duck-unders, cable duck-unders or line swap overs to maximise the potential landscape and visual benefits of an optimal close parallel solution.
  - South of the 4ZM 400 kV overhead line (Option 2) that utilises no overhead line duck-unders, cable duck-unders or line swap overs to maximise the potential landscape and visual benefits.
- 8.2.7 The review identified 15 areas where potential features exist that impede Option 1 and Option 2. More constraining features were identified for Option 1 (13 areas) than for Option 2 (eight areas) and therefore Option 2 would be less technically constrained. These features are primarily residential properties and using Option 1 or Option 2 may result in the need to acquire residential property or require owners to temporarily vacate them (referred to as 'acquisition' in this report).
- 8.2.8 As detailed in **Chapter 5**, overcoming the features constraining a close parallel route would require the use of either a line-swap over, taller pylons, overhead line duck-unders, or a cable duck-under, subject to engineering preference as well as detailed landscape and visual impact assessments. Each use of these engineering methods would increase the technical complexity of construction and would increase the required permanent infrastructure (for example overhead line duck-unders would require use of additional pylons including angle pylons). In addition, the use of these engineering methods increases the potential for significant adverse environmental impacts on nearby receptors and would be worse than the potential benefits of an optimal close parallel. Furthermore the use of these engineering methods would also increase the overall cost of construction and the length of the construction programme. For example, an overhead line duck-under would likely require use of multiple angle pylons and result in an area of inconsistent span length and pylon heights, resulting in increased visual clutter and significantly reducing the benefits of close paralleling in that area. A cable duck-under would require the use of SECs which would result in additional visual clutter for receptors in their proximity. Line swap overs may require existing overhead lines to be re-routed or require temporary diversions for longer periods and may also result in an area of inconsistent span length and pylon heights.
- 8.2.9 To seek to reduce the potential impacts upon features (primarily residential properties) that impede Option 1 and Option 2, three more options were considered. These options, detailed below are not north or south specific but instead provide flexibility to route in close parallel either side of the 4ZM 400 kV overhead line:
- Option 3 – sought to maximise paralleling by combining the use of overhead line duck-unders and line swap overs. This option still has the potential to impact upon several residential properties (which may result in acquisition).

- Option 4 – is a variation of Option 3 which looks to reduce the number of overhead line duck-unders and line swap overs by instead increasing the deviation of the close parallel alignment. This option still has the potential to impact upon several residential properties (which may result in acquisition).
- Option 5 - is a variation of Option 3 which looks to reduce the number of overhead line duck-unders and line swap overs by instead including a cable duck-under at a narrower area where the Northern Corridor crosses the A151. This option still has the potential to impact upon several residential properties (which may result in acquisition).

8.2.10 Although use of Options 3, 4 and 5 would reduce the number of constraining features when compared to a full close parallel route (provided by Option 1 and Option 2), it would not significantly reduce this number. In addition, the use of Options 3, 4 and 5 would increase the technical complexity of construction, result in additional costs, result in a lengthier construction programme, would (subject to the specific option) require outages on the 4ZM 400 kV overhead line and would erode the environmental benefits (primarily landscape and visual) offered by Options 1 and 2.

8.2.11 Therefore, the optimal close parallel technical solution is considered to be Option 2 (a close parallel route to the south of the 4ZM 400 kV overhead line) and this optimal technical solution (described in this report as ‘the close parallel route’) has been used as the basis of the appraisal detailed below.

## Environmental Factors

### Landscape and Visual

8.2.12 The Northern Corridor lies within the Fens National Character Area (NCA 46) which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The Northern Corridor and its Link are over 10 km away from any nationally designated landscapes and impacts to designated landscapes are therefore not expected to occur.

8.2.13 Continuing from Section C21A/C21B (detailed in **Chapter 7**), the Northern Corridor and its associated Connection Link are located within an open landscape which contains the 4ZM 400 kV overhead line. The existing electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. Running close parallel to the existing overhead line, this would intensify existing adverse impacts on the landscape and on visual amenity and would require oversailing, encircling or removal of residential properties. However, running close parallel would limit the spread of landscape and visual effects by introducing an overhead line into an area which is already affected and would help to reduce the potential for a wirescape.

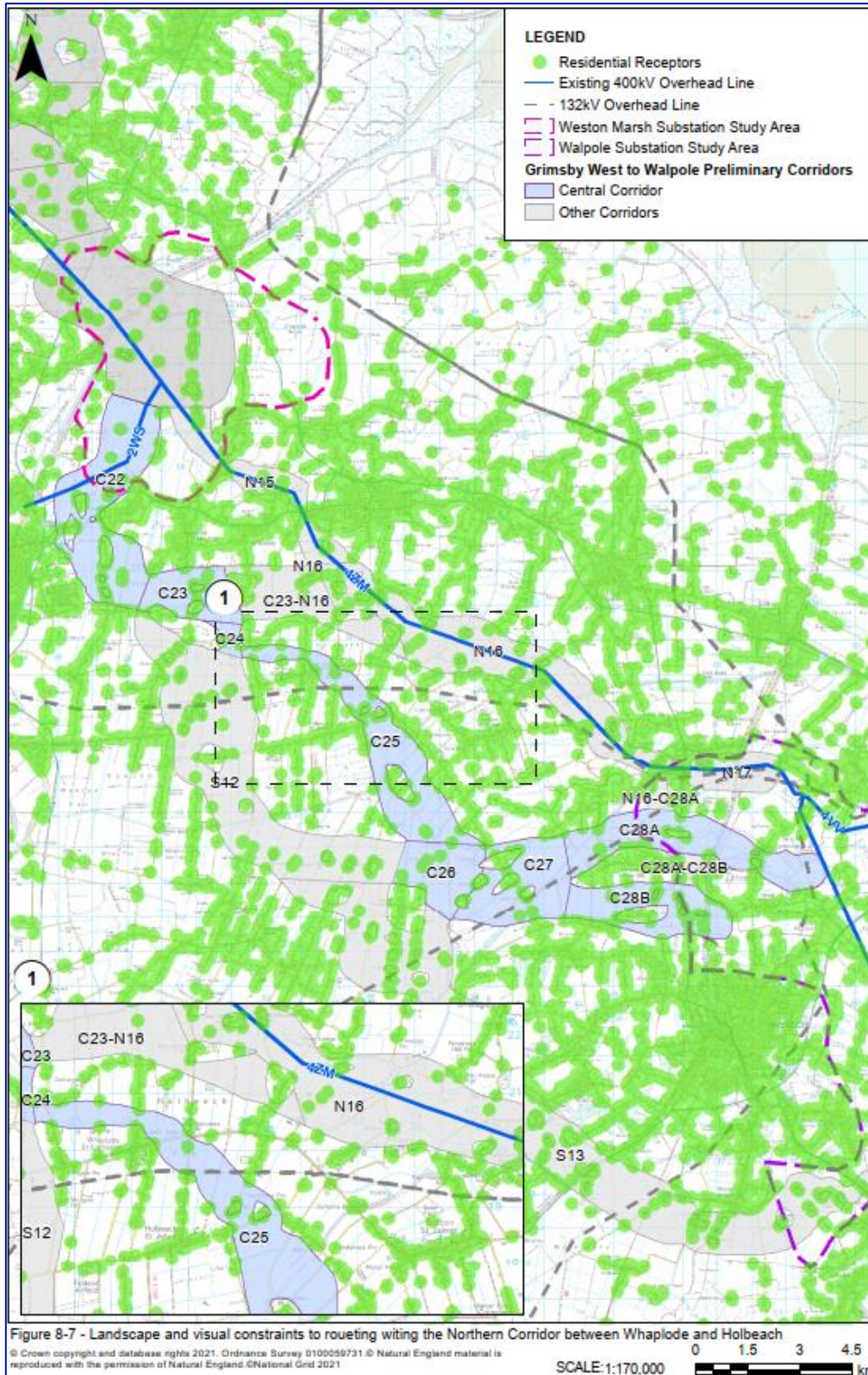
8.2.14 Within Section N15 the close parallel route will exit the new Weston Marsh substation. Here it should be considerate of both the 4ZM and 2WS 400 kV overhead lines. A crossing of the 2WS 400 kV overhead line may be required, and if this is the case through later design development there is the potential for additional impacts due to the requirement of SECs. The key residential receptors for this Section include those located at the villages north and south of the 4ZM 400 kV overhead line including Loosegate, Moulton Seas End, Weston, Moulton, Whaplode, Saracen’s Head, and those at the west and south of Holbech. Key recreational receptors are users of the Whaplode River, Spalding Cricket Club and other recreational facilities within the

villages identified above. The close parallel route would have potential for adverse impacts on the landscape and visual amenity in combination with the existing overhead lines on both the residential and recreational receptors. These impacts would be most prominent at Whaplode, Holbeach and individual properties (some of which would be oversailed or encircled) at Loosegate, along Stockwell Gate and at a crossing of the A151 where the Corridor narrows (and an overhead line would be in closer proximity).

- 8.2.15 Moving south-east in Section N16, there are several clusters of residential properties likely to be oversailed or encircled by the close parallel route. In addition, south of the South Holland Main Drain a NGED 132 kV overhead line is present within the Section until its eastern boundary at the A1101. Due to the presence of this existing 132 kV overhead line, there is the potential for the close parallel route to contribute to an increased wirescape. To reduce the potential for this, modification of the NGED 132 kV overhead line is likely to be required to materially reduce potential impacts. The mitigation of this 132 kV overhead line may also provide the opportunity to reduce any potential wirescape that currently exists (from the NGED 132 kV and 4ZM 400 kV overhead lines), but this would increase the overall cost of the northern corridor. At the east of the Section a crossing of the North Level Main Drain would be required which would require larger pylons, like those for the 4ZM 400 kV overhead line, and a crossing of the A1101. The key residential receptors for this Section include those located at the villages north and south of the 4ZM overhead line including Holbeach, Fleet, Long Sutton, Tydd St Mary, Sutton St James, Tydd St Giles, Tydd St Mary and Tydd Gote as shown in **Figure 8-7**. Key recreational receptors are users of the South Holland Main Drain, North Level Main Drain, NCN Route 1, Tydd St Giles Golf Course and other recreational facilities within the villages identified above. The close parallel route would have potential for adverse impacts on the landscape and visual amenity in combination with the existing overhead lines on both the residential and recreational receptors. These impacts would be most prominent at: Sutton St James, where a route would be near to the NGED 132 kV overhead line and require crossing South Holland Main Drain; Tydd St Mary, Tydd St Mary and Tydd Gote, where the Corridor narrows, would be near to the NGED 132 kV overhead line and would require crossing the North Level Main Drain; and individual properties (some of which would be oversailed or encircled) at Huddletree Bank, the B1390 Wonton's Cross Gate/Sutton Road, Hannath Road, Swallow Lane and for the Tydd St Giles Golf Course.
- 8.2.16 From Section N16 there is potential to use Link N16-C28A to connect into the Central Corridor. This short link is open and level, however, it would require deviation from the close parallel route and crossing an NGED 132 kV overhead line that increases the potential for a wirescape. Key visual receptors for the Link are residential properties at Newton-in-the-Isles, Four Gotes, Tydd St Giles and those along the A1101, and recreational users of the Tydd St Giles Golf Course.
- 8.2.17 Continuing from Section N16 into N17 the NGED 132 kV overhead line is still present. This overhead line, the 4ZM 400 kV overhead line, a UKPN 132 kV overhead line (routeing from the south-east) and a 400 kV overhead line from Sutton Bridge Power Station are all present in this Section. Here the close parallel route will have to be developed to seek to avoid further contributing to a wirescape, especially due to larger pylons required to cross the River Nene. Modification of the existing 132 kV overhead lines should be considered in detail alongside the potential line entries to a new Walpole substation, and if applicable, into the existing Walpole substation to limit adverse landscape and visual impacts. Key visual receptors for this Section are residential properties at Tydd St Mary, Tydd Gote, Tydd St Mary's Marsh, Tydd St Giles, Foul Anchor and Four Gotes Walpole Marsh and recreational users of the River Nene and Nene Way National Trail ('Nene Way'). As with the other Sections of the Northern

Corridor, the close parallel route would have potential for adverse impacts on the landscape and visual amenity in combination with the existing overhead lines on the residential and recreational receptors, especially due to convergence of multiple overhead lines.

Figure 8-7 – Landscape and visual constraints to routing within the Northern Corridor between Whaplode and Holbeach



## Ecology

- 8.2.18 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological assets where possible, and there remain few designated and important ecological areas identified within and in proximity to the Northern Corridor and the Connection Link N16-C28A. Those identified are appraised below.
- 8.2.19 The Northern Corridor and Link N16-C28A are located over 6 km from the nearest NSN and Ramsar Sites. The closest is Section N15 located approximately 6.3 km south of The Wash designated sites, as described in Paragraph **6.2.83**. Impacts upon NSN and Ramsar sites are predominantly limited to potential pollution pathways and functionally connected habitats and the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA (conducted in the absence of mitigation), as the Project development progresses. However, for the purposes of Options Appraisal, those corridors, sections and links located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. Due to the distances between the Northern Corridor and the designated sites, the likelihood of significant effects is low. Should the HRA identify adverse effects on the integrity of these the emerging preferences identified will be revisited.
- 8.2.20 The close parallel route would help to avoid the introduction of a new overhead line over open stretches of large drains and the River Nene. The advantages associated with the close parallel route results from the grouping, rather than separation, of infrastructure which would reduce the potential for adverse impacts on birds as their flightpaths would likely already avoid the existing overhead line. However, there is the potential for adverse ecological impacts associated with introducing a new overhead line as two overhead lines would result in a wider area of avoidance for bird species travelling along watercourses.
- 8.2.21 No other SSSIs, except those identified above, are within 2 km of the Northern Corridor or its Link (N16-S28A).
- 8.2.22 Other important habitats identified within the Northern Corridor and its Link comprise priority habitats. Those habitats present are:
- Coastal and floodplain grazing marsh priority habitat within all Sections and within Link N16-C28A.
  - Deciduous woodland priority habitat within Section N16.
  - Mudflats priority habitat within Section N17.
  - Traditional orchard priority habitat is adjacent to Section N16.
- 8.2.23 There is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the extent of the priority habitat areas within these Sections and Link N16-C28A is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures.

## Historic Environment

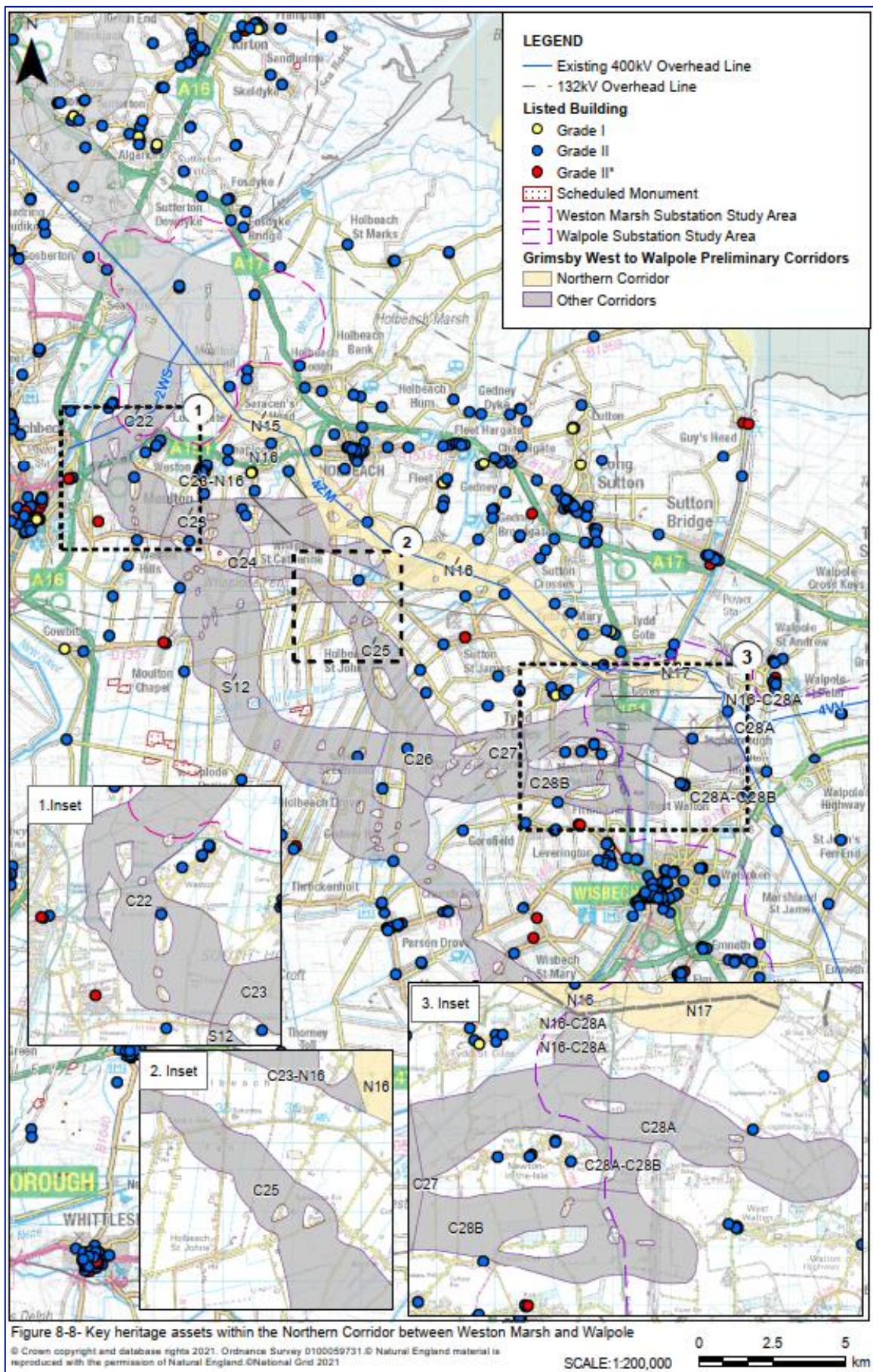
- 8.2.24 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few identified within and in proximity to the



Northern Corridor and its Link (N16-C28A) between Weston Marsh and Walpole. Those identified are appraised below.

- 8.2.25 The only designated heritage asset located within the Northern Corridor and Link N16-C28A is the Foreman's Bridge Grade II listed building within Section N16. Due to the localised nature of this heritage asset, it is considered that direct impacts could be avoided through careful routeing. Should this occur then impacts on designated heritage assets are limited to affects upon their setting.
- 8.2.26 There are numerous designated heritage assets within 1 km of the Corridor and its Link, the majority of which comprise scattered Grade II listed buildings near to Section and Link boundaries. There are also small clusters of other designated heritage assets located at the villages of Moulton Seas End, Whaplode and Tydd St Mary. The most notable (shown in Figure 8-8) in proximity are:
- a Grade II listed building, *Whaplode House*, located 140 m south of Section N15;
  - one scheduled monument, *White Cross*, 80 m north of Poultry Farm, located immediately adjacent to the south of Section N16;
  - two Grade II listed buildings, *Hurdle Tree Bank House* and *Hannath Hall*, located within areas specifically excluded from Section N16;
  - a Grade II listed building, *Woad Farmhouse*, located 80 m east of Section N16; and
  - a Grade II listed building, *County Boundary Post*, located 120 m north of Section N17.
- 8.2.27 The close parallel route is likely to intensify impacts upon the setting of those assets already affected by the existing overhead line due to the additional presence of the new overhead line. The *Foreman's Bridge* Grade II listed building is not currently considered to require oversailing (subject to detailed engineering studies) however the close parallel route would be within 50 m of this asset and therefore the potential for significant adverse impacts to its setting are increased.

Figure 8-8 – Key heritage assets within the Northern Corridor between Weston Marsh and Walpole



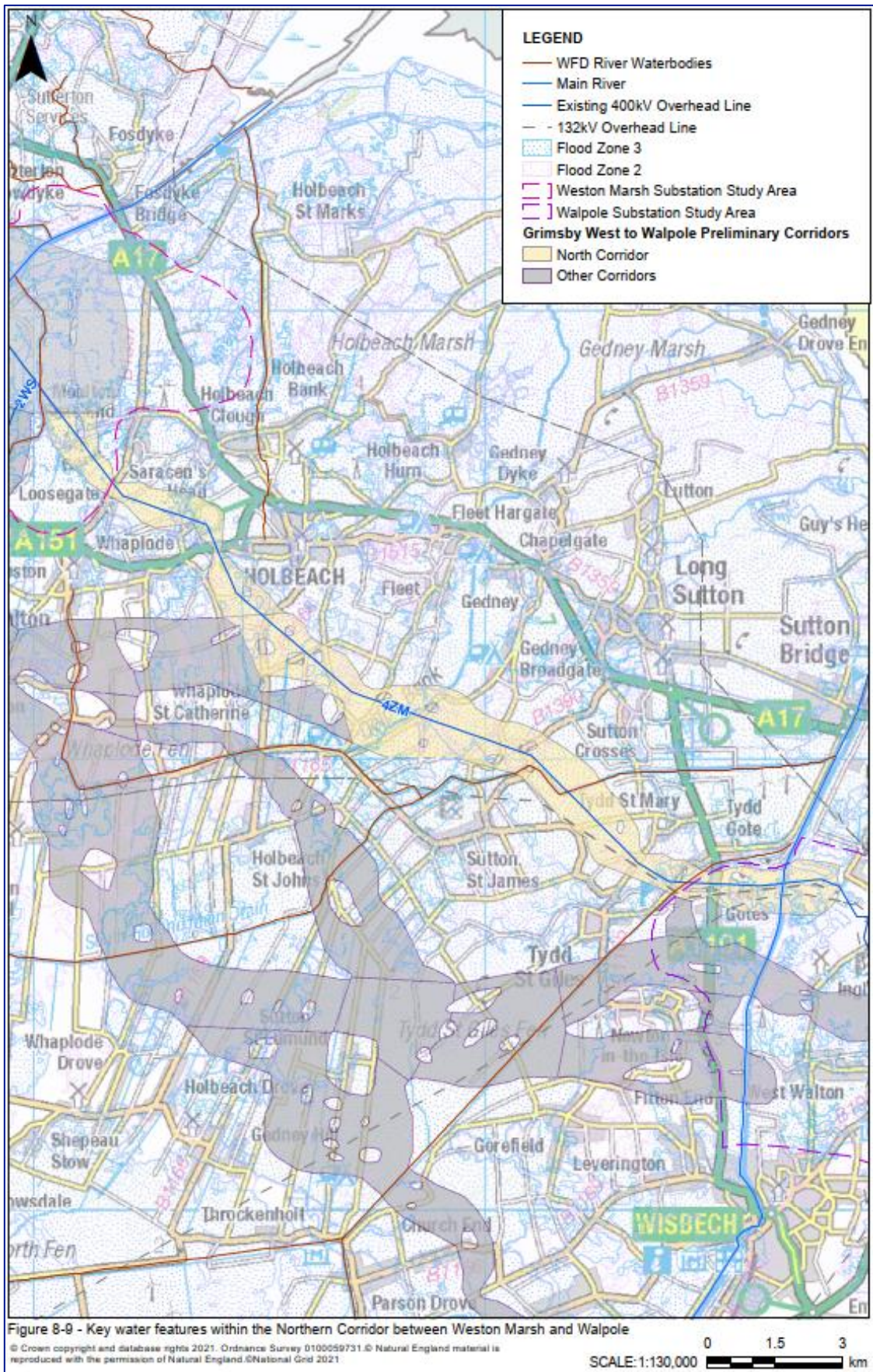
## Socio-economics

- 8.2.28 There are few socio-economic features located within or near the Northern Corridor and its Link (N16-C28A) between Weston Marsh and Walpole. Those identified are:
- Tydd St Giles Golf and Country Club at the south of Section N16;
  - the NCN Route 1 which crosses north to south through Section N16; and
  - The River Nene, a navigable waterway, which is crossed by Section N17.
- 8.2.29 These features are already impacted by the 4ZM 400 kV overhead line and/or 132 kV overhead lines and the addition of a new overhead line (the close parallel route) would intensify impacts. However, given the nature of these features adverse impacts are not likely to be significant.
- 8.2.30 As detailed in **Paragraph 8.2.51**, the close parallel route is likely to impact upon a number of residential properties and may potentially result in acquisition, oversail or removal. Where reasonably practicable, avoidance of residential property (including its curtilage) during routeing is an important objective and is important to consider in decision making. As described within **Paragraph 5.9.5**, these impacts are not considered as part of the socio-economic appraisal but will be considered in determining the end-to-end solution.

## Other Considerations

- 8.2.31 Other environmental topics were also considered as part of the Options Appraisal and included air quality, noise and water.
- 8.2.32 Residential receptors are predominantly located outside the Corridor and its Link (N16-C28A). Within the Corridor and Link there are scattered, sparsely distributed residential, commercial and agricultural properties throughout. There is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality impacts are anticipated during operation. The close parallel route would result in an intensification of noise impacts in combination with the 4ZM 400 kV overhead line for properties in closest proximity.
- 8.2.33 As outlined in **Chapter 5**, all the Corridor and its Link are almost completely covered by areas of Flood Zones 2 and 3 and it cannot be avoided even through careful routeing. All the Corridor and its Link contains field drains and all contain either a statutory main river and / or a WFD river waterbody, see **Figure 8-9**. In addition to field drains, the watercourses present within each Section or Link comprise:
- Section N15 – Two WFD waterbodies (Moulton River and Whaplode River) and one IDB watercourse.
  - Section N16 – Two WFD waterbodies (South Holland Main Drain and North Level Main Drain) and two IDB watercourses.
  - Section N17 – River Nene WFD waterbody and two IDB watercourses.

Figure 8-9 – Key water features within the Northern Corridor between Weston Marsh and Walpole



## Summary

8.2.34 The close parallel route (described in **Paragraph 8.2.31**) would limit the spread of environmental and socio-economic impacts into the surrounding areas. However, it would result in the intensification of impacts for receptors (most notably upon visual amenity and setting of designated heritage assets) in proximity to the 4ZM 400 kV overhead line due the addition of a new overhead line. There are individual receptors along the close parallel route which would suffer significant adverse effects (primarily landscape and visual) where oversailing or encircling of receptors may occur. Where residential properties are impacted this may potentially result in acquisition or removal that would have to be factored into decision making when determining a preferred end-to-end solution.

## Engineering and System Factors

- 8.2.35 There are several constraints located throughout the Northern Corridor and its Link which are considered likely to reduce routeing flexibility and/or increase the technical complexity of routeing, especially of the close parallel route.
- 8.2.36 Almost all the Corridor and its Link are covered by Flood Zone 2 and 3 and it is therefore unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction cannot take place.
- 8.2.37 The main features which reduce the routeing flexibility of the close parallel route are areas of highest amenity south of, and near to, the 4ZM 400 kV overhead line. These primarily include residential properties that would require oversailing or encircling, or woodland that would require removal. As mentioned in Paragraph **8.2.37**, overcoming the features that impede the close parallel route have been considered (i.e., by utilising methods such as overhead line duck-unders); however, the use of these engineering methods would increase the technical complexity of routeing and may require outages of the 4ZM 400 kV overhead line.
- 8.2.38 Within Section N15 those features that impede the close parallel route, in the order they are encountered from north-west to south-east, are:
- Residential properties at the crossing of the B1357.
  - Residential properties along Stockwell Gate.
  - A mix of residential and commercial properties at the A151 (where the Corridor narrows).
- 8.2.39 Within Section N16 those features that impede the close parallel route, in the order they are encountered from west to east, are:
- Residential properties and deciduous woodland priority habitat at Strong's Bank and Huddletree Bank;
  - Residential properties at the B1390 Wonton's Cross Gate/Sutton Road/ St James Road. Here the close parallel route would be required to remove an existing wind turbine and cross the B1390 before crossing the South Holland Main Drain (requiring crossing protection and taller pylons).
- 8.2.40 South of Draw Dyke, a NGED 132 kV overhead line is located parallel to the south of the 4ZM 400 kV overhead line and continues east until the end of Section N16. To

achieve the close parallel route a NGED 132 kV overhead line would require re-routing or undergrounding.

- 8.2.41 Residential properties at Hannath Road and Swallow Lane, in addition to the NGED 132 kV overhead line and Tydd St Giles Golf Course. Here the close parallel route would also require crossings of North Level Main Drain (and require taller pylons) and the A1101 which increase technical complexity.
- 8.2.42 Should Link N16-C28A be used then the residential properties at Swallow Lane could be avoided. However, this change in direction would likely increase the number of angle pylons required and therefore the technical complexity of routing.
- 8.2.43 Once across the A1101 within Section N17 those features that impede the close parallel, in the order they are encountered from west to east, are:
- The NGED 132 kV overhead line which continues east from Section N16 into the existing Walpole substation. To achieve the close parallel route the NGED 132 kV overhead line would require re-routing or undergrounding.
  - A UKPN 132 kV overhead line which routes from the south-west of the Section towards the 4ZM 400 kV overhead line and into the existing Walpole substation. To achieve the close parallel route the 132 kV overhead line would require re-routing or undergrounding.
  - High pressure gas pipelines in proximity to the River Nene and the River Nene itself (which would require larger pylons for crossing).

### Summary

- 8.2.44 Overall, the constraints that impede the close parallel route are primarily residential properties and the close parallel route would impact these properties and may require oversail, acquisition and removal. Engineering methods that could be implemented if seeking to avoid these constraints would increase technical complexity and potentially require outages of the 4ZM 400 kV overhead line and may not fully avoid impacts to residential properties. The impacts (and potential acquisition) of residential properties are important considerations and will have to be factored into decision making when determining a preferred end-to-end solution. In addition to residential properties, the close parallel route would require consideration of crossings of existing linear features (drains, rivers, gas pipelines and main roads) as well as parallel 132 kV overhead lines (which would require re-routing or undergrounding) which will increase technical complexity.

### Holford Rules

- 8.2.45 The Northern Corridor has been defined to exclude larger areas of highest amenity value and interest in accordance with **Holford Rule 1**.
- 8.2.46 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded from the Corridor. The smaller areas of high amenity value which remain within the boundaries of the Corridor comprise individual residential properties, listed buildings and priority habitats. Where there are smaller areas of high amenity value, sufficient space has been included within the Corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**. The close parallel route would require oversailing or encircling residential property and careful routing may not be able to avoid the *Foreman's Bridge* Grade II listed (subject to

detailed engineering and environmental studies) both of which would conflict with **Holford Rule 2**.

- 8.2.47 The Northern Corridor follows a more direct route (in line with **Holford Rule 3**) parallel to the 4ZM 400 kV overhead line as it routes towards Walpole.
- 8.2.48 The Northern Corridor, particularly Section N16 includes more land than is needed for construction of the close parallel route which provides flexibility and optionality when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**. It also allows the opportunity to implement the use of engineering methods to overcome features that impede the close parallel route; however, these may result in use of additional angle pylons and/or changes in direction which would be contrary to the aims and objectives of **Holford Rule 3**.
- 8.2.49 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 8.2.50 The close parallel route within the Northern Corridor would not require crossing the 4ZM 400 kV overhead line. However, if seeking to avoid oversailing or encircling properties, then crossings of this existing overhead line would be required (**Holford Rule 6**) potentially multiple times (subject to the chosen engineering solution). The close parallel route may require crossing two 132 kV overhead lines. To avoid a wirescape it is considered likely that re-routeing or undergrounding of the existing 132 kV overhead lines is likely to be required. The close parallel solution provides the opportunity to limit the potential creation of a wirescape and limit visual intrusion to areas not affected by existing infrastructure (in line with **Holford Rule 6**).
- 8.2.51 No industrial zones exist within the Northern Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

- 8.2.52 The close parallel route within the Northern Corridor follows a direct route to Walpole parallel to the south of the 4ZM 400 kV overhead line. The close parallel route would limit the potential creation of a wirescape and limit visual intrusion to areas not affected by existing infrastructure. However, not only would it result in an intensification of impacts upon receptors already affected by the 4ZM 400 kV overhead line (due to the addition of a new overhead line) but where individual features, such as residential properties, impede a close parallel route these would require oversailing, encircling or removal; or, for woodland, removal unless alternative engineering methods are employed. As detailed in **Paragraph 8.2.6**, the close parallel route appraised does not account for use of engineering methods to avoid impacting upon identified individual features as each use of such methods would result in an increase in technical complexity, may result in inconsistent span length, pylon heights, additional angle pylons, and would contribute towards the development of a wirescape, thus significantly eroding the landscape and visual amenity benefits of close paralleling. In addition to the individual features impeding the close parallel route, the presence of two 132 kV overhead lines, main roads, watercourses, gas pipelines and Flood Zones 2 and 3 are notable constraints to routeing and would have implications for design and construction.

8.2.53 A tabulated summary of the appraisal of the close parallel route within the Northern Corridor (between Weston Marsh and Walpole) is provided in **Table 8-1**.



Table 8-1 Summary of Northern Corridor Options Appraisal between Weston Marsh and Walpole

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>The presence of the 4ZM 400 kV overhead line reduces the sensitivity of the local landscape within the corridor. However, the presence of this overhead line may intensify existing adverse impacts on the landscape and on visual amenity.</li> <li>The sensitivity of the local landscape within the corridor is further reduced in Sections N16 and N17 due to the presence of two 132 kV overhead lines. Re-routing or undergrounding of the existing 132 kV overhead lines may be necessary to avoid additional cumulative landscape and visual amenity impacts and to avoid creation of a wirescape.</li> <li>There is potential for adverse impacts on views experienced by recreational receptors including users of the Whaplode River, South Holland Main Drain, NCN Route 1, River Nene and Nene Way.</li> <li>Scattered residential properties and settlements, particularly where the corridor narrows around Moulton Seas End, Holbeach and the A1101, would likely experience a significant intensification of existing adverse impacts.</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>There is potential for the Northern Corridor to have functionally connected habitats and pollution pathways to The Wash designated sites.</li> <li>River habitat and coastal and floodplain grazing marsh and traditional orchard priority habitats are within and adjacent to the Northern Corridor. These can be avoided through careful routing to reduce impacts.</li> <li>Deciduous woodland priority habitat within Section N16 and Mudflats priority habitat within Section N17 would need to be avoided to reduce impacts.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>There is the potential for significant adverse impacts to the setting of <i>Foreman's Bridge</i> Grade II listed building located within Section N16.</li> <li>Several listed buildings and scheduled monuments are scattered adjacent to the Northern Corridor and its Link. These are avoided by the close parallel route however may experience an</li> </ul>

Theme	Topic	Summary
		intensification of impacts to their setting, especially those south of and closest to the 4ZM 400 kV overhead line.
	Socio-economics	<ul style="list-style-type: none"> <li>• Tydd St Giles Golf and Country Club overlaps with the Corridor and its Link near Tydd St Giles and is a constraint to routing.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>• Almost all the Corridor is covered by Flood Zones 2 and 3 which presents a constraint since siting infrastructure within this cannot be avoided.</li> <li>• The River Nene, a navigable waterway, is crossed by Section N17.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• The close parallel solution routes south of the 4ZM 400 kV overhead line and would not require crossing this overhead line.</li> <li>• Individual features impede a close parallel route and would require oversailing, encircling, or with regards to woodland, removal if they are not to be avoided by use of engineering methods. Engineering methods employed to avoid these individual features would increase technical complexity and may require outages on the 4ZM 400 kV overhead line.</li> <li>• Existing NGED and UKPN 33 kV and 132 kV overhead lines are present within the Northern Corridor and Link N16-C28A which would require removal or undergrounding to ensure there is sufficient space prior to the construction for a new close parallel overhead line.</li> <li>• The South Holland Main Drain, North Level Main Drain, River Nene and several main roads would require crossing.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• The 4ZM 400 kV overhead line along the length of the Corridor will restrict the placement of new infrastructure within the Corridor.</li> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road and watercourse crossings, such as of the A151, A1101, North Level Main Drain and River Nene.</li> <li>• Infrastructure would be required within Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>

## Central Corridor (Sections C22 to C28A and C28B)

- 8.2.54 The Central Corridor (Sections prefixed with 'C') is shown in **Figure 8-10**. It starts at the southern end of Section C21B to the west of Moulton-Seas-End and the east of the River Welland. It then routes south-west around Weston towards Spalding, crossing the A151, before continuing south-east into Section C23 to the north of Low Fulney and Weston Hills. The 2WS 400 kV overhead line routes north to south through the northern end of this Section before heading east out of the Corridor to the north of Spalding. From Section C23, the Corridor continues south-east and narrows through Whaplode St Catherine in Sections C24 and C25. The corridor continues to route south until Section C26, to the east of Sutton St Edmund, where a more easterly direction is then taken. Within Section C27 the corridor crosses a UKPN 132 kV overhead line and the North Level Main Drain before the corridor splits in two, representing the multiple options considered to route around Newton. The UKPN 132 kV overhead line continues north-east and across Section C28A. Both branches of the Central Corridor then cross the A1101 and River Nene, connecting to Walpole siting zones WLP1 to WLP5, appraised within **Chapter 12**. The southern branch (Section C28B) ends to the west of West Walton and the northern branch (Section C28A) continues east across the existing 132 kV overhead line to end at the 4ZM 400 kV overhead line.
- 8.2.55 The Central Corridor is located between the Northern and Southern Corridors. Notable constraints for this corridor include the priority habitats such as traditional orchards and coastal floodplain grazing marsh, residential properties, narrow sections, and heritage assets within the corridor. In addition, existing overhead lines constrain routing due to the need to maintain separation distances (to avoid the creation of a wirescape). These constraints are shown on **Figure 7-6**.
- 8.2.56 In addition to the corridor itself, there are two Links between the Central Corridor and the Northern Corridor. These Links have been provided where it would be possible to avoid constraints or narrower areas associated with a particular Section by transferring from one section or corridor to another and are as follows:
- Link C23-N16, which connects the Central and Northern corridors between the B1357 (south of Moulton) and Ravens Gate (south of Holbeach); and
  - Link C28A-C28B, which connects Sections C28A and C28B to the west of the River Nene and adjacent to the A1101.

Figure 8-10 – Weston Marsh to Walpole Central Corridor – Key Constraints

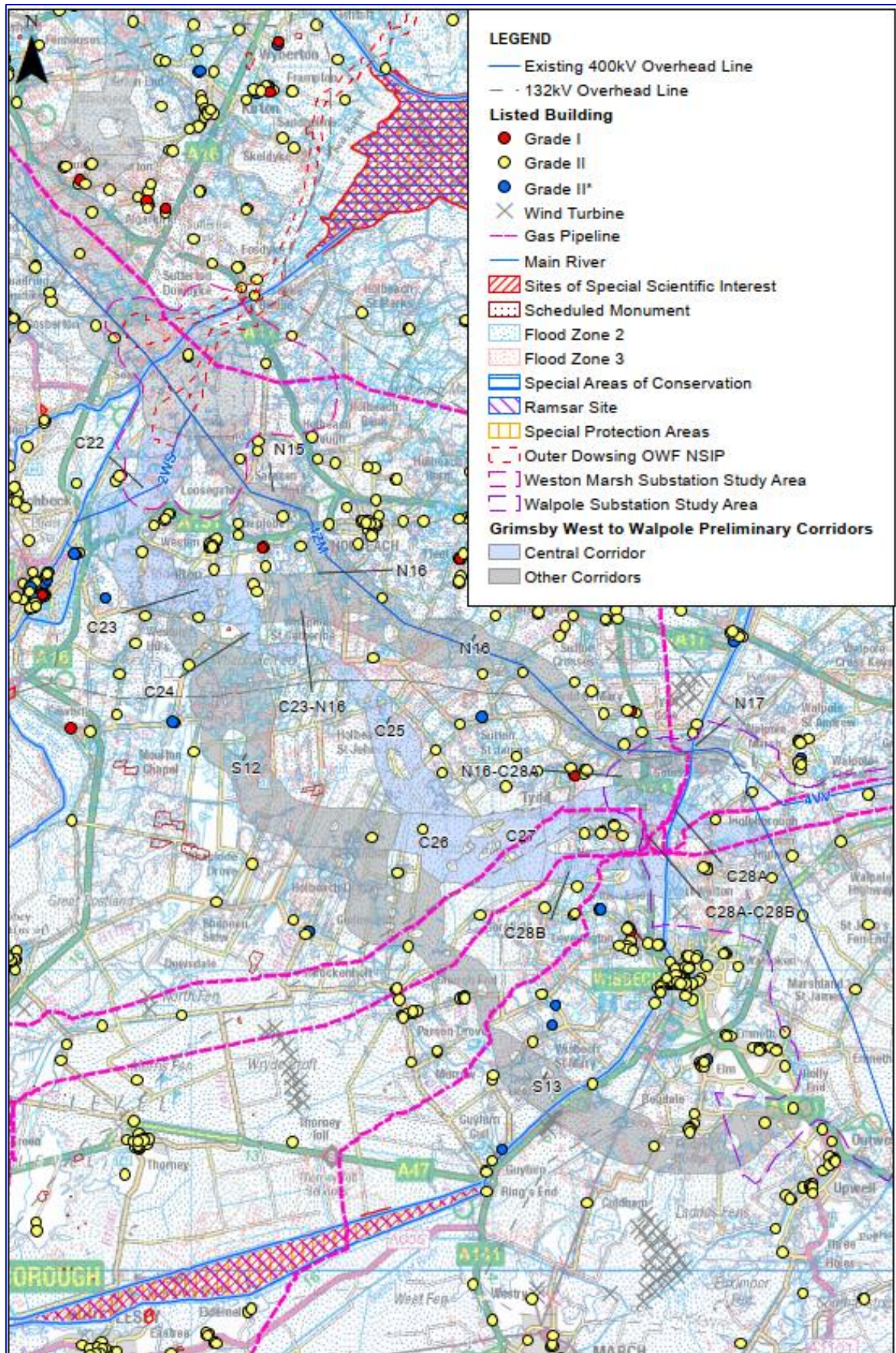


Figure 8-10 Weston Marsh to Walpole Central Corridor – Key Constraints

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SCALE: 1:200,000 0 2 4 6 km

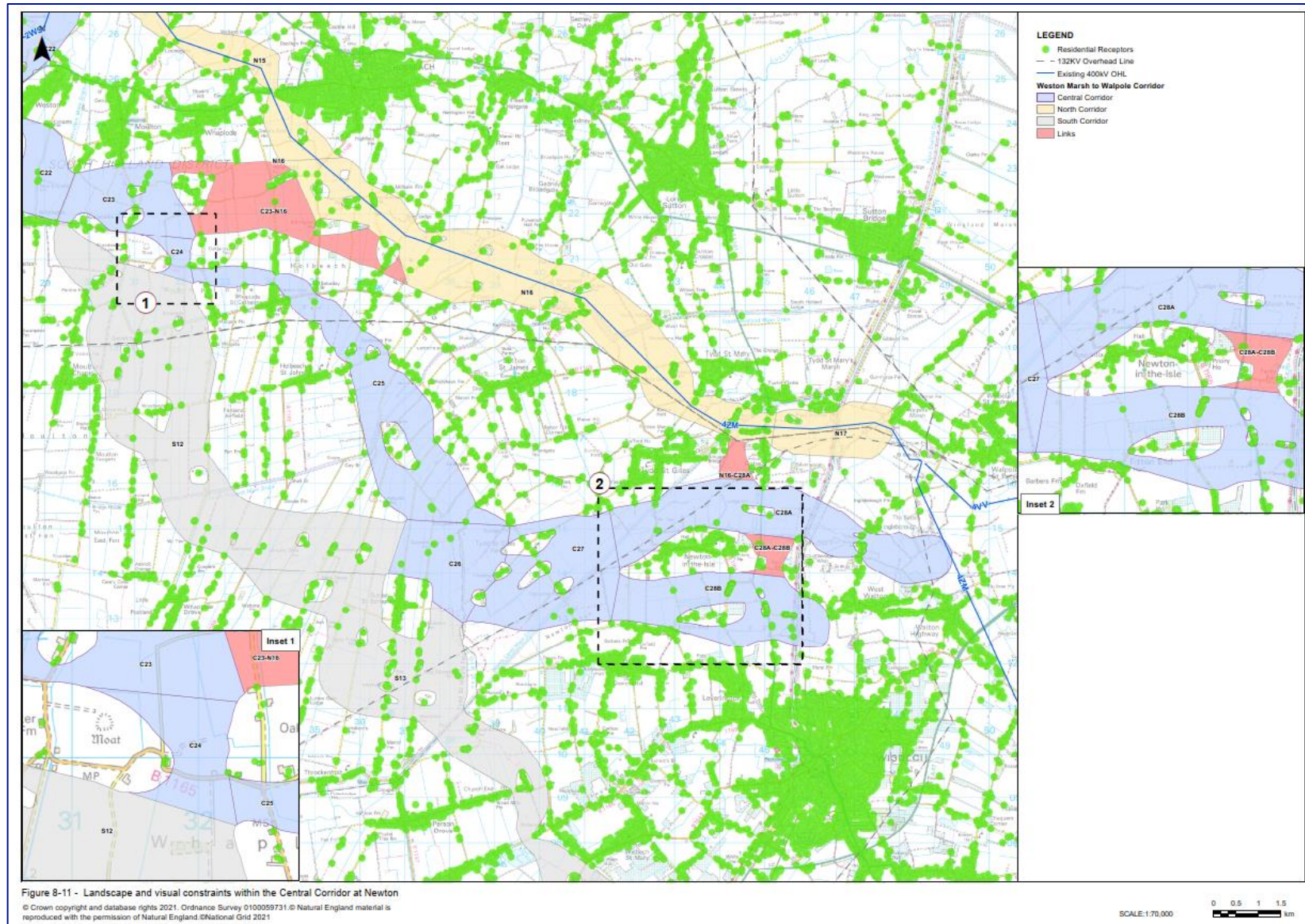
## Environmental Factors

### Landscape and Visual

- 8.2.57 The Central Corridor and its Links are located within the Fens NCA (NCA 46) which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. The Central Corridor and Links are over 10 km away from any nationally designated landscapes and therefore significant impacts are not expected to occur.
- 8.2.58 Continuing from Section C21A/C21B (detailed in **Chapter 7**), the Central Corridor and its Links between Weston Marsh and Walpole are located within an open landscape. The open landscape has a level topography that therefore offers considerable routing flexibility, subject to individual features located within and surrounding specific Sections and Links, as shown in **Figure 8-11**. The scattered pattern of development and features, wide Sections and Links, and open landscape is such that routing should seek a more direct line where feasible. This will considerably reduce the potential for landscape impacts, especially where angle pylons or larger pylons for crossing rivers or existing infrastructure are required. Use of the Links may require additional angle pylons, increasing the potential for landscape and visual impacts. Across the Central Corridor, impacts upon some individual receptors are unavoidable but can be reduced through careful routing.
- 8.2.59 At the northern end of the Central Corridor, within Section C22, the 2WS 400 kV overhead line routes through the centre and then west towards Spalding. In addition, the 4ZM 400 kV overhead line is approximately 500 m north of the Section and routes east to west. The presence of this existing electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure. The 2WS 400 kV overhead line has similar tower heights and spans which could be matched by a parallel route for the new overhead line and therefore offers the opportunity to closely parallel. Closely paralleling this overhead line would result in an intensification of effects for those receptors already impacted by the existing overhead line but reduces the potential for a wirescape and spread of effects. If a crossing of the 2WS 400 kV overhead line is required, this will risk additional impacts due to the requirement for SECs. The key residential receptors for this Section include those located at the villages of Weston, Moulton, Low Fulney, Weston Hills, those at the east of Spalding and linear settlement along the A151 and B1165. Linear settlement may constrain routing along, and off the A151 and along the B1357. A new overhead line in this Section has the potential to adversely impact the visual amenity for these receptors, although with careful routing the number and severity of impacts could be materially reduced.
- 8.2.60 Following south and south-east of Moulton into Sections C23 and C24 there is little existing above ground electrical infrastructure to influence the sensitivity of the landscape; an existing 132 kV overhead line is located approximately 1.1 km south. Routing flexibility is only limited by linear settlement along the B1357 and the B1165. The key visual receptors in this area include residential receptors at Weston, Moulton, Whaplode, Weston Hills, the linear settlement along (and users of) the B1357 and B1165 and scattered properties for Section C23; and Whaplode St Catherine and scattered properties for Section C24, as shown in **Figure 8-11**. A new overhead line in these Sections has the potential to adversely impact the visual amenity for these receptors, although with careful routing the number and severity of impacts could be materially reduced.

- 8.2.61 Link C23-N16 could be used here to connect the Central Corridor to the Northern Corridor from Section C23 and would route a new overhead line towards the 4ZM 400 kV overhead line within Section N16. Key visual receptors are those noted for Section C23 and C24 above, but also include those residential receptors along the B1168 and further scattered receptors along minor roads. As the Link nears Section N16 it will be between approximately 400 m and 1 km from the 4ZM overhead line and therefore could lead to the potential encircling of settlements. There is potential that, even with careful routeing, significant adverse visual effects on identified receptors may not be avoided and other mitigation (as described in **Paragraph 4.8.4**) may require consideration, however these are unlikely to completely avoid potential adverse impacts.
- 8.2.62 As the Corridor heads south-east through Section C25 it is comparatively narrow prior to crossing South Holland Main Drain. Here a NGED 132 kV overhead line would require crossing, located south-east of Whaplode St Catherine, which routes east to west through the Section. Mitigation (in the form of re-routeing, removal or undergrounding) of this existing overhead line would materially reduce potential impacts. The narrower areas within Section C25 limit routeing flexibility and larger pylons required for crossing South Holland Main Drain may result in more widespread landscape and visual impacts. Key visual receptors are residential properties at Whaplode St Catherine, Holbeach St Johns, Sutton St James, Tydd St Giles Fen, scattered properties and recreational users of South Holland Main Drain. A new overhead line in this Section has the potential to adversely impact the visual amenity for these receptors, although with careful routeing and undergrounding of the NGED 132 kV overhead line, most impacts could be materially reduced.
- 8.2.63 Towards Sutton St Edmund within Section C26 and then east into Section C27 the Corridor is wide except where clusters of settlement have been specifically excluded from the Corridor. Key visual receptors for these Sections are the settlements of Sutton St Edmund, Tydd St Giles Fen, those at the outskirts of Tydd St Giles, Newton-in-the-Isle and Gorefield, and scattered clusters of properties, as shown in **Figure 8-11**. A UKPN 132 kV overhead line is present within Section C27 and routes east to west near to Section C26. The presence of this overhead line reduces the sensitivity of the landscape here to adverse impacts from new infrastructure. However, its presence also constrains routeing and may result in intensified impacts should a wirescape (with the existing overhead line) be created. Routeing to the north of these Sections and into Section C28A would help to limit the potential for a wirescape. Routeing further south and into Section C28B would result in the potential for significant adverse visual effects on identified receptors which may be unavoidable, and therefore modification of the existing 132 kV overhead line should be considered to materially reduce the severity of potential adverse impacts.

Figure 8-11 – Landscape and visual constraints to routing within the Central Corridor at Newton



- 8.2.64 Following Section C27 the Corridor splits (north and south of Newton-in-the-Isle) into C28A and C28B which continue east towards the Walpole siting zones. Key visual receptors include residential receptors at Tydd St Giles, Newton-in-the-Isle, Four Gates, West Walton and Ingleborough for Section C28A; and Newton-in-the-Isle, Gorefield, Fitton End, Leverington and West Walton for Section C28B. Key recreational visual receptors are users of the Nene Way, River Nene, North Level Main Drain and NCN Route 1. The UKPN 132 kV overhead line continues within Section C28A and adjacent to the west of Section C28B. The potential impacts associated with the 132 kV overhead line as detailed within Section C27 are also relevant for these Sections. Within Section C28A the proximity of the 132 kV overhead line is such that, even with careful routing, the potential for significant adverse visual effects on identified receptors may not be avoided and therefore other mitigation should be considered. In addition, as Section C28A routes further east, it is in closer proximity to the 4ZM 400 kV overhead line routing into Walpole substation. A route at the north of Section C28A should seek to avoid encircling residential properties west of the River Nene along the A1101 and those properties east of the River Nene along Mill Road. Both Sections will require crossing of the River Nene and larger pylons for crossings may result in more widespread landscape and visual impacts. However, a new overhead line would be perceived in the context of existing overhead lines in the area.
- 8.2.65 An alternative route across the River Nene could be achieved for Sections C28A and C28B by utilising Link C28A-C28B. Use of this Link would likely require additional angle pylons, increasing the potential for landscape and visual impacts, especially for those properties along the A1101 and users of the River Nene and Nene Way.

### Ecology

- 8.2.66 As described in **Chapter 5**, the Corridor was developed to avoid designated ecological features where possible, however there remain few designated and important ecological areas identified within and in proximity to the Central Corridor and its Links between Weston Marsh and Walpole. Those identified are appraised below.
- 8.2.67 The Central Corridor and its Links (C23-N16 and C28A-C28B) are located over 7 km from the nearest NSN and Ramsar Sites. The closest are The Wash designated sites, as described in **Paragraph 6.2.83**, which are located approximately 7.1 km north-east of Section C22. Impacts upon NSN and Ramsar Sites are predominantly limited to the potential for pollution pathways and functionally connected habitats, and the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within an HRA, as the Project development progresses. However, for the purposes of Options Appraisal, the corridors, sections and links located further from the NSN and Ramsar sites are generally considered to have a lesser likelihood of resulting in impacts. Due to the distances between the Corridor and the designated sites, the likelihood of significant effects is low.
- 8.2.68 No other SSSIs, except those identified above, are within 2 km of the Central Corridor.
- 8.2.69 Other important habitats identified within the Sections of the Corridor and its Links comprise priority habitats. Those habitats present are:
- Coastal floodplain grazing marsh priority habitat within Sections C22, C25, C26, C27, C28A and C28B, and Link C23-N16.
  - Deciduous woodland priority habitat within Sections C25 and C27, and Link C23-N16.



- Traditional Orchard priority habitat within Sections C22, C26, C28A and C28B.

8.2.70 There is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the extent of the priority habitat areas within these Sections is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures.

### Historic Environment

8.2.71 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified within and in proximity to the Central Corridor and its Links between Weston Marsh and Walpole. Those identified are appraised below.

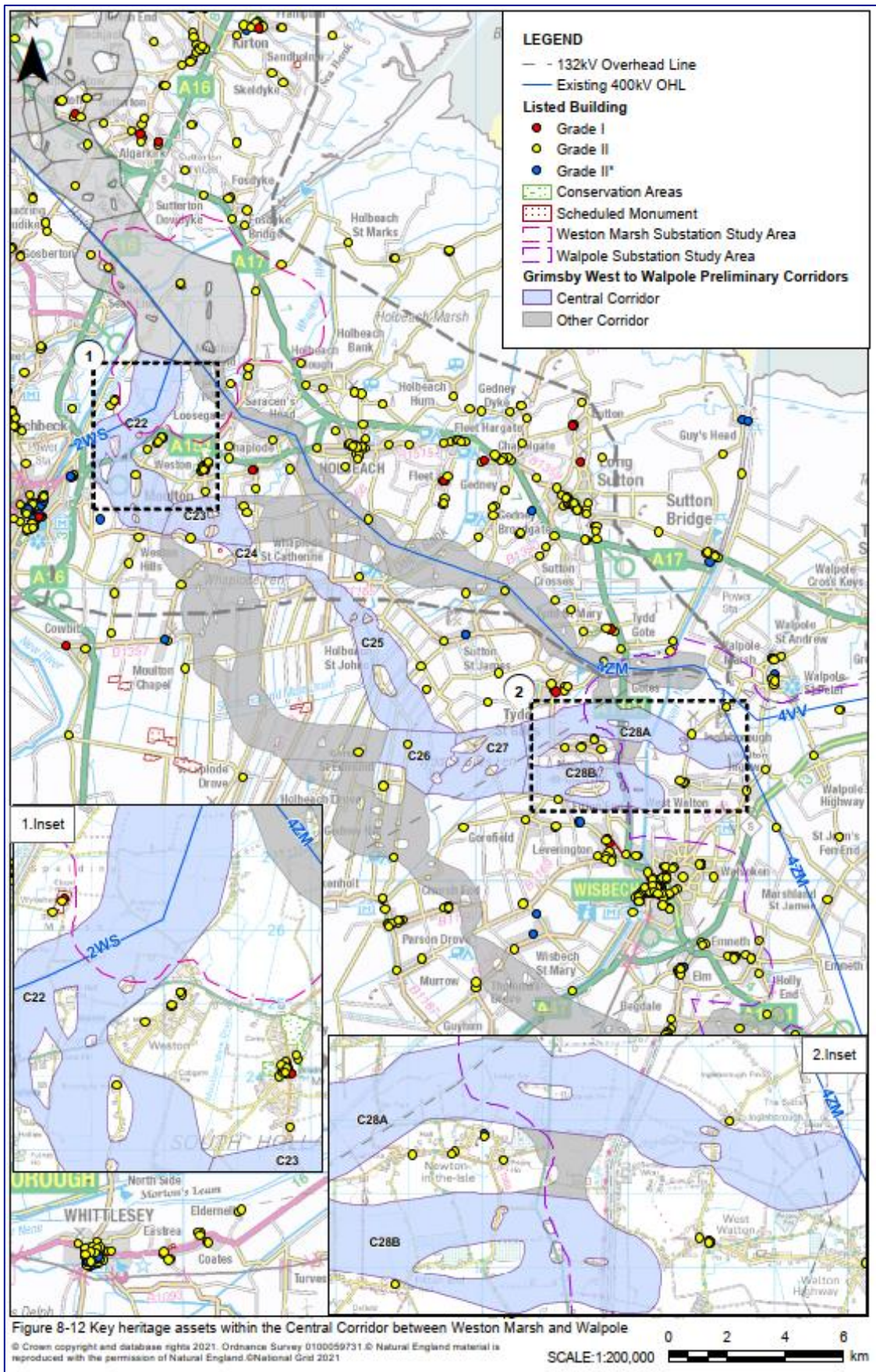
8.2.72 The only designated heritage asset located within the Corridor and its Links is *Guanock House* Grade II listed building within Section C26. Due to the localised nature of this heritage asset, it is considered that direct impacts could be avoided through careful routeing. Should this occur then impacts on this designated heritage assets are limited to affects upon their setting.

8.2.73 There are numerous designated heritage assets within 1 km of the Central Corridor and its Links, the majority of which comprise scattered Grade II listed buildings near to Section and Link boundaries. There are also small clusters of other designated heritage assets located at the villages of Moulton, Weston, Newton, West Walton and Tydd St Giles. The most notable (shown in **Figure 8-12**) in proximity are:

- a Grade I listed building, *St Mary's Parish Church*, located in the centre of West Walton (south of Section C28A);
- a Grade II listed building, *Broadgate House Farmhouse*, located within an area specifically excluded from Section C22;
- two Grade II listed buildings, *Austendike Hall* and *Holly House Farmhouse*, located approximately 95 m south-west and 180 m to the east of Section C23, respectively;
- a Grade II listed building, *Holly House Farmhouse*, located 120 m south of Connection Link C23-N16.
- a Scheduled Monument, *King's Hall moated site*, located 200 m south-west of Section C24;
- a Grade II listed building, *Sandy Gate Farmhouse*, located 200 m east of Section C25;
- a Grade II\* listed building, *Church of St James*, and a Grade II listed building, *Ingleborough Mill*, which are located 180 m south and 100 m north of Section C28A, respectively; and
- a Grade II listed building, *The Manor House*, located 70 m south of Section C28B.

8.2.74 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing an overhead line in proximity and an increased potential for additional buried archaeology to be disturbed due to an assumed greater presence. However due to the width of these sections and links, there is sufficient flexibility to materially reduce adverse impacts through careful routeing and the implementation of standard construction measures.

Figure 8-12 – Key heritage assets within the Central Corridor between Weston Marsh and Walpole



## Socio-economics

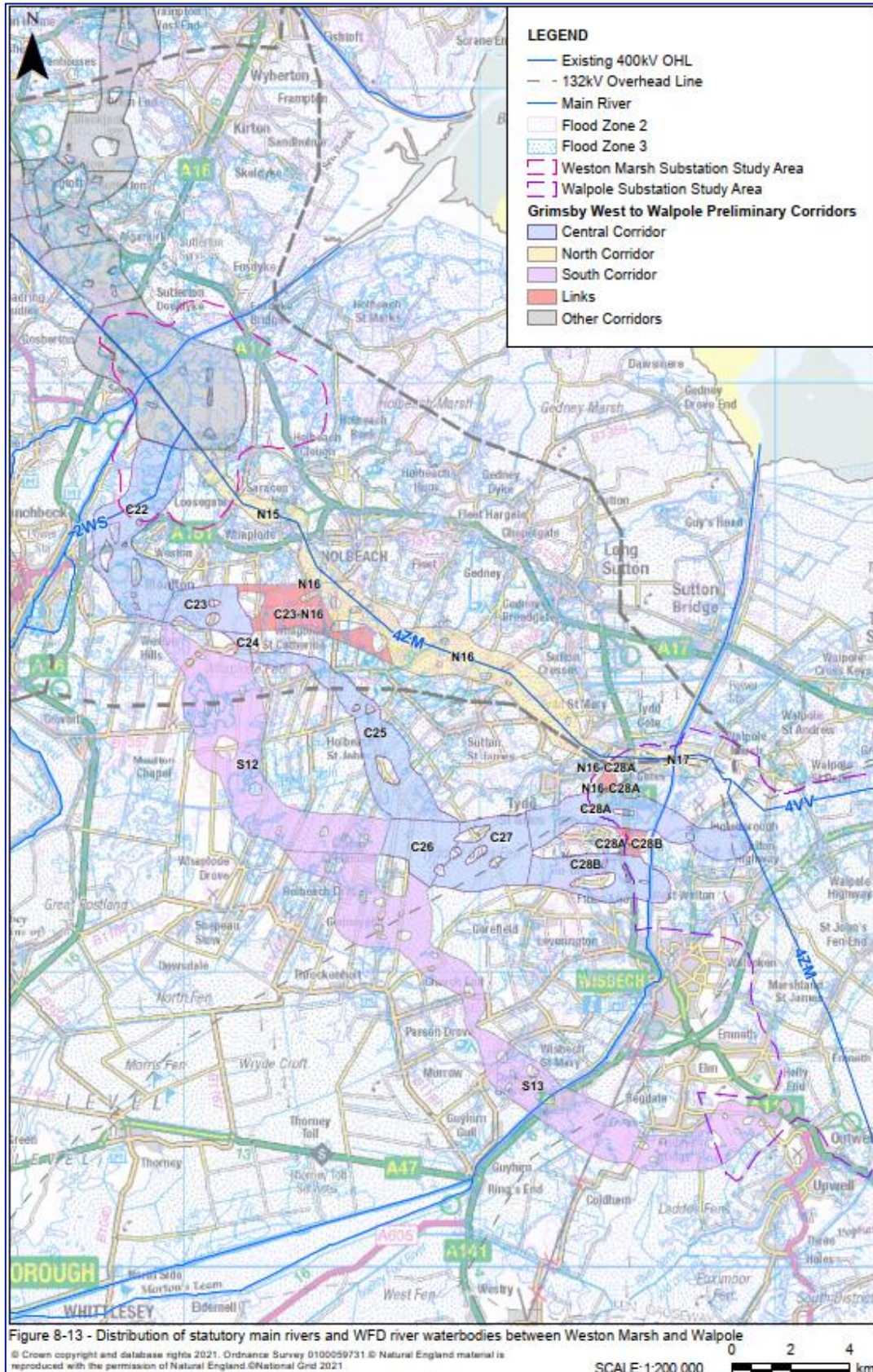
- 8.2.75 There are few socio-economic constraints located within or near the Central Corridor and its Links between Weston Marsh and Walpole. Those identified are:
- a proposed Solar Farm development (F/YR22/1070/SC) at the south of Section C26;
  - The Rose and Crown Solar Farm at the boundary of Section C28A; and
  - the River Nene, a navigable waterway, which is crossed by both Sections C28A and C28B.
- 8.2.76 Given the nature of these constraints and their distribution, predominantly at the boundaries of Sections and Links, implementation of careful routeing will minimise, and where possible avoid the receptors and as such, significant adverse impacts are unlikely.

## Other Considerations

- 8.2.77 Other environmental topics considered as part of the Options Appraisal include air quality, noise and water.
- 8.2.78 Residential receptors are predominantly located outside the Corridor and its Links. Within the Corridor and Links there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrow nature of certain areas (along the A151 in Section C22, along the B1357 and B1165 in Sections C23, C24 and C25, at the boundary of Sections C26 and C27 and along the A1101 in Sections C28A and C28B), further careful investigation of infrastructure placement would be required (at a later stage) to avoid adverse residual impacts on residential properties immediately adjacent.
- 8.2.79 As outlined in **Chapter 5**, the Central Corridor and its Link are almost completely covered by Flood Zone 3. The only Section not covered is Section C24 where only Flood Zone 2 is present. All Sections and Links contain field drains and all, except for Section C24 due to its size, contain either a statutory main river and / or a WFD river waterbody, see Figure 8-13. In addition to field drains, the watercourses present within each Section or Link comprise:
- Section C22 – one Anglian WFD river waterbody (Moulton River) waterbody and six IDB watercourses;
  - Section C23 – one Anglian WFD river waterbody (Moulton River), which is also an IDB watercourse;
  - Section C25 – two WFD river waterbodies (Little South Holland Drain and North Level Main Drain) and 14 IDB watercourses;
  - Section C26 – six IDB watercourses;
  - Section C27 – North Level Main Drain WFD river waterbody and 11 IDB watercourses;
  - Section C28A – River Nene (main river and WFD river waterbody), North Level Main Drain WFD river waterbody and 10 IDB watercourses; and

- Section C28B – River Nene (main river and WFD river waterbody) and six IDB watercourses.

Figure 8-13 Distribution of statutory main rivers and WFD river waterbodies between Weston Marsh and Walpole



## Summary

- 8.2.80 Most of the environmental features and constraints in the Central Corridor between Weston Marsh and Walpole are scattered. In this area those features which exert most influence on a new overhead line are:
- proximity to residential receptors, particularly at narrower areas along the B1357, B1165 and A1101 and between Sections C26 and C27;
  - the presence of the existing 400 kV overhead lines in Section C22 (4ZM and 2WS) and Section C28A (4ZM);
  - the presence of the existing NGED and UKPN 132 kV overhead lines in, or in proximity to, Sections C24, C25, C27, C28A and C28B;
  - the settings of scattered designated heritage assets;
  - the crossing of the River Nene; and
  - the Rose and Crown Farm solar farm.
- 8.2.81 When considering receptors outside of the Central Corridor and its Links, there are scattered residential properties, recreational receptors and designated heritage assets which may be impacted visually, or experience impacts on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. However, most of these adverse impacts can be avoided, or reduced, through careful routeing due to the width of, and therefore flexibility within, the Central Corridor.
- 8.2.82 Overall, there are few significant environmental constraints to overhead line routeing.

## Engineering and System Factors

- 8.2.83 There are several constraints located throughout the Central Corridor and its Links which are considered likely to reduce routeing flexibility and/or increase the technical complexity of the individual.
- 8.2.84 Throughout the Central Corridor, there are scattered constraints including residential properties, industrial and agricultural buildings, woodland blocks and watercourses. Almost all the Central Corridor and associated Connection Links are covered by Flood Zone 2 and 3 and it is therefore unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction cannot take place.
- 8.2.85 Overall routeing flexibility is high in Section C22. The 2WS 400 kV overhead line runs through and across Section C22 and paralleling this line should be considered when routeing. Here routeing flexibility is reduced at two narrower areas, one at the A151 (which requires crossing) and one along Broadgate (located off the B1165). A reservoir and planning application (associated with Lansen Nursery) intersect the western extent of the Section south of the A151, which limits routeing flexibility. However, this could be avoided by routeing to the centre or east of the Section, otherwise these features may require oversailing.
- 8.2.86 Routeing further west into Section C23, the two narrower areas along the B1357 (which will require crossing) reduces routeing flexibility. Here there may be a requirement to oversail properties if routeing at the south of the Section and depending upon onward

routeing, additional angle pylons may be required. Apart from the area along the B1357, Section C23 offers high routeing flexibility.

- 8.2.87 Link C23-N16 has narrow areas at its connections to Section C23 and N16 which would limit routeing flexibility and mean routeing near to residential properties. The overhead line would require road crossings; however, this should not significantly constrain routeing. From Sections C23 and C24 there is also the option to route south into Section S12 (as described in **Paragraph 8.2.104**).
- 8.2.88 South-east of Section C23, Section C24 is comparatively shorter and Sections C24 and C25 are comparatively narrower. However, the generally open topography with few and scattered constraints offers good routeing flexibility. An overhead line within these Sections would require crossings of the B1165 (within Section C24 and twice within Section C25), existing NGED 132 kV and 33 kV overhead lines (within Section C25), the Little South Holland Drain (within Section C25) and South Holland Main Drain (within Section C25). Each of these crossings may require crossing protection and the existing overhead lines would both require a technical solution prior to construction of the Project. East of Holbeach St Johns (within Section C25) is a narrower area where additional angle pylons may be required to ensure no oversailing of properties from a new overhead line.
- 8.2.89 North and east of Sutton St Edmund within Sections C26 and C27, the main constraint to overhead line routeing is a solar farm application at the south-east of Section C26 that also partly covers the south-west of Section C27. If constructed, connections from Section C26 into Section S13 or into the south of Section C27 would be significantly restricted. Between Sections C26 and C27 clusters of properties result in a narrower corridor in certain areas which limits routeing flexibility. Routeing through these narrower areas may require the use of additional angle pylons. In addition, a UKPN 132 kV overhead line and the North Level Main Drain both route north-east to south-west across the Section. A connection from Section C27 into C28B would be required to cross this drain (with crossing protection and larger towers for the drain crossing) and to avoid this overhead line. There is also a high-pressure gas pipeline (Wisbech Nene West to Tixover) which cuts through the Section and would require crossing. Crossing the drain and the 132 kV overhead line can be avoided within Section C27 if routeing into Section C28A, although crossings of these features would be required within that Section. Within Section C28A, there are two 132 kV overhead lines within the Section which may require crossing.
- 8.2.90 At Newton-in-the-Isle, the Corridor splits in two, with Section C28A to the north of the settlement and C28B to the south. As detailed above, an overhead line in Section C28A would require crossing the North Level Main Drain and a UKPN132 kV overhead line. In addition to these features, an overhead line routeing through this Section would need to cross the B1165, the A1101 and the River Nene (all of which require crossing protection). Crossing of the River Nene and North Level Main Drain are likely to require taller pylons due to the change in elevation associated with the embankment of the River Nene, like those that currently cross the River Nene to the north. East of the River Nene, the constraints for routeing within Section C28A comprise narrower areas along Mill Road (where additional angle pylons may be required to avoid oversailing properties), the Rose and Crown Farm Solar Farm (that could be avoided), a UKPN 132 kV overhead line (that would require mitigation prior to construction of the Project) and the 4ZM 400 kV overhead line. Between North Level Main Drain and the 4ZM (Burwell to Walpole) 400 kV overhead line between Burwell and Walpole, the Section overlaps with the proposed Walpole substation siting zones.

- 8.2.91 South of Newton-in-the-Isle is Section C28B. Routeing through this Section also requires crossing of the A1101 and the River Nene. A review of mitigation requirements will be determined by the chosen corridor and Walpole siting zone in combination. In addition, the narrower corridor, due to the presence of large woodland blocks, orchards and clusters of residential properties, within this Section would limit routeing flexibility. In Section 28B, there are two high pressure gas pipelines that would also require crossing.
- 8.2.92 Link C28A-C28B routes between the two most easterly Sections of the Central Corridor and contains fewer technical constraints. However due to its comparative narrowness, those present which include the A1101, a drain and two gas pipelines, considerably limit routeing flexibility. In addition, use of this Link would likely require use of additional angle pylons to navigate constraints including scattered properties and the A1101.

### Summary

- 8.2.93 Overall, there is sufficient flexibility for routeing within the Central Corridor, however there are some Sections that consist of narrow areas which may reduce flexibility in parts of the Corridor. Constraints present which influence routeing are residential properties, priority habitats, watercourses, road networks and existing overhead lines and underground pipelines. Areas of Flood Zones 2 and 3 are a notable constraint throughout the Central Corridor but are unavoidable and may therefore have implications for the design and construction of infrastructure.

### Holford Rules

- 8.2.94 The Central Corridor and its Links with have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 8.2.95 Sections have generally avoided smaller areas of high amenity value through excluding them from the Corridor and its Links. The smaller areas of high amenity value which exist within the boundaries of the Corridor and its Links comprise individual listed buildings. Where there are smaller areas of high amenity value, sufficient space has been included within the Corridor and its Links to enable routeing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 8.2.96 The Central Corridor initially follows an indirect route south-west from Weston Marsh towards Spalding. From here it then follows a largely direct route east/south-east (in line with **Holford Rule 3**) to the Walpole siting zones. The use of Link C23-N16 may result in a slightly more direct route, subject to detailed routeing at a later stage, and use of Link C28A-C28B would result in a less direct route.
- 8.2.97 The Central Corridor and its Links were developed to avoid highly constrained areas, and specific constraints including settlements, and specific constraints including settlements such as Weston, Moulton, Newton-in-the-Isle and West Walton (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in each area, with narrow sections, particularly because of areas of highest amenity specifically excluded, such within Sections C24.
- 8.2.98 The Central Corridor includes more land than is needed for the construction of an overhead line which provides flexibility when undertaking more detailed routeing, following consultation feedback and later in the project development process. This approach also provides the opportunity to implement the most direct route (avoiding constraints) within the Sections and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.

- 8.2.99 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 8.2.100 The Central Corridor would require the crossing of the existing 132 kV and 400 kV overhead lines (**Holford Rule 6**). This may result in adverse landscape and visual impacts unless mitigation is undertaken. In addition, there is the potential for a wirescape to be created in Sections C22, C25, C27, C28A and C28B due to the presence of existing 132 kV and 400 kV overhead lines.
- 8.2.101 No industrial zones exist within the Central Corridor and therefore **Holford Rule 7** is not applicable.

### **Conclusion**

- 8.2.102 The Central Corridor follows a mostly direct route and routeing flexibility is considerable due to scattered environmental features and the size of the Sections and its Links. Those Sections most likely to be constrained are Section C25, C26 and C27 due to the presence of narrower areas and the presence of existing above ground infrastructure. Technical constraints are scattered except for the linear features. The presence of existing gas pipelines, overhead lines and the major road network, especially within Sections C27 and C28B and Link C28A-C28B limit routeing flexibility. Unavoidable areas of Flood Zones 2 and 3 present a notable constraint to routeing and would have implications for design and construction. It is noted however that Flood Zones are present across almost all the Sections and Links between Weston Marsh and Walpole.
- 8.2.103 A tabulated summary of the appraisal of the Central Corridor (between Weston Marsh and Walpole) is provided in **Table 7-1**.



Table 8-2 Summary of Central Corridor Options Appraisal between Weston Marsh and Walpole

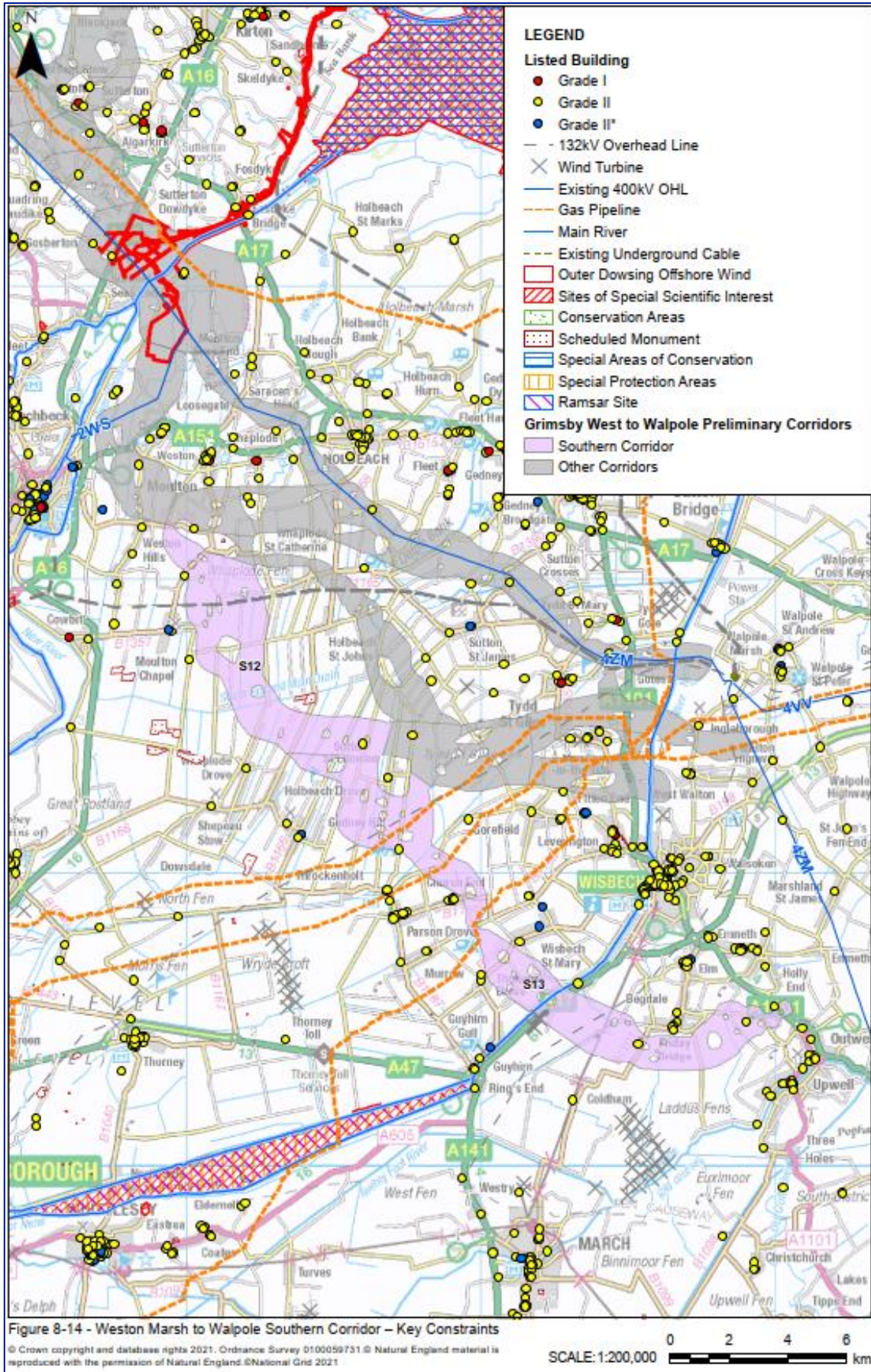
Theme	Topic	Summary	
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>The presence of the 2WS 400 kV overhead line and several 132 kV overhead lines across the Central Corridor may, in combination, have adverse impacts on the landscape and visual amenity to the east of Spalding, south-east of Whaplode St Catherine, and at the eastern extent of the Corridor.</li> <li>The sensitivity of the local landscape within the corridor is reduced in places due to the presence of existing electrical infrastructure.</li> <li>There is potential for adverse impacts on views experienced by recreational receptors including users of South Holland Main Drain, Nene Way, River Nene, North Level Main Drain, and NCN Route 1.</li> <li>Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts.</li> </ul>	
		Ecology	<ul style="list-style-type: none"> <li>There is potential for the Central Corridor to have functionally connected habitats and pollution pathways to The Wash designated sites.</li> <li>Coastal and floodplain grazing marsh, deciduous woodland and traditional orchard priority habitats are within and adjacent to the Central Corridor.</li> </ul>
		Historic Environment	<ul style="list-style-type: none"> <li>There is the potential for setting impacts on <i>Guanock House</i> Grade II listed building located close to the boundary of Section X.</li> <li>Several listed buildings and scheduled monuments are scattered adjacent to the Corridor and its Links. Most of these can be avoided with careful routeing, however, impacts on their setting are likely to arise should the overhead line be developed where the Corridor is closest to these heritage assets.</li> </ul>
		Socio-economics	<ul style="list-style-type: none"> <li>Adverse effects may occur on a proposed solar farm to the east of Sutton St Edmund, the Rose and Crown Solar Farm and the River Nene waterway. However, adverse effects could be reduced to an acceptable level or avoided through the implementation of careful routeing.</li> <li>Numerous navigable waterways fall within or are crossed by the corridor.</li> </ul>

Theme	Topic	Summary
	Other Considerations	<ul style="list-style-type: none"> <li>• Almost all the corridor is covered by Flood Zones 2 and 3 which means this cannot be avoided. The Sections and links contain field drains and either a Statutory Main River or WFD river waterbody.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• The 2WS 400 kV overhead line routes through Section C22. Paralleling this should be considered during routeing.</li> <li>• Existing gas pipelines are present which will require crossing; however, these should not cause significant constraints.</li> <li>• Multiple existing 33 kV and 132 kV overhead lines are present within the corridor and will require mitigation, such as removal or undergrounding, to ensure there is sufficient space prior to the construction of a new overhead line.</li> <li>• Narrower areas, particularly in the vicinity of the A151, Broadgate, the east of Holbeach St James, and a proposed solar farm to the east of Sutton St Edmund present a technical constraint.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• Coordination with developers will be required to ensure the proposed overhead line can be facilitated in combination with the various other proposed developments located within the Central Corridor, particularly a proposed solar farm near Sutton St Edmund.</li> <li>• Existing 132 kV and 33 kV overhead lines may restrict the placement of infrastructure within the Corridor.</li> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road and watercourse crossings, such as crossing of the A1151, A1101, B1165, Little South Holland Drain, South Holland Main Drain, North Level Main Drain and River Nene.</li> <li>• The Rose and Crown Farm Solar Farm presents a minor constraint to routeing at the very eastern extent of the corridor within Section C28A.</li> <li>• Infrastructure is likely to be required within areas of Flood Zones 2 and 3 which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li> </ul>

## Southern Corridor (Sections S12 to S13)

- 8.2.104 The Southern Corridor (Sections prefixed with 'S') is shown in **Figure 8-14** and comprises two Sections (S12 and S13) between Weston Marsh and Walpole. It starts at the B1165 Austendike Road east of Spalding where it continues from Central Corridor Sections C23 and C24. Section S12 routes south, crossing a UKPN132 kV overhead line to the north-east of Moulton Chapel and north-west of Fenland airfield. It then crosses South Holland Main Drain before routeing east towards Sutton St Edmund. As it reaches Sutton St Edmund (specifically excluded from the Corridor) it connects to the Central Corridor (Section C26) to the east, and to Section S13 to the south. Section S13 then routes south-east, crossing a UKPN 132 kV overhead line, North Level Main Drain and the B1166 east of Church End and the B1542 west of Wisbech St Mary. From here it continues south-east, crossing the River Nene and the adjacent A47 to the south-west of Wisbech. The Corridor then routes east across an existing UKPN 132 kV overhead line and the B1101 before continuing south of Friday Bridge and to the A1101 between Outwell and Emneth where it connects to the Walpole substation siting zone WLP6.
- 8.2.105 The Southern Corridor is located furthest south of the Corridors appraised between Weston Marsh and Walpole. Notable constraints for this corridor include residential properties, priority habitats, heritage assets such as listed buildings and scheduled monuments, Fenland Airfield, areas of Flood Zones 2 and 3 and watercourses. These constraints are shown on **Figure 8-14**.
- 8.2.106 There are no additional Connection Links starting from the Southern Corridor to either of the other two Corridors between Weston Marsh and Walpole. However, as described above, there are Sections of Southern Corridor that abut the Central Corridor.

Figure 8-14 – Weston Marsh to Walpole Southern Corridor – Key Constraints

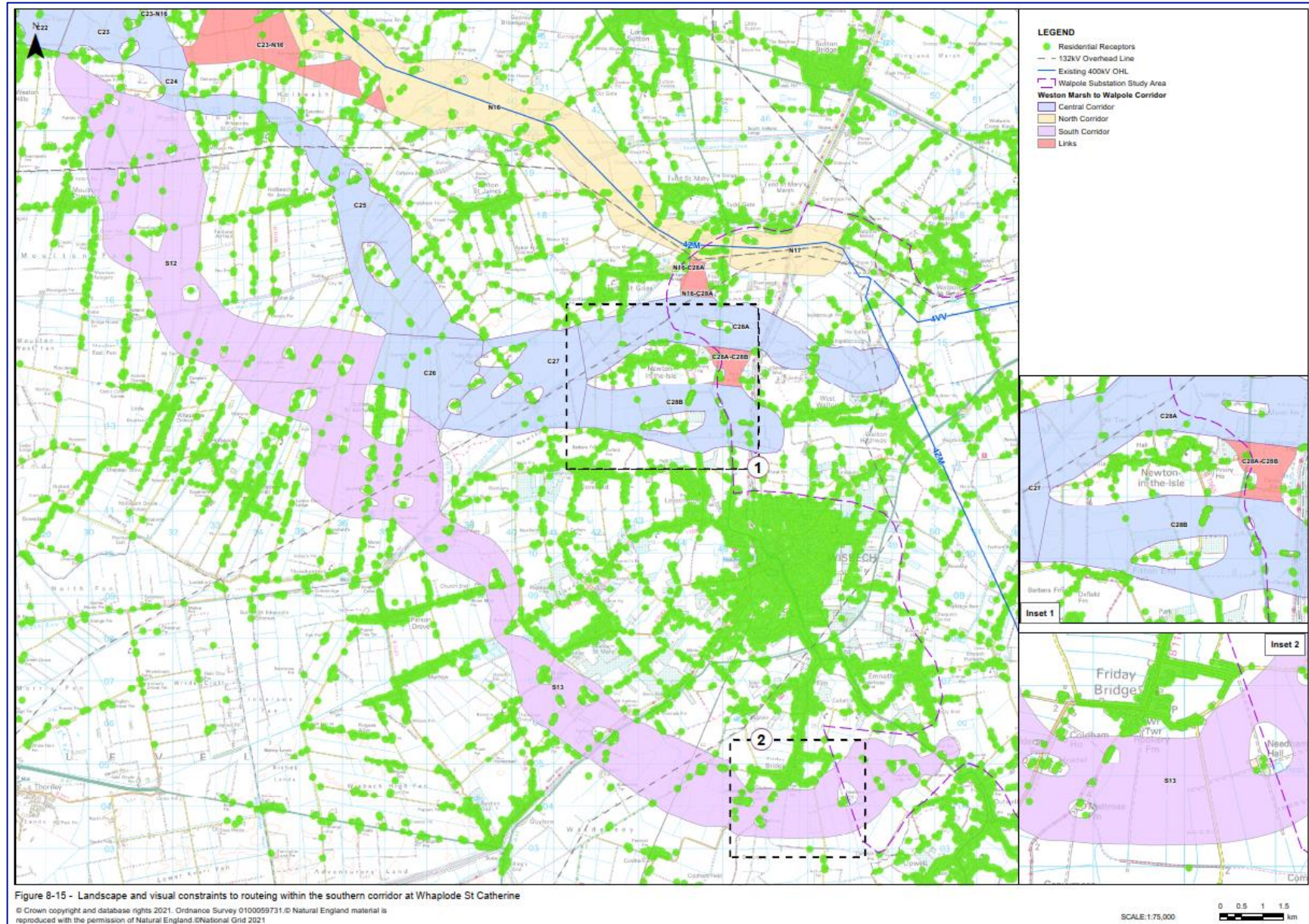


## Environmental Factors

### Landscape and Visual

- 8.2.107 The Southern Corridor is located within the Fens NCA (NCA 46) which is a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and is notable for its large-scale, flat, open landscape with extensive vistas to level horizons. All Sections of the Southern Corridor are over 10 km away from nationally designated landscapes and therefore impacts are unlikely to occur.
- 8.2.108 Continuing from Section C21A/C21B, the Southern Corridor between Weston Marsh and Walpole is located within an open landscape. The open landscape has a level topography that therefore offers considerable routeing flexibility, subject to individual features located within and surrounding specific Sections. The scattered pattern of development and features, wide Corridors, and open landscape is such that routeing should seek a more direct line where feasible. This will considerably reduce the potential for landscape impacts, especially where angle pylons or larger pylons for crossing rivers or infrastructure are required. Across the corridor, impacts upon some individual receptors are considered unavoidable but could be reduced through careful routeing.
- 8.2.109 Continuing from Section C23 the north of Section S12 is comparatively narrow and routeing flexibility is reduced along the B1357. Further south a UKPN 132 kV overhead line routes across the Section (north of Moulton Chapel). The presence of this existing electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure but also has the potential to intensify impacts to receptors which already experience adverse effects and to contribute to a wirescape. The 132 kV overhead line will require crossing and therefore mitigation is required which is considered to materially reduce impacts. Near the south of the Section, crossing South Holland Main Drain would require larger pylons and therefore may result in more widespread landscape and visual impacts. Key visual receptors are residential properties within Weston Hills, Moulton Chapel, Moulton East Fen, and Whaplode Drove, and recreational users of the South Holland Main Drain. A new overhead line in this Section has the potential to adversely impact the visual amenity for of these receptors, although with careful routeing and the required crossing of the UKPN 132 kV overhead line most impacts can be materially reduced.
- 8.2.110 Section S13 starts wider and then becomes comparatively narrow between Sutton St Edmund and the A47. There are two UKPN 132 kV overhead lines within this Section; one that routes across the Section between Sutton St Edmund and North Level Main Drain, and one that routes across the Section between the A47 and Friday Bridge. In these areas this existing above ground electrical infrastructure means that the landscape here is less sensitive to adverse impacts from new infrastructure but may have the potential to contribute to a wirescape. The UKPN 132 kV overhead lines will require crossing. Between these areas (approximately 9.5 km) there is little existing above ground electrical infrastructure to influence the sensitivity of the landscape. Here the addition of a new overhead line, in combination with a comparatively narrow corridor, the River Nene, and a winding route is likely to result in widespread landscape and visual impacts. The key visual receptors are scattered residential receptors adjacent to the section boundary and residential receptors within the settlements of Sutton St Edmund, Parson Drove, Wisbech St Mary, Guyhirn, Friday Bridge, Upwell, and Outwell. Other key visual receptors include users of the North Level Main Drain, River Nene, Nene Way and NCN Route 1. It is considered that although careful routeing would limit the potential scale of impacts, alternative engineering solutions measures such as low height pylons may be required to materially limit potential impacts.

Figure 8-15 – Landscape and visual constraints to routing within the Southern Corridor at Whaplode St Catherine



## Ecology

- 8.2.111 As described in **Chapter 5**, the Southern Corridor was developed to avoid designated ecological features where possible, and there remain few designated and important ecological areas identified within and in proximity to the Southern Corridor between Weston Marsh and Walpole. Those that have been identified are appraised below.
- 8.2.112 The Southern Corridor is located within 3 km of NSN and Ramsar sites. Section S13 is the closest Section to these sites, located approximately 2.9 km north-east of the Nene Washes SPA, SAC, Ramsar sites which also overlap with a SSSI ('The Nene Wash designated sites') located adjacent to the River Nene between Peterborough and Guyhirn. The Nene Washes designated sites are a Flood Storage Reservoir for the River Nene and include an extensive area of seasonally flooded wet grassland along channelised river reaches. Several nationally scarce plants and vulnerable, rare or relict fenland invertebrates are represented as well as supporting habitat (predominantly along Moreton's Leam) for the spined loach. The Nene Washes designated sites are important for various species of breeding and wintering waterbirds, notably Tundra Swan, Black-tailed godwit and Northern pintail.
- 8.2.113 The River Nene is also hydrologically connected to The Wash and therefore The Wash designated sites (as described in **Paragraph 6.2.82**).
- 8.2.114 Impacts upon NSN and Ramsar sites from Section S13 are predominantly limited to the potential for pollution pathways and functionally connected habitats, and the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA (conducted in the absence of mitigation), as the Project development progresses. However, for the purposes of Options Appraisal, the corridors, sections and links located further from the NSN and Ramsar sites are considered to have a lesser likelihood of resulting in impacts. Due to the distances between the Corridor and the designated sites, the likelihood of significant effects is likely to be low.
- 8.2.115 No other SSSIs, except those identified above, are within 2 km of the Southern Corridor.
- 8.2.116 Other important habitats identified within the Sections of the Southern Corridor comprise priority habitats. Those habitats present are:
- coastal and floodplain grazing marsh and deciduous woodland located throughout Section S12 (predominantly to the south of the Section and south of South Holland Main Drain); and
  - traditional orchard priority habitat, coastal and floodplain grazing marsh and deciduous woodland located throughout Section 13.
- 8.2.117 There is potential for priority habitat loss/degradation and impacts to designated features and protected species (e.g., birds) due to pylon siting and access routes (direct impacts). However, the dispersed nature of the priority habitat areas within these Sections is such that potentially adverse impacts could be avoided and reduced to an acceptable level through careful routeing, oversailing and implementation of standard construction measures.

## Historic Environment

- 8.2.118 As described in **Chapter 5**, the Corridor was developed to avoid designated heritage assets where possible, and there remain few designated heritage assets identified

within and in proximity to the Southern Corridor between Weston Marsh and Walpole. Those identified are appraised below.

8.2.119 Between Weston Marsh and Walpole, the only designated heritage asset located within the Southern Corridor is a Grade II listed building, *Hawthorn Farmhouse*, located within Section S13. Due to the localised nature of this heritage asset, it is considered that direct impacts could be avoided, through careful routeing. Should this occur then impacts on designated heritage assets relevant to the Southern Corridor are limited to effects upon their setting.

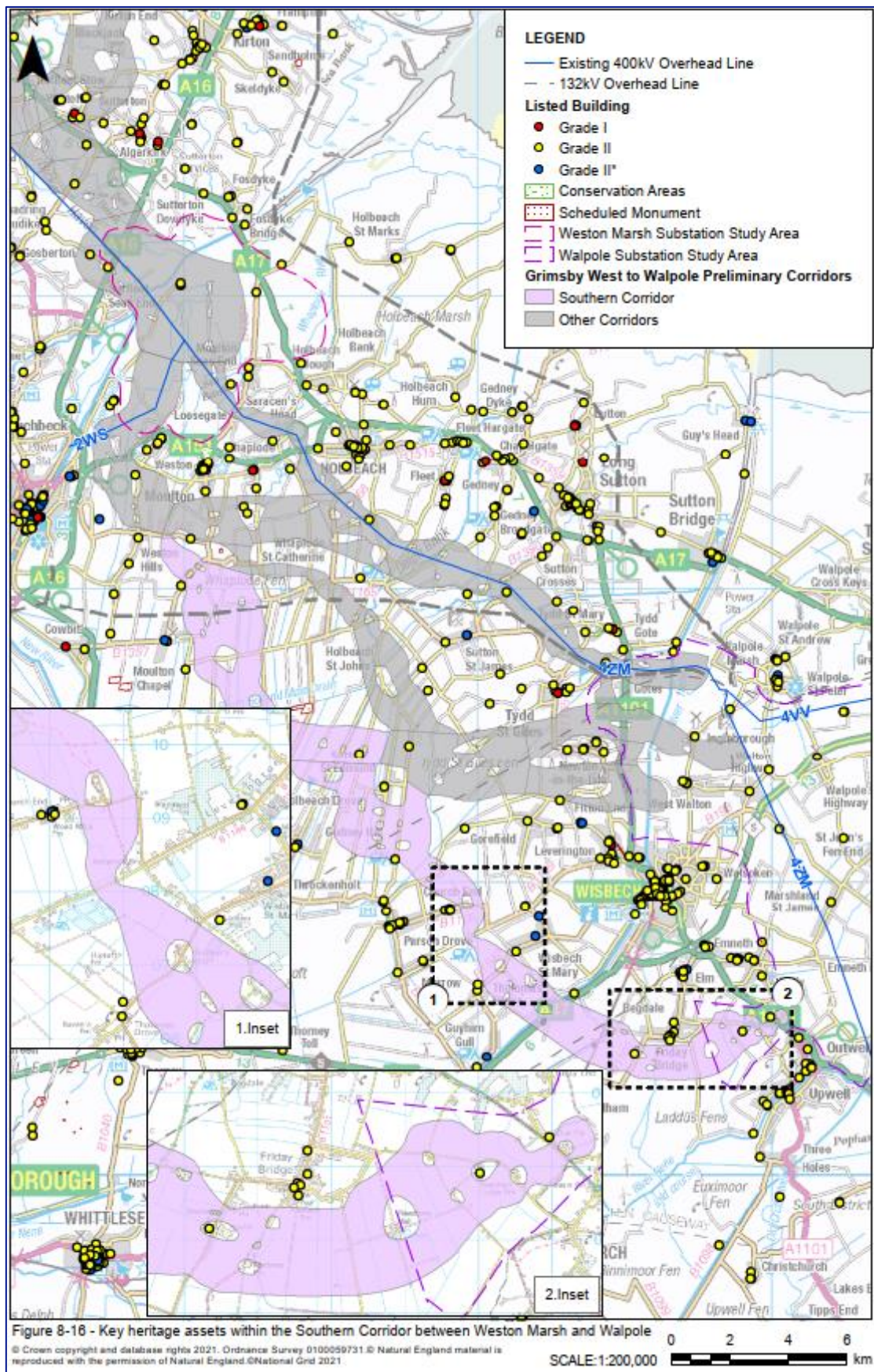
8.2.120 There are numerous designated heritage assets within 1 km of the Southern Corridor, the majority of which comprise scattered Grade II listed buildings at the edge of Sections. There are also small clusters of other designated heritage assets located at the villages of Sutton St Edmund, Friday Bridge and Gedney Hill. The most notable (Shown in **Figure 8-16**) in proximity are:

- A scheduled monument (*Romano-British settlement S of Shell Bridge*) located approximately 300 m east of Section S12;
- a Grade II listed building, *Yarwood house*, located adjacent to Section S12;
- two Grade II listed buildings, *Needham Lodge* and *Waldersea House*, which are located adjacent to Section S13; and
- a Grade II listed building, *Dial Farmhouse*, located adjacent to Section S13.

8.2.121 There are likely to be potentially significant impacts upon the setting of identified designated heritage assets where routeing an overhead line in proximity and an increased potential for additional buried archaeology to be disturbed due to an assumed greater presence. However, due to the width of these Sections, there is sufficient flexibility to materially reduce adverse impacts through careful routeing and the implementation of standard construction measures. Due to open landscape and the presence of scheduled monuments east (as noted above) and views between this asset and a cluster of scheduled monuments surrounding Providence House to the north-west of Whaplode it may be the case that potentially significant impacts upon the setting of these assets still exist even with careful routeing.



Figure 8-16 – Key heritage assets within the Southern Corridor between Weston Marsh and Walpole



## Socio-economics

8.2.122 There are few socio-economic constraints located within or near the Southern Corridor between Weston Marsh and Walpole. Those identified are:

- Fenland Airfield - located adjacent to Section S12, along its eastern border. The most western edge of the Section is approximately 2 km from the runway; therefore, pylons may pose a collision risk to flights;
- The proposed Grantham to Bexwell water pipeline NSIP – this NSIP crosses the at the south of Section S13 and would require crossing; and
- a proposed Solar Farm development (F/YR22/1070/SC) – located at the north-east of Section S13 and south-east of Sutton St Edmund. Avoidance of the solar farm should be possible, unless a route from Section C26 is progressed south into Section S13.

8.2.123 Given the nature of these constraints and their distribution, predominantly at the boundaries of the Sections, implementation of careful routeing will minimise, and in most instances avoid the receptors. As such, it is considered that significant adverse impacts are unlikely.

## Other Considerations

8.2.124 Other environmental topics were also considered as part of the Options Appraisal and include air quality, noise and water.

8.2.125 Residential receptors are predominantly located outside, or within areas specifically excluded from the Southern Corridor. Within the Corridor there are scattered, sparsely distributed residential, commercial and agricultural properties throughout and there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality or noise and vibration impacts are anticipated during operation. It is noted that due to the narrow nature of certain areas (along the B1165 and B1357 in Section S12; along the Broadgate Road (south of Sutton St Edmund) in Sections S13; and between Church End and the A47 in Section S13) further careful investigation of infrastructure placement (at a later stage) would be required to avoid adverse residual impacts on residential properties immediately adjacent.

8.2.126 Flood Zones 2 and 3 cover most of Sections S12 and S13. Flood Zone 3 is only not present in small patches along each Section and generally cannot be avoided even through careful routeing. In addition to Flood Zones 2 and 3 areas at risk of flooding from reservoirs are present south-east of the River Nene in Section S13. All Sections contain field drains, and all contain either a Statutory Main River and / or a WFD river waterbody, see **Figure 8-13**. In addition to field drains, the watercourses present within each Section comprise:

- Section S12 – one WFD waterbody (South Holland Main Drain) and two IDB watercourses; and
- Section S13 – one WFD waterbody (South Holland Main Drain), the River Nene (main river) and two IDB watercourses.

## Summary

8.2.127 Most of the environmental features and constraints in the Southern Corridor between Weston Marsh and Walpole are scattered along both Sections. In this area, those

environmental constraints which exert the most influence on the routing of a new overhead line are:

- proximity to residential receptors, particularly at narrower areas along the B1165 and B1357 in Section S12, along the Broadgate Road (south of Sutton St Edmund) in Section S13, and between Church End and the A47 in Section S13;
- the presence of a UKPN 132 kV overhead lines in, or in proximity to, Sections S12 and S13;
- current development proposals such as the Grantham to Bexwell water pipeline NSIP;
- priority habitats (coastal and floodplain grazing marsh and traditional orchards);
- the settings associated with scattered designated heritage assets;
- the crossing of the River Nene; and
- The Nene Washes designated sites.

8.2.128 When considering receptors outside of the Southern Corridor these comprise scattered residential properties, recreational receptors and designated heritage assets which may be impacted visually or on their setting. It is considered that there is the potential for significant adverse impacts on scattered individual receptors. It is considered that some of these adverse impacts can be avoided, or reduced, through careful routing, however between Church End and the A47 the comparative narrowness of the Corridor where are such impacts may be unavoidable.

### **Engineering and System Factors**

8.2.129 There were several constraints located throughout the Southern Corridor which were considered likely to reduce routing flexibility and/or increase the technical complexity of the individual Sections.

8.2.130 Throughout the Southern Corridor, there are scattered constraints including residential properties, industrial and agricultural buildings, woodland blocks and watercourses. Almost all the Southern Corridor is covered by Flood Zones 2 and 3 and it is therefore unavoidable. Infrastructure required within these areas would need to be designed accordingly and there is also the potential for access and construction limitations, particularly at certain times of year where flood risk is increased, and construction cannot take place.

8.2.131 There are several areas which include residential receptors throughout Section S12. In the north-west of the Section (following Section C23) there are narrower areas at Weston Hills which reduces routing flexibility and here, subject to further detailed alignments, oversailing of curtilages may be required. However, another option to enter Section S12 is present east of the B1357 Hall Gate (from Section C24) which is comparatively wider and avoids the area at Weston Hills. Whichever entry point to the Section is used, a crossing of either the B1357 and/or B1168 would be required, both of which require crossing protection. Further south within the Section are two 33 kV overhead lines and a 132 kV overhead line which would both require engineering solutions to facilitate crossing prior to construction of the Project.

8.2.132 The Section then continues south in proximity to Fenland Airfield, the runways of which are north-south and east-west. The proximity of this airfield will limit routing flexibility, should minimising the impact upon its operations be sought. If seeking to avoid impacts

upon the flight paths, it may be required (subject to consultation with the airfield operator) to route an overhead line further west. However residual impacts upon the airfield may still occur as the furthest extent of the Section is within 2 km.

- 8.2.133 South of Fenland Airfield within Section S12, a crossing of South Holland Main Drain would be required before routeing south-east and crossing the B1168 to either connect to Section C26 or Section S13. Both crossings will require crossing protection.
- 8.2.134 Like Section S12, Section S13 includes a narrower area near a cluster of properties adjacent to Highstock Drain. If this area of the corridor is used, multiple angle pylons may be required to avoid oversailing residential properties. There is a wider area available within the Section further east, or an alternative connection from Section C26 are comparatively wider. However, the presence of a proposed solar farm application at the south-east of Section C26 and into Section S13 would reduce flexibility of an overhead line entry into Section S13 to the east of Sutton St Edmund.
- 8.2.135 South of Sutton St Edmund routeing an overhead line would need to consider crossing two gas pipelines, a UKPN 132 kV overhead line and North Level Main Drain all within a stretch of approximately 2-3 km. The presence of these features in close proximity to one another will reduce routeing flexibility, would require sufficient stand-off distances (for the gas pipelines) limiting pylon placement, require mitigation prior to construction (for the overhead line) and require larger pylons (to facilitate the drain crossing). At Church End a crossing of the B1166 is required in a narrow area of the Section and additional angle pylons may be required reducing the potential for oversailing of properties and/or their curtilages.
- 8.2.136 South of Church End and until the A47, Section S13 is generally narrower, and this limits routeing flexibility. Within this area routeing an overhead line would have to consider a gas pipeline that routes into and along the Section north and south of Seadyke Bank, a larger wetland area adjacent to the Section south of Seadyke Bank, a crossing of the B1542, large orchards partially within and the Section, the crossing (in one span) of the River Nene and A47. Combined, these constraints considerably increase the technical complexity of routeing an overhead line within this Section.
- 8.2.137 South of the A47 the Section begins to widen, and constraints become more scattered. However, between this point and the A1101 (at the end of the Section), a new overhead line would be required to consider existing wind turbines at the western edge of the Section south of the A47, crossing a UKPN existing 132 kV overhead line, large orchards partially within the Section, crossing the B1101 and potentially multiple crossings of the proposed Grantham to Bexwell water pipeline NSIP. Combined, these constraints increase the technical complexity of routeing an overhead line within this Section.

## Summary

- 8.2.138 Overall, there is sufficient flexibility for routeing within the Southern Corridor, however there are some areas that are narrow which may reduce flexibility in parts of the Corridor. There are constraints present within the Corridor which will influence routeing. These are residential properties, priority habitats, watercourses, major road networks and existing overhead lines and underground pipelines. Appropriate distance will need to be maintained between an overhead line route and the Fenland Airfield. Areas of Flood Zones 2 and 3 are a notable constraint throughout the Southern Corridor and are considered unavoidable and therefore will likely result in implications for design and construction.

## Holford Rules

- 8.2.139 The Southern Corridor has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.
- 8.2.140 Sections have generally avoided smaller areas of high amenity value through areas specifically excluded from the Corridor. The smaller areas of high amenity value which exist within the boundaries of the Corridor comprise individual listed buildings and priority habitats. Where there are smaller areas of high amenity value, sufficient space has been included within the Corridor to enable routeing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.
- 8.2.141 The Southern Corridor was specifically developed to connect to Walpole siting zone WLP6 only (as WLP6 it is the only Walpole siting zone outside areas of Flood Zones 2 and 3). From Weston Marsh generally follows a largely direct route (in line with **Holford Rule 3**). However, it is noted that although it follows a largely direct route it is the longest route from Weston Marsh to a Walpole siting zone, requiring approximately 10 km of additional overhead line (compared to other Corridors).
- 8.2.142 The Southern Corridor was developed to avoid highly constrained areas, and specific constraints including settlements, and specific constraints including settlements such as Sutton St Edmund and Friday Bridge (Holford Rule Supplementary Note 1). The width of the Corridor reflects the constraints in each area, with narrow sections particularly because of areas specifically excluded.
- 8.2.143 The Southern Corridor includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**.
- 8.2.144 Given the generally very flat and open landscape, with long views, **Holford Rules 4 and 5** which primarily refer to topography were not found to be relevant, except in respect of woodland blocks, where the width of the Corridor is generally sufficient to provide opportunities for them to be skirted in the detailed design at a later stage of the Project.
- 8.2.145 The Southern Corridor would require the crossing of three existing 132 kV overhead lines (**Holford Rule 6**), and this would result in adverse landscape and visual impacts unless the mitigation (re-routeing, removal or undergrounding) is undertaken.
- 8.2.146 No industrial zones exist within the Southern Corridor and therefore **Holford Rule 7** is not applicable.

## Conclusion

- 8.2.147 The Southern Corridor follows mostly a direct route to siting zone WLP6 and there is sufficient flexibility in routeing. However, it is likely to be the longest overhead line route, requiring an additional 10 km of overhead line, and there are narrow areas within the Sections that restrict routeing. Sections S12 and S13 both have constraints within them, such as residential properties, priority habitats and existing infrastructure, however, most can be avoided through careful routeing. Flood Zone 2 and 3 would present a notable constraint to routeing and would have implications for design and construction. The crossing of existing overhead lines would result in landscape and visual impacts unless suitable mitigation is actioned.

8.2.148 A tabulated summary of the appraisal of the Southern Corridor (between Weston Marsh and Walpole) is provided in **Table 8-3**.

Table 8-3 Summary of Southern Corridor Options Appraisal between Weston Marsh and Walpole

Theme	Topic	Summary
Environmental	Landscape and Visual	<ul style="list-style-type: none"> <li>• The proposed overhead line and the presence of existing 132 kV overhead line infrastructure may in combination have adverse cumulative impacts on the landscape and visual amenity to the north of Moulton Chapel, south of Whaplode St Catherine, and south of Sutton St Edmund.</li> <li>• There is potential for adverse impacts on views experienced by recreational receptors including users of the North Level Main Drain, River Nene, Nene Way National Trail and National Cycle Route 1.</li> <li>• Scattered residential properties and settlements within and adjacent to the corridor may experience potential adverse visual impacts.</li> </ul>
	Ecology	<ul style="list-style-type: none"> <li>• There is potential for the Southern Corridor to have functionally connected habitats and pollution pathways to the Nene Washes designated sites, the Ouse Washes designated sites and The Wash designated sites.</li> <li>• Coastal and floodplain grazing marsh, deciduous woodland and traditional orchard priority habitats are within and adjacent to the Southern Corridor. This will require careful routeing to avoid these areas.</li> </ul>
	Historic Environment	<ul style="list-style-type: none"> <li>• Potential setting impacts on <i>Hawthorn Farmhouse</i> Grade II listed building located within the Corridor.</li> <li>• Several listed buildings and scheduled monuments are scattered adjacent to the Corridor, and within areas specifically excluded from Sections. Direct impacts will be avoided through careful routeing, however, impacts on setting are likely to arise especially where the Corridor is in proximity to the assets.</li> <li>• There is the potential for significant cumulative impacts on <i>Walderssea House</i> and <i>Hawthorn Farmhouse</i> Grade II listed buildings as a result of the presence of multiple existing 132 kV and 33 kV overhead lines.</li> </ul>

Theme	Topic	Summary
	Socio-economics	<ul style="list-style-type: none"> <li>• There is the potential for impacts on Fenland Airfield with a new overhead line presenting a flight collision risk due to its proximity.</li> <li>• The Grantham to Bexwell water pipeline NSIP crosses the Southern Corridor and further mitigation will likely be required to avoid impacts.</li> <li>• Numerous navigable waterways fall within or are crossed by the overhead line Corridor.</li> </ul>
	Other Considerations	<ul style="list-style-type: none"> <li>• Almost all the Corridor is covered by Flood Zones 2 and 3 which presents a constraint since siting infrastructure within this cannot be avoided.</li> <li>• Almost all the Corridor Sections contain field drains and either a Statutory Main River or WFD river waterbody.</li> <li>• Peaty soils are present within the south-west of the corridor within S13 and will need to be avoided.</li> </ul>
Technical	Technical Complexity	<ul style="list-style-type: none"> <li>• The proposed Grantham to Bexwell water pipeline has the potential to reduce routeing flexibility in the south.</li> <li>• Existing gas pipelines to the south of Sutton St Edmund will reduce routeing flexibility as sufficient stand-off distances will be required between these pipelines and the placement of new pylons.</li> <li>• A suitable distance will be required between a new overhead line and existing 33 kV and 132 kV overhead lines or these will require mitigation, such as removal or undergrounding, to ensure there is sufficient space prior to the construction of a new overhead line.</li> </ul>
	Construction and Delivery	<ul style="list-style-type: none"> <li>• Coordination with developers will be required to ensure the proposed new overhead line can be facilitated in combination with the various other proposed developments located within the Southern Corridor including the Grantham to Bexwell water pipeline.</li> <li>• Additional and larger angle pylons may be required to facilitate perpendicular road and watercourse crossings, such as of the B1357 and B1168.</li> </ul>



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Theme	Topic	Summary
		<ul style="list-style-type: none"><li>• Fenland Airfield is adjacent to the Corridor. Further investigation would be required to establish the potential impacts of an overhead line on the flight paths from this location.</li><li>• Infrastructure is likely to be required within Flood Zones which could pose a risk to construction and maintenance – specific foundations, drainage and mitigation access routes would need to be designed to suit.</li></ul>

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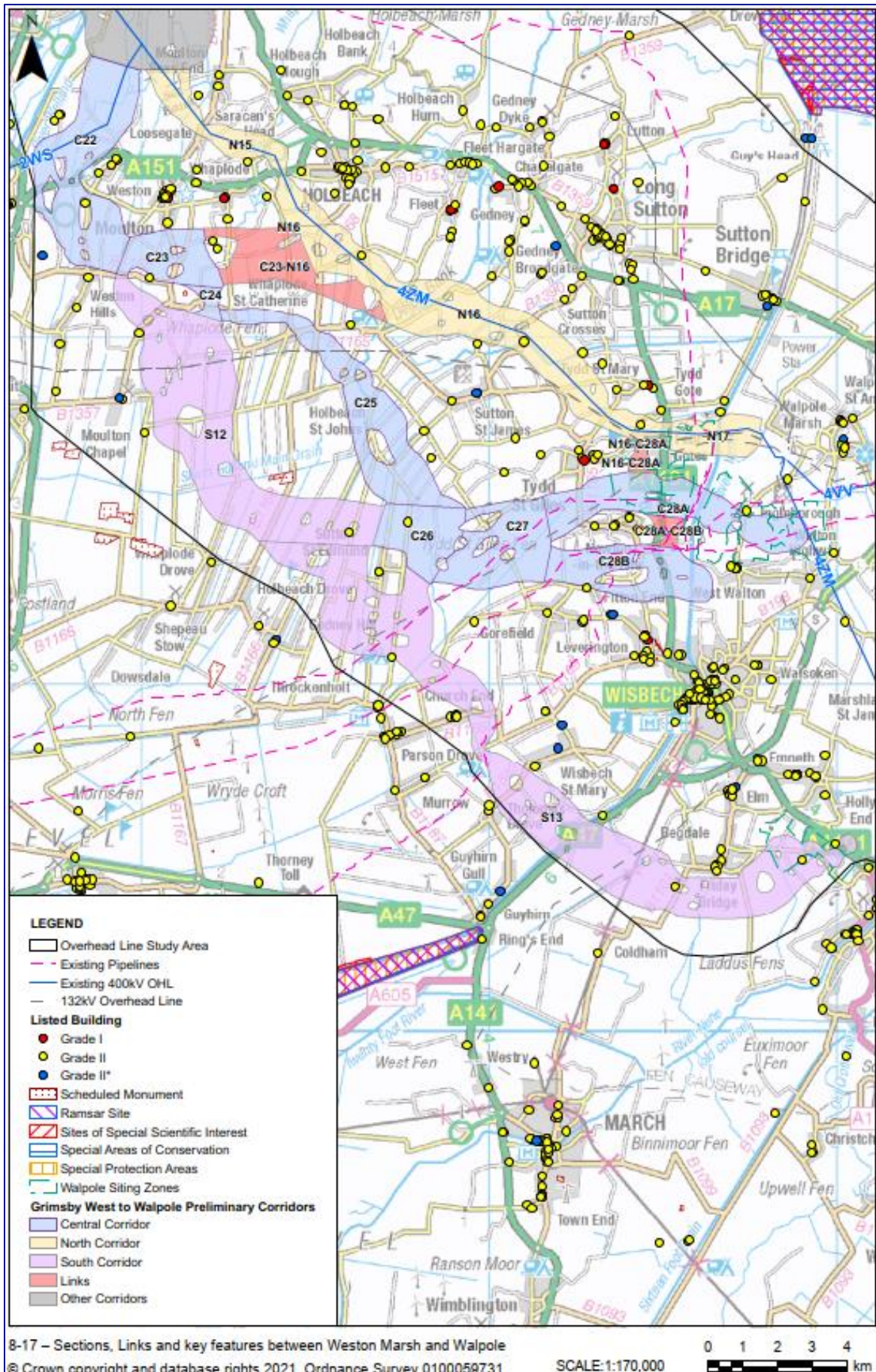
## 8.3 Comparative Appraisal and Conclusion

- 8.3.1 Following the above Options Appraisal, the appraisal findings were considered and the relative merits of the different options for the 400 kV overhead line between Weston Marsh and Walpole were compared. The corridor was broken down into smaller components (listed below) for the purposes of comparative appraisal as each of the sections and links has localised constraints which could be avoided through alternative routing. Therefore, it was likely that a combination of Sections and Links, rather than a single corridor would be used. The defined components of the route between Weston Marsh and Walpole were considered in isolation (i.e., without consideration of the emerging preferences for the Weston Marsh siting zones or Walpole siting zones).
- 8.3.2 The need to use underground cables in any part of the route will be reviewed as the design process progresses, in response to survey findings to obtain baseline data and stakeholder and community feedback.
- 8.3.3 This section presents the factors considered to influence the decision-making process for determining the emerging preferred corridor between Weston Marsh and Walpole. As the design progresses, regular reviews will be undertaken to ensure the emerging preferred corridor taken forward at this stage remains the optimum corridor when all environmental, socio-economic and technical aspects are considered.

### Comparative Appraisal

- 8.3.4 This area runs from the Spalding Tee-Point (and the Weston Marsh siting zones) in the north-west to the Walpole siting zones in the south-east and considered the following sections and links as shown in **Figure 8-17**:
- Central Corridor (Sections C22 to C28A/B);
  - Southern Corridor (Sections S12 to S13);
  - Northern Corridor (Sections N15 to N17);
  - Central Corridor to Northern Corridor Link (Link C23-N16);
  - Central Corridor to Central Corridor Link (Link C28A-C28B); and
  - Northern Corridor to Central Corridor Link (Link N16-C28A).

Figure 8-17 - Sections, Links and Key Features between Weston Marsh and Walpole



- 8.3.5 All the corridor Sections overlap or provide routes to the Walpole siting zones emerging as preferred when considered in isolation (WLP4, WLP5 and WLP6). When reviewed alongside the Corridors, using Sections and Links to reach a siting zone at WLP6 is least preferred. Use of Sections and Links to reach siting zone WLP6 would require between approximately 6 km and 12 km (subject to detailed alignments) of additional overhead line infrastructure to reach it. As the EGL 3 and EGL 4 Projects are also cabling to within proximity of the new Walpole substation, this would also require a similar length of additional cable infrastructure (subject to the routeing of these projects). The requirement for this additional infrastructure, which routes primarily through areas of Flood Zones 2 and 3, in combination with the constraints faced by routeing through Sections S12 and S13 into WLP6 are:
- proximity to the Fenland Airfield;
  - comparatively more crossings of linear features (watercourse, drains, roads and the Grantham to Bexwell water pipeline NSIP);
  - routeing through narrower areas which may require oversailing residential properties recreational routes and local road network or the use of multiple angle pylons in proximity to residences;
  - closer proximity to the Nene Washes designated sites; and
  - potential impacts to numerous areas of traditional orchard priority habitat.
- 8.3.6 When reviewing the other Sections and Links, use of Link C28A-C28B is least preferred. This is due to the technical complexity of routeing in a comparatively narrow area with a winding drain and two gas pipelines, and the potential comparatively greater landscape and visual impacts that this would present (using additional angle pylons). When comparing Sections C28A and C28B, Section C28A was more preferred as it would limit the potential for encircling properties at Newton-In-The-Isles (with a new 400 kV overhead line to the south and an existing 132 kV overhead line to the north), and it offers better opportunities to enter siting zones WLP4 and onward into WLP5 (without using Link C28A-C28B) if required.
- 8.3.7 Section N17 was less preferred due to the technical complexity and potential environmental implications for routeing into siting zone WLP2 and the presence of two existing 132 kV overhead lines and the existing 400 kV 4ZM overhead line within this area.
- 8.3.8 When comparing the remaining identified options for routeing the overhead line these were:
- A route following the Central Corridor (Sections C22 to C28A) to the Walpole siting zones WLP1 to WLP5;
  - A route following Sections C22, Link C23-N16, and then a close parallel route within Section N16 and Link N16-C28A to Walpole siting zones WLP1 to WLP5; or
  - A route following Sections N15, N16 and Link N16-C28A to Walpole siting zones WLP1 to WLP5.
- 8.3.9 Compared to solely using the Northern Corridor close parallel solution or a new overhead line solely within the Central Corridor, using Section C22 then routeing via Link C22-N16 was considered less preferred as it would have reduced benefits as a close parallel alignment and would result in the encirclement of properties as it routes

towards the existing 4ZM 400 kV overhead line. Therefore, a route using these Sections and Links is less preferred.

- 8.3.10 Environmentally, an optimal close parallel overhead line route in the Northern Corridor (south of the existing 4ZM 400 kV overhead line) would have relative benefits as it would limit the spread of effects, especially landscape, visual and those upon the setting of heritage assets, to a wider (or new) area. However, achieving the close parallel route may require the acquisition of several residential properties. Permanent acquisition, temporary possession (both referred to in this report as 'acquisition') or direct oversail of such properties is not a preferred approach and where possible avoidance of this is sought where alternatives exist. Technical solutions (i.e., duck-unders or line swap overs) that would likely be required to avoid such acquisitions or direct oversail of residences would diminish the benefits from the close parallel route because of their visual impact. The use of duck-unders or line swap overs would restrict future operation of the overhead line and increase technical complexity whilst potentially not fully avoiding oversailing property curtilages. The use of line swap overs would require outages upon the 4ZM 400 kV overhead line which would increase technical complexity of construction and affect current power flows on the transmission system. In addition, the use of duck-unders or line swap overs would result in a wirescape or a requirement for other infrastructure (such as SECs). A route using the Northern Corridor would also have to use Link N16-C28A where routing into Walpole siting zones WLP2 to WLP5 which would require the use of Section C28A. Using Link N16-C28A would introduce two changes of direction (firstly south, then east across the River Nene) which would increase technical complexity (especially as it would require crossing two 132 kV overhead lines) and potentially contribute to a wirescape and more widespread landscape and visual impacts.
- 8.3.11 Compared to the close parallel route which may require multiple acquisitions or direct oversail of residential properties, a route using the Central Corridor would introduce an overhead line into areas without one, except for a section which would closely parallel the 2WS 400 kV overhead line and result in the crossings of two existing 132 kV overhead lines. However, compared to the Northern Corridor, an overhead line using the Central Corridor is considerably less likely to result in the potential acquisition or direct oversail of residential properties.
- 8.3.12 When comparing the Northern (close parallel route) and Central Corridor, the Northern Corridor has an environmental benefit. It would limit the amount of new infrastructure in areas currently without overhead lines, which is offered by the close parallel of the existing 4ZM 400 kV overhead line in the corridor. However, to achieve this close parallel route the acquisition of residential properties is likely to be required. The use of technical solutions such as duck-unders to avoid this would reduce the environmental benefits that could be obtained by close paralleling in the Northern Corridor. This would be likely to create a 'wirescape,' reducing the overall environmental benefits that the close parallel route in the Northern Corridor offers. Additionally, these technical solutions would introduce far greater technical complexity to routing the overhead line, increasing the cost and duration of construction. Acquisition of residential properties is unlikely to be needed in the Central Corridor. However, routing an overhead line within this corridor would introduce an overhead line into areas where there currently are none, thereby having a greater potential for landscape and visual impacts when compared to the Northern Corridor. Nevertheless, the environmental benefits that could be obtained by routing within the Northern Corridor are not considered significant enough to outweigh the requirement to either directly oversail or acquire residential properties. As such, giving greater weight to avoiding impacts on homes and properties in these circumstances means that there is a clear preference for the Central Corridor.

## Summary of Decision

8.3.13 The following Sections are preferred and therefore selected to progress at this stage:

- Central Corridor (Sections C22 to C28A) – While technical complexities and environmental challenges exist within the Central Corridor (C22 to C28A), it is considered that these can be mitigated through careful routeing. A route using this Corridor (compared to the Northern Corridor) is also unlikely to require acquisition or direct oversail of residences.

8.3.14 The following Sections are less preferred and therefore were not progressed at this stage:

- Southern Corridor (Sections S12 to S13) - Sections S12 to S13 would require approximately 6 km and 12 km (subject to detailed alignments) of additional overhead line infrastructure (for the Project) and underground cable infrastructure (for the EGL 3 and EGL 4 projects) to reach siting zone WLP6 (for which it was developed to reach). The additional environmental and socio-economic impacts and technical complexity from this additional linear infrastructure is less preferred.
- Northern Corridor (Sections N15 to N17) - The close parallel route within the Northern Corridor (south of the 4ZM 400 kV overhead line) would be the shortest route. It would limit the spread of environmental impacts to new or wider areas. However, as it would require the potential acquisition or direct oversail of several residential properties to achieve the optimal close parallel route, it is less preferred. Use of duck-unders or line swap overs (to avoid acquisition or direct oversail) would increase the technical complexity of the close parallel route and erode the benefits of a close parallel route.
- Central Corridor to Northern Corridor Link (Link C23-N16) - Routeing through this comparatively narrow Link would require avoiding clusters of settlements and may require use of multiple angle pylons. As it nears the existing 4ZM 400 kV overhead line within Section N16, it is also likely to result in the encirclement of multiple properties. It would also need to consider the onward routeing within the Northern Corridor which, as the close parallel route, may involve the compulsory acquisition or oversail of multiple residences.
- Central Corridor to Central Corridor Link (Link C28A-C28B) – Use of this Link would be required to navigate a comparatively narrow area which contains a drain that zigzags across the Link and two gas pipelines which may require the use of additional angle pylons, increasing technical complexity and creating comparatively greater landscape and visual impacts.
- Northern Corridor to Central Corridor Link (Link N16-C28A) - Routeing through Link N16-C28A would introduce two changes in direction (first south from Section N16 and then east within Section C28A) conflicting with Holford Rule 3. It would also need to consider the constraints of routeing within Section N16, where a close parallel route would require the potential acquisition of multiple residences.

## Conclusion

8.3.15 Overall, when considered in isolation, the emerging preferred corridor between Weston Marsh and Walpole is an overhead line in Sections C22 to C27 and Section C28A. This however is subject to the identification of the emerging preferences for the Weston Marsh siting zones (set out in **Chapter 11**) and the Walpole siting zones (set out in

**Chapter 12).** The emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14.**

# 9. Options Appraisal – Grimsby West

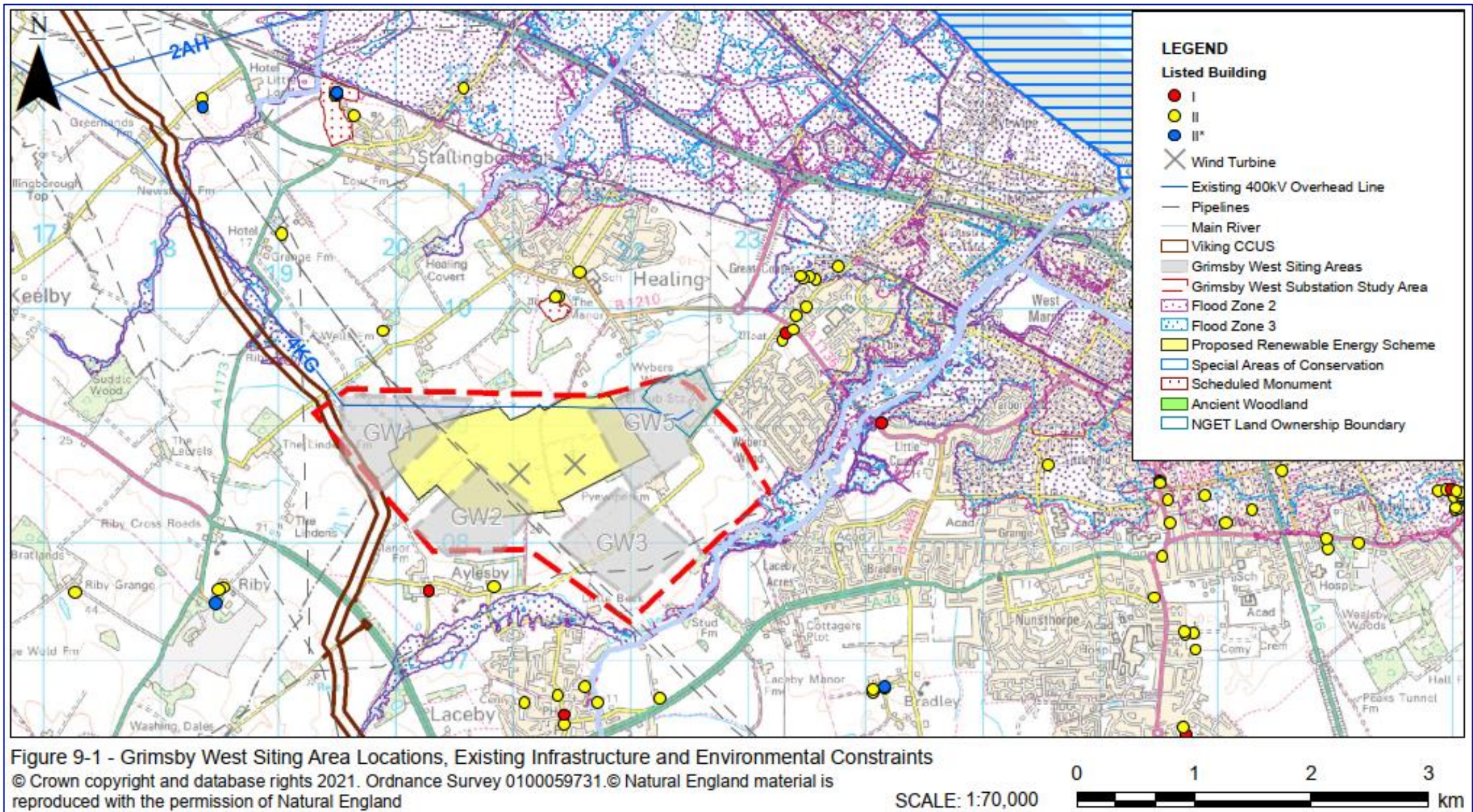


# 9. Options Appraisal - Grimsby West Substation

## 9.1 Introduction

- 9.1.1 This Chapter details the outcomes of the Options Appraisal (Step 7 as described in **Chapter 4**) for the preliminary siting areas for the new Grimsby West substation. The Grimsby West siting areas have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6). They have been developed to accommodate an AIS substation that could extend to approximately 600 m by 200 m (approximately 12ha). The siting area options progressed for appraisal (shown on **Figure 5-2**) comprise:
- Siting area GW1 – an area, approximately 800 m by 1,200 m, located north-west of Aylesby and existing wind turbines which encompasses the existing 400 kV overhead line to the north;
  - Siting area GW2 – an area, approximately 800 m by 600 m, located immediately north of Aylesby and south of existing wind turbines;
  - Siting area GW3 – an area, approximately 800 m by 700 m, located east of Aylesby and north-east of Laceby, Aylesby Road travels through the centre; and
  - Siting area GW5 – an area, approximately 900 m by 600 m, located west of Wybers Wood which encompasses the existing 400 kV overhead line, and NGET and NPG substations at Grimsby West.
- 9.1.2 The Options Appraisal of environmental, socio-economic and technical issues for the new Grimsby West substation has considered, as detailed in **Chapter 5**, the potential impacts on relevant receptors, and whether such effects could be avoided or mitigated through routeing and careful siting. Where impacts cannot be avoided or mitigated by careful routeing other forms of mitigation have been considered in accordance with NGET's mitigation hierarchy (as described in **Paragraph 4.8.4**).
- 9.1.3 For the current Project stage, the relevant data to inform the appraisal comprises desk study information, supplemented by a site visit to select locations, on important receptors.

Figure 9-1 – Grimsby West Siting Areas, Key Existing Infrastructure and Environmental Features



## 9.2 Environmental Factors

### Landscape and Visual

- 9.2.1 Due to the short distance, approximately 3 km, between the locations of the siting areas for the new Grimsby West substation there was little to differentiate regarding the potential effects on the surrounding landscape. All the siting areas are:
- located within the Lincolnshire Coast and Marshes NCA, characterised by a wide coastal plain extending from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness;
  - located over 3 km from the AONB<sup>42</sup>; siting area GW5 is located the furthest from the AONB at 4 km. The closest LCA is the Chalk Wolds (includes Laceby to Louth); and
  - located within an open landscape with level topography offering flexibility for siting.
- 9.2.2 Like the potential effects on the surrounding landscape, the potential visual impact of a new Grimsby West substation within each of the siting areas was comparatively similar. The surrounding area comprises an open flat landscape, surrounded by residential areas at Aylesby, Healing, Laceby, Laceby Acres and Wybers Wood. The different siting areas would impact the visual amenity of each of these residential areas to varying degrees; those further east having more of an effect on Wybers Wood; those further south having more of an effect on Laceby; and those further west having more of an effect on Aylesby. Siting area GW3 is likely to be the most visually intrusive due to the limited presence of existing vegetation which may have otherwise assisted in screening the siting area. In addition, all siting areas have the potential to impact the visual amenity of future receptors proposed by the GWUE allocation adjacent to Wybers Wood (at the east of the Grimsby West Study Area). However, siting area GW5 offers the opportunity to locate the new Grimsby West substation near the existing Grimsby West substations which would limit potential impacts and the spread of visual effects.
- 9.2.3 All the Grimsby West siting areas have an opportunity to utilise existing woodland screening within the Grimsby West Study Area, however the greatest opportunity is provided by siting area GW5. Compared to the other siting areas and depending on final substation orientation (which would be determined later in the project development process), a new Grimsby West substation could be well screened at siting area GW5 and would limit the spread of visual effects from introducing infrastructure into areas not presently affected by this type of development.
- 9.2.4 Overall, there was little to differentiate between each of the Grimsby West siting areas. However, siting area GW5 offers the greatest opportunity to take advantage of existing screening provided by vegetation and is located immediately adjacent to the existing NPG 132 kV and NGET 400 kV infrastructure.

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<sup>42</sup> The local landscape of the AONB in closest proximity is the Chalk wolds. Key features of this area identified in the AONB management plan are the open rolling arable farmland on gently dipping plateau, the wooded and lush inward-facing valleys and dry valleys, the attractive nucleated villages, the enclosure roads with wide verges and characteristic hedgerows, the small plantation woodlands and beech clumps of the 18th and 19th centuries, the isolated chalk grassland, deserted medieval villages, the archaeological sites on the plateau, the manors and parkland, the geomorphological and geological sites and the localised old enclosed landscape.

## Ecology

- 9.2.5 All the siting areas for the new Grimsby West substation are located over 4 km from NSN, Ramsar and SSSI sites. The nearest is the Humber Estuary designated sites, located approximately 4 km east of the Grimsby West Study Area, which is hydrologically connected to Laceby Beck. Due to the distance of the siting areas from the Humber Estuary designated sites, potential impacts in relation to substation infrastructure are limited to pollution during construction of functionally connected habitats. In relation to overhead line entries, potential impacts also include the risk of collision, flight path disruption, injury, and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within a HRA, as the Project development progresses. Should the HRA identify adverse effects on the integrity of the NSN, the emerging preferences identified will be revisited.
- 9.2.6 Priority habitat datasets identified priority habitat, in the form of headwater areas, as present only within siting areas GW1 and GW2. However, it was noted from site walkovers that the identified priority habitat area currently comprises arable land and therefore this was not considered a differentiating factor.
- 9.2.7 Overall, there was little to differentiate between each of the Grimsby West siting areas from an ecological perspective.

## Historic Environment

- 9.2.8 There are no designated heritage assets located within any of the siting areas for the new Grimsby West substation, however designated heritage assets are present within 1 km. Therefore, each siting area has the potential to affect the setting of identified designated heritage assets. The significance of the potential impact upon the setting of these assets is limited due to the presence of either intervening woodland, other development, and/or the distance from the siting areas. Identified designated heritage assets within 1 km of each siting area include:
- Siting area GW1: One Grade I listed building and two Grade II listed building assets; the closest is *Farm Range On North Side Of Healing Wells Farm* located approximately 550 m from the siting area. The remaining are located over 900 m from the siting area.
  - Siting area GW2: One Grade I listed building and two Grade II listed building assets; the closest is *F W Mcaulay Cottages* which is located approximately 300 m from the Zone. The remaining are located over 300 m from the Siting Area.
  - Siting area GW3: four Grade II listed buildings and one Conservation Area; the closest is the *Cottage* located approximately 550 m from the siting area. The remaining assets are located over 600 m from the siting area.
  - Siting area GW5: One Grade I listed building, two Grade II listed buildings, one Conservation Area and one Scheduled Monument; the closest is Great Coates Conservation Area which is approximately 640 m from the siting area. The remaining assets are located over 700 m from the siting area.
- 9.2.9 Further consideration has been given to the impact upon the setting of receptors of a higher sensitivity (Grade I, Grade II\*, Scheduled Monuments) within 1 km of each siting area. Those identified are:
- Siting area GW1: *Church Of St Lawrence* Grade I listed building is located approximately 900 m south-east of the siting area and *Two moated sites at Healing*

*Hall* Scheduled Monument is located approximately 940 m north-east of the siting area. Due to the distance of these assets from the siting area and intervening settlement at Aylesbury, the potential impacts on the setting of these assets from the new Grimsby West substation could be materially reduced;

- Siting area GW2: *Church Of St Lawrence* Grade I listed building is located approximately 340 m south-west of the siting area. While intervening settlement at Aylesbury will help screen the new Grimsby Substation from the asset, due to the proximity of the asset, other mitigation may be required;
- Siting area GW5: *Church Of St Nicolas* Grade I listed building is located approximately 750 m north-east of the siting area and *Two moated sites at Healing Hall Scheduled Monument* is located approximately 835 m north-west of the siting area. Due to the distance of these assets from the siting area and the presence of intervening vegetation, infrastructure (existing Grimsby West substation) and settlement (properties along Carr Lane), the potential impacts on the setting of these assets from the new Grimsby West substation could be materially reduced.

9.2.10 There are a limited number of designated heritage assets within 1 km of all siting areas. Although siting area GW5 has the most assets identified within 1 km, it offers opportunity to limit the spread of effects on the setting of identified designated heritage assets. This is because siting within siting area GW5 would not introduce infrastructure into areas not presently affected by this type of development. It would also offer the opportunity to screen a new substation from identified designated heritage assets by using existing woodland screening around the existing Grimsby West substation.

## Socio-economics

- 9.2.11 The key socio-economic features associated with the siting of the Grimsby West siting areas (described from west to east) are the Lindens Farm Airstrip, Viking CCS NSIP, an approved planning application for the Aura Power Solar Farm, two existing wind turbines and part of the GWUE allocation.
- 9.2.12 Siting area GW1 overlaps with the Viking CCS NSIP, which covers approximately half of the siting area. It is also the only siting area anticipated to interact with Lindens Farm Airstrip, located approximately 250 m to the west, which could limit the overhead line entries and therefore limit the substation orientations. However, it was considered that micro-siting of infrastructure would likely enable reduction, or possibly avoidance altogether, of impacts on the airstrip and NSIP.
- 9.2.13 Siting areas GW1, GW2 and GW5 all overlap with the Aura Power Solar Farm; covering approximately 50%, 40% and 20% of the siting areas, respectively. Siting areas GW1 and GW2 may require complex engineering solutions to avoid and/or minimise impacts to this application or complex land negotiations to agree settlement for removing portions of the proposed solar farm.
- 9.2.14 The GWUE allocation interacts with siting areas GW3 and GW5; covering approximately 5% and 20% of the siting areas, respectively. The GWUE allocation is located at the edge of siting area GW3 and is therefore considered avoidable through careful siting. As the GWUE allocation covers an area near the centre of siting area GW5 it is unlikely to be avoidable, although land take of the GWUE allocation is unlikely to significantly impact the viability of this allocated area. An opportunity was identified to locate the new Grimsby West substation near the existing Grimsby West substation (at the east of the siting area) to limit impacts upon the GWUE allocation.

9.2.15 Overall siting area GW3 has the least interaction with the identified socio-economic constraints. There is little to differentiate between the other siting areas.

## Other Considerations

- 9.2.16 Other environmental topics were also considered as part of the options appraisal and include air quality, noise and water.
- 9.2.17 The only properties within the Grimsby West Study Area are those located at Pyewipe Farm, located within 150 m of siting areas GW3 and GW5. There are other properties (residential, commercial and agricultural) surrounding the siting areas; most notably at Aylesby and Wybers Wood. There is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality impacts are anticipated during operation, however there is the potential for localised changes in noise and vibration on settlements adjacent to the siting areas. However, each siting area is considered sufficient in size to allow for careful siting (at a later stage) to reduce the likelihood and magnitude of these effects.
- 9.2.18 All the siting areas for the new Grimsby West substation are situated above a bedrock principal aquifer. In addition to this hydrological feature, siting area GW3 is located within 200 m of Laceby Beck (Main River and WFD watercourse) and its associated Flood Zone 2 and 3 areas. With implementation of standard pollution prevention measures, the presence of these hydrological features is not considered likely to result in adverse impacts which would prevent substation siting.
- 9.2.19 Overall, there is little to differentiate between the siting areas for the new Grimsby West substation; however siting area GW2 has overall the least comparative interaction with air quality, noise and vibration and water features.

## 9.3 Engineering and System Factors

- 9.3.1 The key factors when considering a best performing siting area for the new Grimsby West substation include the proximity to the existing 400 kV 4KG overhead line and the existing NGET 400 kV and NPG 132 kV substations and the minimisation of system outages required to facilitate construction.
- 9.3.2 For all siting areas, construction sequencing will be rationalised to reduce the potential for system outages. The new Grimsby West substation and the 400 kV transmission connection will be built offline<sup>43</sup> as far as practicable with the final 400 kV transmission turn ins and connections to the existing 132 kV substation completed under outages for all siting areas.
- 9.3.3 The Aura Power Solar Farm overlaps with siting areas GW1, GW2 and GW5, and Viking CCS NSIP overlaps with siting area GW1. These projects are substantially progressed, and if constructed, seeking to limit interactions with these projects would increase the technical complexity of the design at these siting areas.
- 9.3.4 Due to their comparatively greater distance from Aylesby Road, siting areas GW1 and GW2 (both located over 600 m from the road) would require additional infrastructure for construction of a new permanent access road and/or upgrades to existing roads to make them suitable to support abnormal invisible loads (AILs). In comparison, siting

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<sup>43</sup> An offline build means that the infrastructure can be built without impacting on the operation of the existing network and without the need for any system outages until the infrastructure is ready to be commissioned.

areas GW5 and GW3 are located on Aylesby Road, which provides access to the existing 400 kV substation and NPG 132 kV substation and therefore are likely to require less civil infrastructure. In addition, siting area GW5 provides an opportunity to reuse the existing access road to the existing 400 kV and NPG 132 kV substations (subject to more detailed siting at a later stage in the Project), and to retain development within NGET land ownership as much as possible, reducing the extent of third-party land acquisition required to deliver the Project.

- 9.3.5 The Project will require the existing 400 kV 4KG overhead line circuits to be diverted and terminated at the new Grimsby West substation. Siting areas GW1 and GW5 encompass a portion of the existing 400 kV 4KG overhead line and therefore offer comparatively better locations for the required connections to occur. Due to their distance from the existing 400 kV 4KG overhead line (over 500 m from each siting area), siting areas GW2 and GW3 will result in increased overhead line connection works.
- 9.3.6 The Project will require the existing NPG 132 kV substation to connect into the new Grimsby West substation. This is most likely to be achieved by the construction of new 132 kV underground cables. Siting area GW5 would require the shortest length of 132 kV connection due to its proximity to the existing 132 kV substation.
- 9.3.7 There is existing underground infrastructure, the Hornsea cables and the ConocoPhillips pipelines present within the Grimsby West Study Area which interact with the siting areas GW1, GW2 and GW3. These assets route north to south through the study area. They route through the centre of siting area GW1, to the eastern edge of siting area GW2, and along the western edge of siting area GW3. As these assets are major existing buried statutory undertaker assets, their presence will substantially constrain the siting flexibility within siting area GW1 and, to a lesser extent, constrain siting flexibility within siting areas GW2 and GW3.

## 9.4 Holford and Horlock Rules

- 9.4.1 The following paragraphs provide commentary of the extent to which the appraised options for siting the new Grimsby West substation accord with the Horlock Rules, and with regards to line entries, the Holford Rules. (NGET's guiding principles for the routeing/siting of new energy transmission infrastructure and a primary mechanism by which compliance with national policy is determined).
- 9.4.2 At this early stage of development Horlock Rules 7, 9, 10 and 11 are not considered applicable as they are primarily concerned with the detailed design of substations following site selection. In relation to the siting areas for the new Grimsby West substation, only Holford Rules 1 and 2 (which relate to avoiding areas of amenity value) are considered applicable as the remaining Holford Rules related to routeing of overhead lines.
- 9.4.3 When reviewed against the applicable Horlock and Holford Rules:
- The definition of siting areas has taken into consideration environmental features and potential impacts upon identified features (Horlock Rule 1).
  - All siting areas have been defined to exclude areas of highest amenity value and interest in the area (Horlock Rules 2 and 3, and Holford Rules 1 and 2).

- Sufficient space is available within the siting areas to enable micro-siting to avoid identified socio-economic constraints and further reduce impacts on environmental features present (Horlock Rules 4 and 5).
- All siting areas offer the opportunity to utilise screening provided by existing features to reduce intrusion into surrounding areas (Horlock Rule 4); with the greatest opportunity offered by siting area GW5 which seeks to maximise use of existing NGET landownership and locating near the existing Grimsby West substation.
- All siting areas are predominantly located on agricultural land (Horlock Rule 6 - reducing effect on agricultural land and drainage). However siting area GW5 offers the opportunity to utilise the existing Grimsby West substation access road.
- Siting area GW5 offers the opportunity to utilise land within NGET's land ownership boundary (Horlock Rules 6 and 8).

## 9.5 Comparative Appraisal and Conclusion

- 9.5.1 Environmentally there were few factors to differentiate between each of the siting areas for the new Grimsby West substation. Siting area GW3 has comparatively less interaction with the identified socio-economic and environmental features than other siting areas. However, siting area GW3 also has comparatively less existing screening to limit visual intrusion, is located closest to Laceby Beck and its associated flood zone and is in proximity to residential receptors at Pyewipe Farm. Although, siting areas GW1 and GW2 are located furthest from Laceby Beck and residential receptors, they both have a considerable overlap with the Aura Farm Solar Farm and siting area GW1 overlaps with the Viking CCS NSIP and is within 250 m of Lindens Farm Airstrip. Siting area GW5 overlaps with the Aura Farm Solar Farm and the GWUE allocation, however it also offers the greatest opportunity to reuse existing infrastructure and to limit the spread of development (and associated impacts) by the opportunity to take advantage to existing screening provided by vegetation.
- 9.5.2 From a technical perspective, there are notable factors to differentiate the siting areas for the new Grimsby West substation. The presence of Aura Farm Solar Farm overlapping with siting areas GW1, GW2 and GW5, and Viking CCS NSIP overlapping with siting area GW1 would increase the technical complexity of substation design to avoid these proposed assets. Additionally, siting areas GW2, and GW3 would require more complex connections to the existing NPG 132 kV substation. The presence of major existing buried statutory undertaker assets would also substantially constrain the flexibility for siting within siting area GW1 and, to a lesser extent, constrain siting flexibility within siting areas GW2 and GW3. Siting area GW5 offers the comparatively better location for siting the new Grimsby West substation from a technical perspective due to its proximity to the existing 400 kV 4KG overhead line and NPG 132 kV substation. It also offers the opportunity for reduced civil infrastructure associated with permanent access and would therefore be less complex to deliver. An additional benefit of the siting area GW5 is that it provides the opportunity utilising existing land within NGET ownership.
- 9.5.3 Overall, when considering all features within the study area, siting area GW5 offers the best opportunity for flexible siting. The opportunity to reuse existing infrastructure and land within NGET ownership, combined with the presence of existing screening vegetation allows the footprint of any substation in the area to be limited and well screened (limiting intrusion in the surrounding area in line with the Horlock Rules) from nearby sensitive receptors, respectively. Additionally, the proximity of GW5 to the



existing 400 kV 4KG overhead line and NPG 132 kV substation alongside opportunities to reduce additional civil infrastructure and permanent access requirements means that it would be less technically complex to construct. Therefore, when considered in isolation, siting area GW5 is the emerging preference for the new Grimsby West Substation subject to the findings of the appraisal of corridors between Grimsby West and Burgh le Marsh (presented within **Chapter 6**). The emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14**.

# **10. Options Appraisal – Lincolnshire Connection Substations**

# 10. Options Appraisal - Lincolnshire Connection Substation

## 10.1 Introduction

- 10.1.1 This Chapter outlines the Options Appraisal (Step 7 as described in **Chapter 4**) for the Lincolnshire Connection Substations (LCS) siting zones. The preliminary LCS siting zones have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6).
- 10.1.2 Ultimately the LCS siting zone(s) emerging as preferred should balance the following to provide the best overall location:
- the requirements of the overhead line corridor developed for the Project (discussed in **Chapter 6**);
  - suitable locations for the LCS-A and LCS-B 400 kV substations;
  - the requirements for customer and other planned transmission connections ('other connections'), including those from landfalls along the Lincolnshire Coast, to LCS-A and LCS-B; and
  - suitable locations for customer and other planned transmission connection infrastructure ('other infrastructure') near the LCS-A and LCS-B 400 kV substations.
- 10.1.3 The LCS siting zones have been developed to accommodate LCS-A and/or LCS-B, taking into consideration the potential for other infrastructure and the ability for other connections to access the LCS siting zones. The siting zone options (shown on **Figure 10-1**) progressed for appraisal comprise:
- Siting zone LCS1 – an area approximately 2 km by 2 km (approximately 400 ha), located immediately east of (and between) North Cockerington and South Cockerington, and west of South Dike. See **Figure 10-2**.
  - Siting zone LCS2 – an area approximately 2.9 km by 1.9 km (approximately 551 ha), located immediately north-east of Grimoldby and Manby and west of North End and Saltfleetby St Peter. See **Figure 10-2**.
  - Siting zone LCS3 – an area approximately 2.4 km by 1.8 km (approximately 432 ha), located east of Great Carlton, north of Gayton le Marsh and south of Long Eau. See **Figure** .
  - Siting zone LCS4 – an area approximately 1.3 km by 1.6 km (approximately 208 ha), located between Great Carlton (to the east of the siting zone) and Castle Carlton to the west of the siting zone). Little Carlton is located to the north and South Reston to the south. See **Figure** .
  - Siting zone LCS5 – an area approximately 1.9 km by 1.1 km (approximately 209 ha), located east of Woodthorpe, west of Claythorpe, north of Greenfield Wood/Mother Wood ('Mother Wood') and south of Great Eau. See **Figure 10-3**.

- Siting zone LCS6 – an area approximately 2 km by 2 km (approximately 400 ha), located south of Beesby, west of Markby, north of Thoresthorpe, east of the A1104 and overlaps with the village of Saleby. See **Figure 10-3**.
- Siting zone LCS7 – an area approximately 2 km by 2.3 km (approximately 460 ha), located north of Alford, west of the A1104, south of Galley Hill and east of Mother Wood. See **Figure 10-3**.
- Siting zone LCS8 – an area approximately 2.5 km by 3.6 km (approximately 900 ha), located south of Markby, west of Huttoft, north of Thurlby, north-east of Bilsby and overlaps with settlement at Asserby. See **Figure 10-3**.
- Siting zone LCS9 – an area approximately 2.4 km by 1.4 km (approximately 336 ha), located south of Alford, east of Farlesthorne and north-east of Mawthorpe. See **Figure 10-4**.
- Siting zone LCS10 – an area approximately 3.1 km by 2.0 km (approximately 620 ha), located south of Willoughby, north-west of Habertoft, north-east of Welton Marsh and overlaps with settlement at Sloothby and Hasthorpe. See **Figure 10-4**.
- Siting zone LCS11 – an area approximately 2.1 km by 1.4 km (approximately 294 ha), located immediately west of the Manby, north-west of Little Carlton and overlaps with the Manby Showground. See **Figure 10-4**.
- Siting zone LCS12 – an area approximately 2.8 km by 1.7 km (approximately 476 ha), located north of Woodthorpe, north-west of Beesby, south-west of Maltby le Marsh and south of Strubby. It overlaps with the Strubby Airfield and Glider Field. See **Figure 10-3**.

10.1.4 The appraisal of environmental, socio-economic and technical factors for the LCS siting zones, has considered, as detailed in **Chapter 5**, the potential impacts on relevant features, and whether such effects could be avoided or mitigated through careful siting. Where impacts cannot be avoided or mitigated by careful routing and siting (and routing of overhead line entries), other forms of mitigation have been considered in accordance with NGET’s mitigation hierarchy. Although properties and areas of settlement overlap with the LCS siting zones, for the purposes of the appraisal it is assumed these would be avoided.

10.1.5 As the LCS siting zones have been developed to accommodate LCS-A and / or LCS-B (alongside other infrastructure) the environmental, engineering and systems factors appraisals below are structured as follows:

- LCS-A or LCS-B – this provides an appraisal of siting either LCS-A or LCS-B (alongside other infrastructure) within each LCS siting zone; and
- LCS-A and LCS-B – this provides an appraisal of siting both LCS-A and LCS-B (alongside other infrastructure) within each LCS siting zone.

10.1.6 As facilitating connections for others connections to LCS-A and LCS-B is a key project driver, a high-level appraisal of the ability for other connections to reach each LCS siting zone is included below.

10.1.7 For the current Project stage, the relevant data to inform the appraisal comprises desk study information, supplemented by site visits to select locations.

Figure 10-1 – Location of LCS Siting zones overview

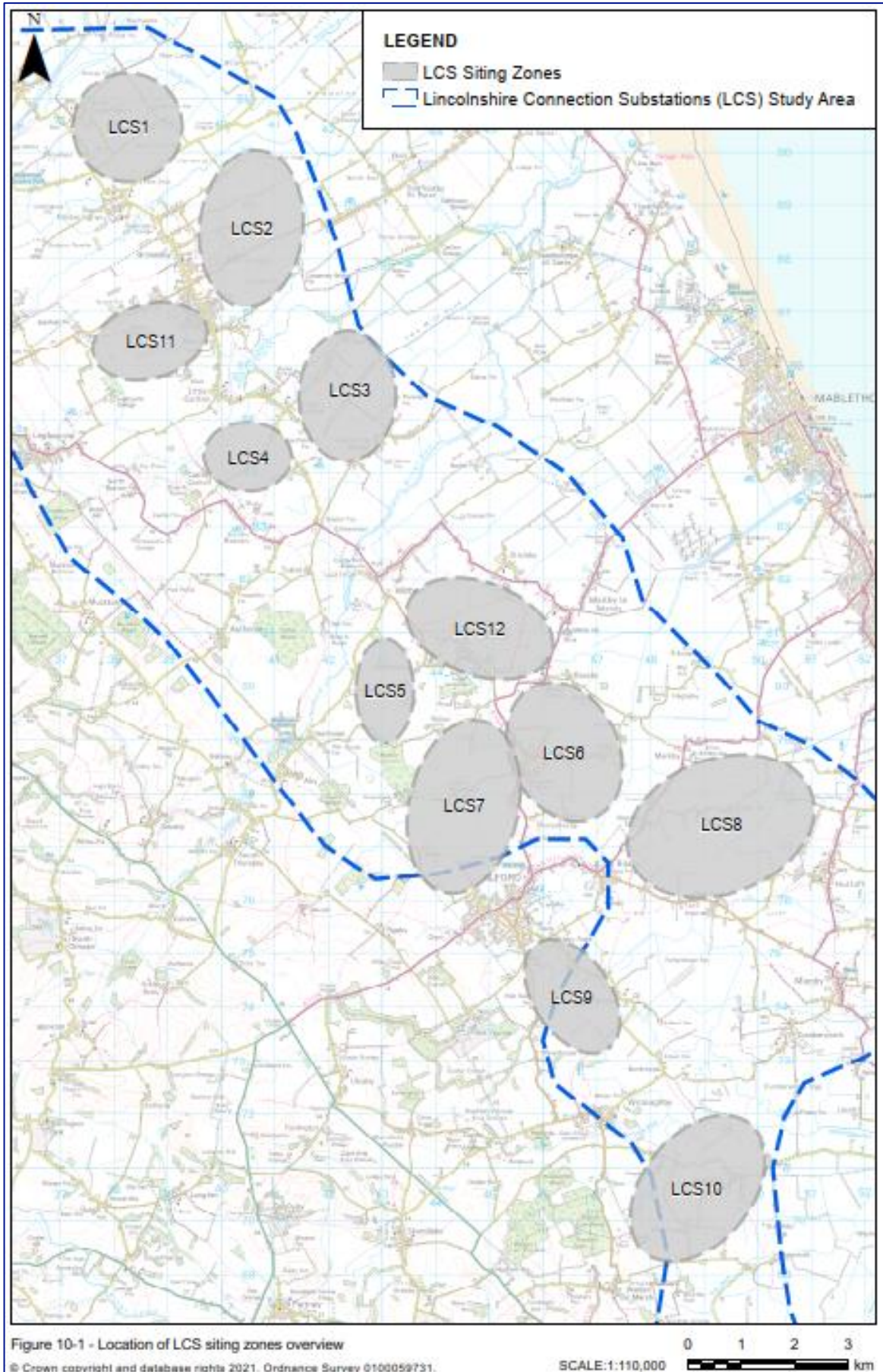


Figure 10-2 – LCS siting zones LCS1, LCS2, LCS3, LCS4, LCS11

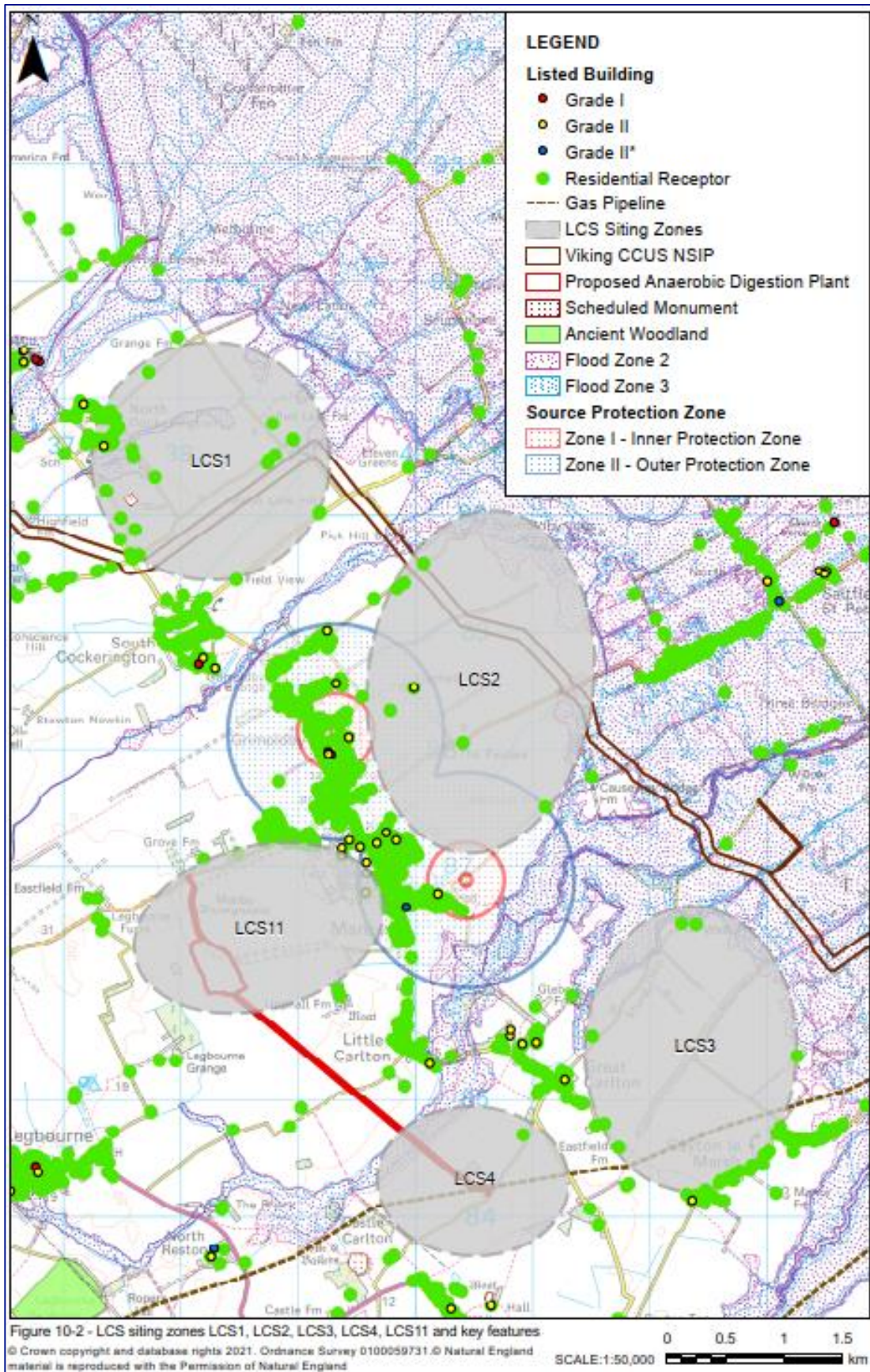


Figure 10-3 – LCS Siting zones LCS5, LCS6, LCS7, LCS8 and LCS12

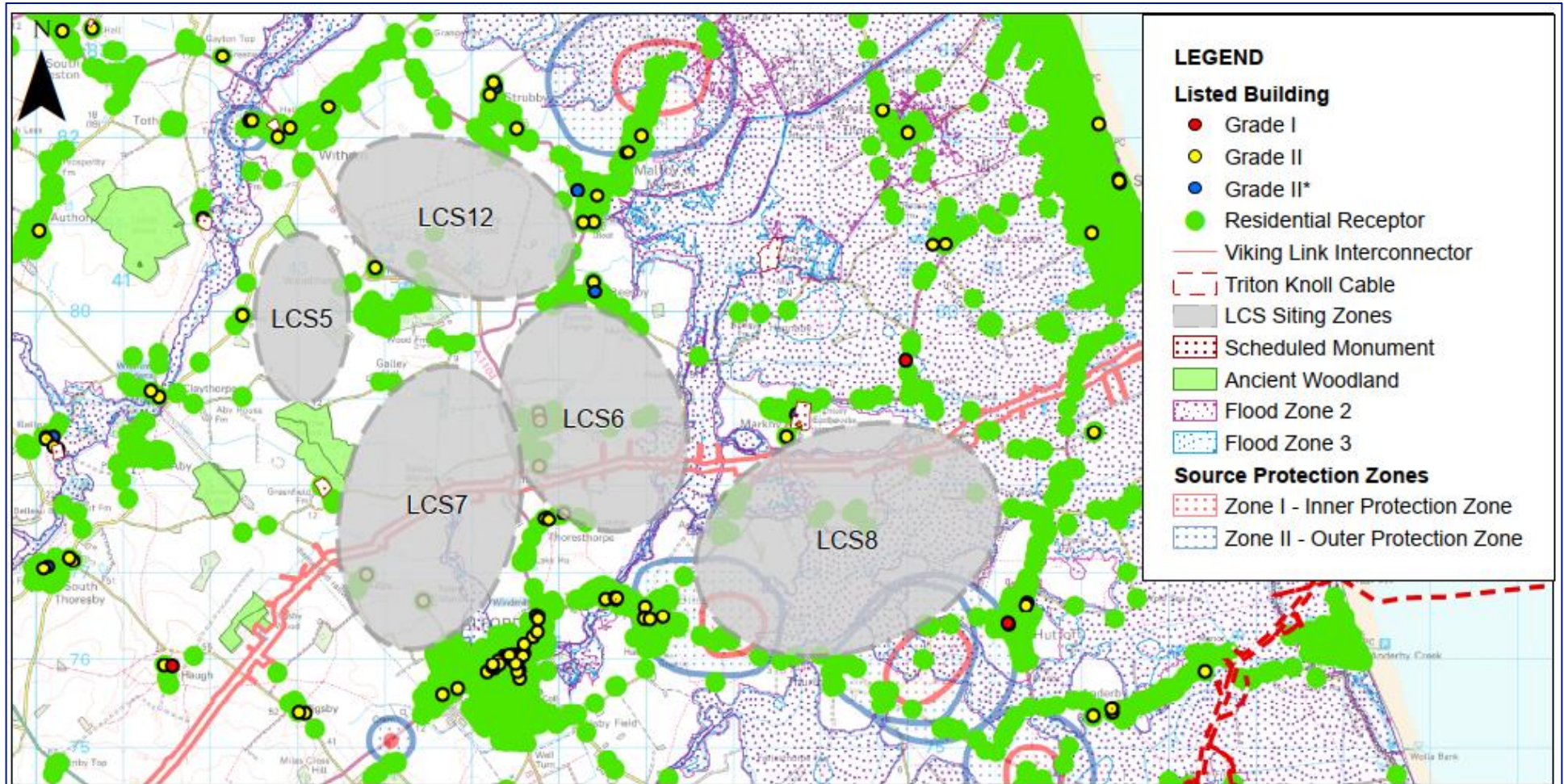


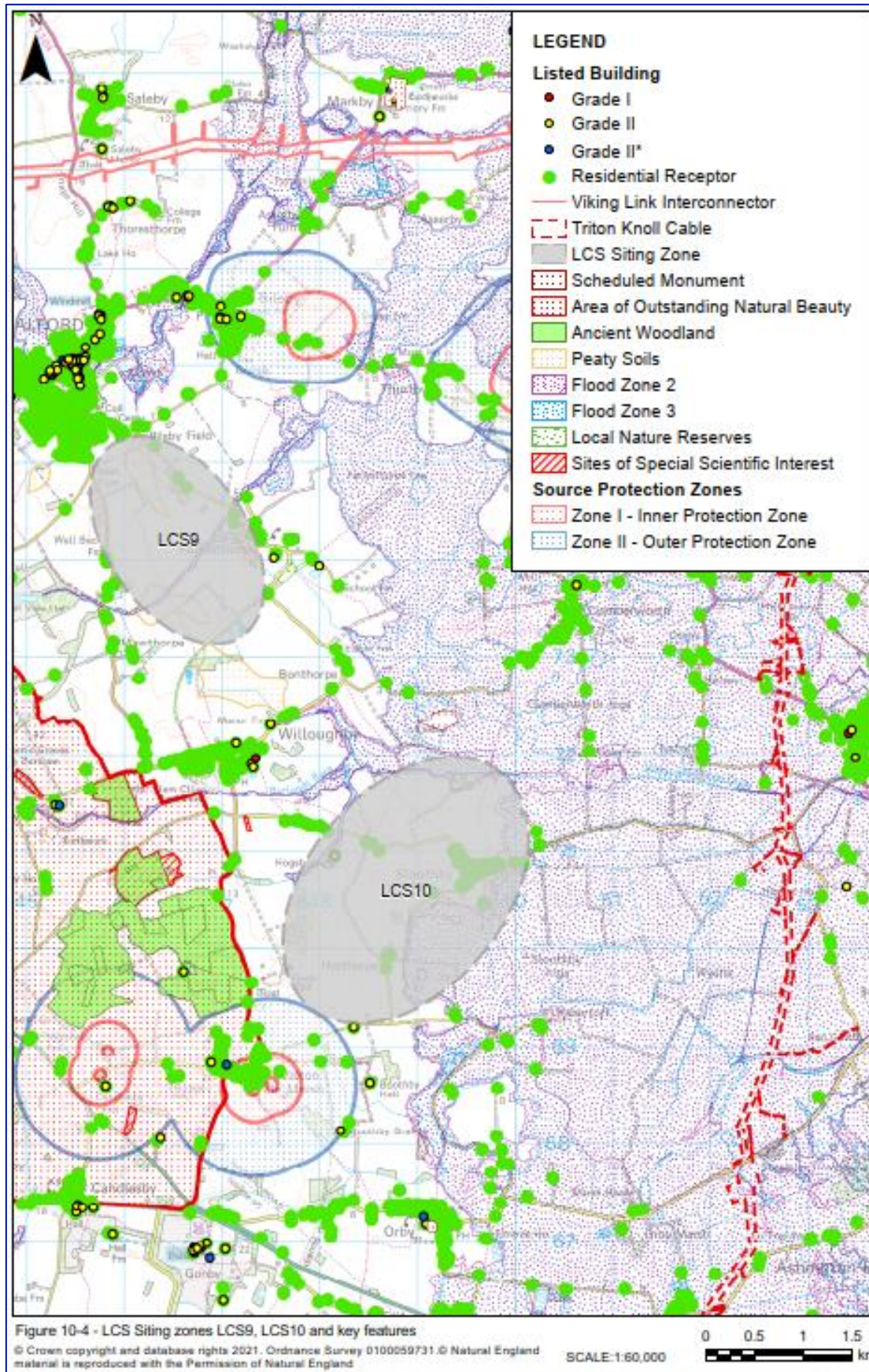
Figure 10-3 - LCS Siting zones LCS5, LCS6, LCS7, LCS8, LCS12 and key features

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Figure 10-4 – LCS Siting zones LCS9 and LCS10





## 10.2 Environmental Factors

### Landscape and Visual

#### LCS-A or LCS-B

- 10.2.1 The LCS siting zones are all within an area located along the Lincolnshire coastal plain between the coastline and the AONB and therefore share some similar landscape and visual amenity characteristics. However, given the distance (approximately 25 km) between the most northerly (siting zone LCS1) and most southerly (siting zone LCS10) siting zone, each has unique landscape and visual amenity characteristics.
- 10.2.2 All the LCS siting zones are located within the Lincolnshire Coast and Marshes NCA (NCA 42) which is characterised by a wide coastal plain extending from Barton-upon-Humber in the north, across to Grimsby at the mouth of the Humber and south to Skegness. In addition, all LCS siting zones are located within 10 km of the AONB, with LCS7, LCS9 and LCS10 located within 2 km and siting zone LCS10 the closest at approximately 450 m east of the AONB. Although all are within 10 km of the AONB, the scale of potential impacts on the AONB and its setting are unique to each siting zone.
- 10.2.3 The landscape and visual amenity characteristics of each of the LCS siting zones is described below and appraised under the assumption that there is no technical requirement for undergrounding of the overhead line at present. However, this is subject to review as design progresses.

#### Lincolnshire Connection Substations Siting Zone 1 (LCS1)

- 10.2.4 Siting zone LCS1 (see **Figure** ) is characterised by a large, open landscape with a smaller field pattern within the settled area of North Cockerington to the west. The siting zone is a generally open, level landscape enclosed by drainage ditches. Urban influences include scattered settlement to the east, and the settled areas of North Cockerington to the west and South Cockerington to the south-west. Public Right of Way (PRoW) NCoc/71/1 also through the siting zone east of North Cockerington. Views within the siting zone and in the surrounding area are generally wide and expansive with big skies, due to sparse vegetation cover. Views comprise occasional hedgerows and blocks of woodland associated with settlements. In the landscape surrounding the siting zone, the main sensitive visual receptors are residents living in properties at North Cockerington, South Cockerington to the south-west, along the banks of the Louth Navigation to the north and the banks of Grayfleet Drain to the south, along with users of PRoW NCoc/71/1.
- 10.2.5 Siting zone LCS1 is located approximately 5.4 km east of the AONB. The Chalk wolds and South-Eastern Claylands local landscape character areas (LCAs) of the AONB are equidistant from this siting zone. A key local feature of the South-Eastern Claylands is the views across the Middle Marsh to the coast. To limit potential impacts to the AONB setting and its key local features, siting within LCS1 should favour the area in the centre and west of the zone to maximise the effectiveness of existing screening (primarily provided by settlement at North Cockerington and South Cockerington but also more distantly by Louth). Although development is likely to be visible from the AONB, given the distance between LCS1 and the AONB, the more urban influences and screening provided by existing settlement, in combination with careful siting and use of mitigation

planting, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

### Lincolnshire Connection Substations Siting Zone 2 (LCS2)

- 10.2.6 Siting zone LCS2 (see **Figure 10-2**) is characterised by large open fields across a level area. Urban influences include scattered settlements throughout the siting zone: Manby and Grimoldby to the west, Saltfleetby St Peter to the east, the Eastfield Farm airstrip and Causeway Bridge Farm to the south. The B1200 Manby Middlegate and a PRow (Grim/219/1) connecting Eastfield Farm to Grimoldby, pass through the siting zone. Views within the siting zone and in the surrounding landscape, are generally wide and expansive with big skies, due to sparse vegetation cover. Views comprise occasional hedgerows and woodland blocks associated with settlements and The Beck (further south). In the landscape surrounding the siting zone the main sensitive visual receptors include residential properties at Manby and Grimoldby, Saltfleetby St Peter and those along the banks of Grayfleet Drain to the north, along with users of the PRow.
- 10.2.7 Siting zone LCS2 is located approximately 5.3 km east of the AONB. The closest landscape of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS2 should favour an area to the south and west of the zone to allow the LCS to utilise the urban influences, and potential screening, provided by settlements at Manby and Grimoldby. Although development is likely to be visible from the AONB, due to the distance between LCS2 and the AONB, the context and screening provided by existing settlement and vegetation, in combination with careful siting and use of mitigation planting and landscaping, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

### Lincolnshire Connection Substations Siting Zone 3 (LCS3)

- 10.2.8 Siting zone LCS3 (see Figure ) is characterised as a large, open level area with flexibility for siting. The existing landscape structure within the siting zone includes hedgerows and small woodland blocks in the north. Urban influences include scattered properties, Sturdy Hill minor road and the villages of Great Carlton and Gayton Le Marsh located to the west and south-east, respectively. Three PRows (GayM/193/1, GayM/193/2, and GtCa/227/2) connecting the surrounding settlements run across the siting zone. There is a large area within the centre of the siting zone which is largely remote from visual receptors. In contrast, the south-east and south-west edges of the zone are overlooked by many visual receptors at Gayton le Marsh and Great Carlton, however the presence of tree belts and large hedgerows provide screening opportunities. A windfarm is also located to the north-east, which will contribute to cumulative visual effects. The main visual receptors associated with this siting zone include the residents living in the properties at Gayton le Marsh and Great Carlton, alongside scattered residential properties and users of the minor roads and PRows.
- 10.2.9 Siting zone LCS3 is located approximately 5.2 km north-east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS3 should favour an area to the centre and north of the zone to maximise the effectiveness of existing screening mostly provided by hedgerows, woodland blocks and settlement at Great Carlton. Although development is likely to be visible from the AONB, due to the distance between LCS3 and the AONB, the context and screening mostly provided by existing settlement, in combination with careful siting and use of mitigation planting, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

## Lincolnshire Connection Substations Siting Zone 4 (LCS4)

- 10.2.10 Siting zone LCS4 (see Figure ) comprises a gently undulating area, with higher ground in the centre, falling to a shallow valley in the north. There are also woodland blocks in the centre and south, which have the potential to be used as screening, alongside other woodland blocks and large treelines to the south, south-west and south-east. This includes Castle Wood, located to the south-west. Urban influences associated with the siting zone include scattered residential properties and the villages of Castle Carlton, Great Carlton and Little Carlton located to the south-west, north-east and north, respectively. South Reston is located to the south and a PRoW (SRes/192/2) connecting Castle Carlton to Great Carlton also crosses the siting zone. Regarding views from the siting zone, the centre of the siting zone forms a local skyline in views from Great Carlton and Little Carlton. The south of the siting zone has more screening available from nearby woodland. In the landscape surrounding the siting zone the main sensitive visual receptors associated with this siting zone include residential properties at Castle Carlton, Great Carlton and Little Carlton, South Reston and other scattered residential properties, along with users of PRoW and minor roads that pass through, and are located close to, the siting zone.
- 10.2.11 Siting zone LCS4 is located approximately 3.5 km north-east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS4 should favour an area to the south to utilise comparatively lower ground and existing screening from woodland blocks and treelines. Although development is likely to be visible from the AONB, the distance and use of mitigation planting would limit, but may not materially reduce potential significant adverse impacts on the AONB's setting or on views to and from the AONB.

## Lincolnshire Connection Substations Siting Zone 5 (LCS5)

- 10.2.12 Siting zone LCS5 (see Figure 10-3) is slightly undulating with areas of lower ground to the north and west, contained by woodland blocks and larger woodland to the south. Urban influences include scattered residential properties, the village of Woodthorpe located to the north-east, Rye Lane which runs through the south of the siting zone, and the Hamlet of Aby Grange located to the west. There are no PRoWs within the siting zone. Overall, the woodlands (most prominently Mother Wood) present around the siting zone provide the potential for adequate screening of views, except for those views from Woodthorpe Hall Golf Course and Caravan Park and the minor road west extend across the siting zone. Additionally, there is a large area within the centre of the siting zone which is largely remote from visual receptors. In the landscape surrounding the siting zone the main sensitive visual receptors include residents living in scattered residential properties, recreational users of Woodthorpe Hall Golf Course and Caravan Park to the east, residents of Woodthorpe, Aby Grange, road users travelling along Rye Lane and recreational users of a PRoW (Clyt/238/1) located north-west of the Great Eau.
- 10.2.13 Siting zone LCS5 is located approximately 2.7 km north-east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS5 should maximise the use of the undulating ground (with individual woodland blocks) to the north and/or the larger woodland blocks to the south. With the implementation of careful siting and use of mitigation planting significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

### Lincolnshire Connection Substations Siting Zone 6 (LCS6)

- 10.2.14 Siting zone LCS6 (see **Figure 10-3**) is a gently undulating area, with high ground in the centre forming a subtle east-west ridge, falling to the north and south. There are limited existing landscape features within the siting zone other than hedgerows and woodland blocks near Saleby. Urban influences include the village of Saleby located in the west of the siting zone, the A1104 and the villages of Beesby and Thoresthorpe located to the north and south respectively. A PRoW (Sale/280/1) connecting Saleby to Alford is also located within the siting zone. Open views are available, from the localised high point in the centre of the siting zone which forms a skyline in views from Beesby. In the landscape surrounding the siting zone the main sensitive visual receptors include residents living in properties at Saleby, Thoresthorpe, Beesby and along Mill Lane, and users of the A1104 and users of PRoW.
- 10.2.15 Siting zone LCS6 is located approximately 3.8 km north-east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS6 should generally favour an area to south of the zone to utilise areas of lower ground and existing screening. Although development may be visible from the AONB, due to the distance between LCS6 and the AONB, the urban influences and screening provided by existing settlement (and associated vegetation), in combination with careful siting and use of mitigation planting and landscaping, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

### Lincolnshire Connection Substations Siting Zone 7 (LCS7)

- 10.2.16 Siting zone LCS7 (see **Figure 10-3**) is a large open area, forming a shallow bowl with watercourses at the centre and rising ground to the west, north and east with limited existing screening features within the zone. However, a large block of woodland, Mother Wood, is located to the west and could be utilised as screening vegetation. Urban influences include the villages of Ailby and Tothby located to the south of the siting zone, Greenfield Lane minor road and the A1104 (which pass through the east of the siting zone), the village of Thoresthorpe to the east, Alford to the south, and Saleby to the north-west. Several PRoWs (Alfo/290/1, Alfo/283/5, and Sale/290/1) pass through the south of the siting zone connecting Greenfield Lane and Tothby to the surrounding area. The north of the siting zone is generally remote from receptors, however overall, the siting zone is on higher ground which may expose infrastructure (especially overhead line entries) to visual receptors including properties in Alford and Saleby (both within LCS7) as well as scattered individual properties.
- 10.2.17 Siting zone LCS7 is located approximately 1.4 km north-east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS7 should generally favour lower ground to the north to maximise the effectiveness of existing screening provided by Mother Wood directly west. Development may be visible from the AONB, however use of screening provided by Mother Wood in combination with use of mitigation planting and landscaping would limit the potential for significant adverse impacts on the AONB's setting or on views to and from the AONB.

### Lincolnshire Connection Substations Siting Zone 8 (LCS8)

- 10.2.18 Siting zone LCS8 (see **Figure 10-3**) comprises a large, slightly undulating area with localised highpoints and lower lying areas associated with watercourses. Vegetation coverage is sparse within the siting zone, primarily limited to large hedgerows with no

large blocks of woodland present. Urban influences include the village of Asserby at the centre of the siting zone, the A1111 Sutton Road which passes through the zone, scattered properties, and the villages of Bilsby to the west, Thurlby to the south, Huttoft to the south-east and Markby to the north. Several PRowS (Hutt/14/1, Bils/11/1, and Hutt/12/1) connecting Asserby to Huttoft pass through the siting zone. The south of the siting zone is remote from residential receptors, and on lower ground that is less visible overall. The north of the siting zone is overlooked by properties at Markby, Hannah and Asserby. In the surrounding landscape the main visual receptors include residents in properties at Asserby, Bilsby, Thurlby, Markby (including Markby Priory Scheduled Monument), Huttoft, road users of the A1111 Sutton Road, B1449 Markby Road and recreational users of PRow.

10.2.19 Siting zone LCS8 is located approximately 4.5 km east of the AONB. The closest local landscape LCA of the AONB in closest proximity is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS8 should favour the lower lying areas within the zone. Although development may be visible from the AONB, due to the distance between LCS6 and the AONB, the urban influence and screening provided by existing settlement adjacent, and intervening settlements, in combination with careful siting and use of mitigation planting and landscaping, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

#### Lincolnshire Connection Substations Siting Zone 9 (LCS9)

10.2.20 Siting zone LCS9 (see **Figure 10-4**) is an open area of lower ground near several watercourses. Vegetation is limited to a sparse distribution of hedgerows and treelines throughout the siting zone, however there are dense treelines and woodland blocks located to the south and south-west of the siting zone. Urban influences include the B1196 which passes through the siting zone, the village of Farlesthorpe located to the east, and the town of Alford located to the north. Views are generally open in all directions as there is limited existing landscape structure. In the surrounding landscape the main visual receptors include residents in properties at Farlesthorpe, Alford, as well as scattered properties. In addition, recreational users of Well Hall Registered Park and Garden, to the west and two PRowS (WiWS/76/3 and Well/76/1) connecting Alford, Willoughby and Farlesthorpe also comprise visual receptors.

10.2.21 Siting zone LCS9 is located approximately 1.3 km east of the AONB. The closest local landscape LCA of the AONB in closest proximity is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS9 should favour areas closer to Farlesthorpe and Alford. Given the linear shape of the siting zone and presence of settlement along the eastern boundary (Farlesthorpe) this would be challenging. Although seen within the urban influence of Alford, careful siting, use of and landscape mitigation planting and landscaping is not likely to materially limit the potential for significant adverse impacts from siting within LCS9 on the AONB's setting or on views to and from the AONB.

#### Lincolnshire Connection Substations Siting Zone 10 (LCS10)

10.2.22 Siting zone LCS10 (see **Figure 10-4**) is characterised by agricultural fields, generally with small field patterns, broken up by large hedges and small woodland blocks provide a degree of existing landscape structure. Urban influences include the village of Sloothby located in the centre/east of the siting zone, Mill Lane minor road which passes through the zone, scattered properties and the villages of Boothby and Welton le Marsh located to the south-west. Views are partially screened by the hedgerows and

blocks of woodland present across the siting zone. In the surrounding landscape the main visual receptors include residents living in properties at Sloothby, Welton le Marsh, Boothby, users of the several PRoWs (WiWS/90/3 and WiWS/92/1) in proximity to Sloothby, and scattered properties throughout the siting zone.

10.2.23 Siting zone LCS10 is located approximately 450 m east of the AONB. The closest local landscape LCA of the AONB is the South-Eastern Claylands. In this area the AONB (closest to the siting zone) is comparatively lower than areas further north. To limit potential impacts to the AONB setting and its key local features, siting within LCS10 should favour the areas closer to Sloothby and use of small existing woodland blocks as siting elsewhere within the zone is likely to have significant impacts upon the on the character of the AONB and the amenity of eastward views. Due to its proximity to the AONB siting within LCS10 may also have an impact on the isolated and remote feel associated with the AONB South-Eastern Claylands AONB local character area.

#### Lincolnshire Connection Substations Siting Zone 11 (LCS11)

10.2.24 Siting zone LCS11 (see **Figure 10-2**) is characterised by a large open field associated with Manby Showground and Manby Business Park. Urban influences include scattered settlements throughout the siting zone, the B1200 Manby Middlegate which passes through the north of the siting zone, the settlements of Manby and Grimoldby to the north-east, and Little Carlton to the south-east. Views in the north and east are generally enclosed, screened by the large commercial units at the adjacent Manby business park. There are more open views to the west and south with screening provided by a dense block of woodland to the south-west of the siting zone and numerous treelines/large hedgerows. A PRoW (Grim/211/1) is located within the siting zone which connects to informal paths associated with Manby Showground. In the surrounding landscape the main visual receptors include residents living in properties at Grimoldby, Manby, Little Carlton, South Cockerington to the north, Legbourne to the south-west, road users on the B1200 Manby Middlegate, Hungry Hill Lane and users of the PRoWs within and surrounding the siting zone.

10.2.25 Siting zone LCS11 is located approximately 2.7 km east of the AONB. The closest local landscape LCA of the AONB in closest proximity is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS11 should be focused to the centre and east of the zone so it is set in the context of Manby and existing large-scale buildings. Although development is likely to be visible from the AONB, siting in the context of Manby and existing large-scale buildings, in combination with careful siting and landscape mitigation planting and landscaping is not considered likely to result in significant adverse impacts on the setting of the designated area on or views to and from the AONB.

#### Lincolnshire Connection Substations Siting Zone 12 (LCS12)

10.2.26 Siting zone LCS12 (see **Figure 10-3**) is characterised by the large open field of Strubby Airfield in a level area in the centre of the siting zone with a local high point in the south-west. Urban influences in the vicinity include Strubby Airfield and Glider Field and their associated commercial units, the B1373 and A1104 roads which intersect the siting zone boundary, and the settlements of Woodthorpe to the south-west, Beesby to the south-east, Maltby Le Marsh to the north-east, Strubby to the north and Withern to the west. Views within the siting zone and in the surrounding area, are generally wide and expansive due to sparse vegetation cover. Views are comprised of occasional hedgerows and blocks of woodland (including Woodthorpe Wood) associated with settlements. In the surrounding landscape the main visual receptors are residents living

in properties at Woodthorpe, Withern, Maltby Le Marsh, Beesby, Strubby, scattered properties along the A157, and road users of the A157, B1373 and A1104, a PRow (Stru/526/1 connecting Strubby and Woodthorpe) which crosses the siting zone, and several PRow to the north-west and north-east.

10.2.27 Siting zone LCS12 is located approximately 4.6 km east of the AONB. The closest local landscape LCA of the AONB in closest proximity is the South-Eastern Claylands. To limit potential impacts to the AONB setting and its key local features, siting within LCS12 should be focused to the centre and south to maximise the use of screening from development and woodland at Woodthorpe (including large agricultural sheds, a garden centre and golf course). Although development is likely to be visible from the AONB, due to the distance between LCS12 and the AONB, the urban influence and screening provided by Woodthorpe (including existing woodland), in combination with careful siting and use of mitigation planting, significant adverse impacts on the AONB's setting or on views to and from the AONB are unlikely.

### Conclusion

10.2.28 Overall, from a landscape and visual perspective there are several distinguishing factors between the siting zones. Siting zones LCS4, LCS7, LCS9, and LCS10 would not be preferred due to a combination of their proximity to, and potential effects on, the AONB, their locations with more remote and isolated landscapes and their lack of existing screening features. These siting zones would likely require further mitigation measures in comparison to other LCS siting zones. In contrast, siting zones LCS5, LCS6, LCS8, LCS11 would be more preferred. Siting in the centre or south of siting zone LCS5 offers the potential to utilise one of the largest areas of existing woodland available as screening between the siting zone and the AONB. Siting south of LCS6 offers the potential to use lower ground that is more remote from nearby visual receptors and likely to be less visible from the AONB. Siting zone LCS8 benefits from areas of lower ground and is more isolated from sensitive receptors where infrastructure would be comparatively less visible overall. Siting zone LCS11, despite being near visual receptors, would be set within the context of existing industrialised development and represents an opportunity to utilise existing brownfield land.

10.2.29 Regarding the other siting zones (LCS1, LCS2, LCS3 and LCS12), there is little to choose between them from a landscape and visual perspective. Whilst distant from the AONB, siting within zones LCS1, LCS2 and LCS3 would need to be cognisant of the pattern of linear settlements including North Cockerington, Grimoldby and Gayton le Marsh. Siting zone LCS12 benefits from surrounding urban influences and screening elements from the AONB but is surrounded by settlements which is likely to constrain siting and result in comparatively greater impacts on visual amenity.

### LCS-A and LCS-B

10.2.30 When considering the siting both of LCS-A and LCS-B (alongside the other infrastructure) within a single siting zone, the potential for significant effects on identified receptors (identified above) and the limitations these impose to development increases considerably. The cumulative siting of this infrastructure in one location would likely alter the approach to settlements, adversely impacting on their character and setting. Moreover, considering the existing rural landscape context, which has limited influence from large-scale infrastructure, the availability of wide expansive open views would be reduced. As such, it is not considered that both LCS-A and LCS-B (including other infrastructure) could be sited within a single siting zone, even following implementation of careful siting and use of landscape mitigation planting, without having a significant

detrimental effect on the local landscape LCA and the setting/approaches to settlements. Additionally, the other connections to LCS-A and LCS-B would add further effects on the receptors identified above and surrounding each of the siting zones.

## Ecology

### LCS-A or LCS-B

- 10.2.31 The LCS siting zones are located between 3 km and 9 km from NSN or Ramsar sites. Those sites nearest are those located along the Lincolnshire Coast and include the:
- Humber Estuary SAC, SPA and Ramsar Sites which also overlaps with a SSSI and several NNRs ('Humber Estuary designated sites' as described in **Paragraph 6.2.16**).
  - The Wash and North Norfolk Coast SAC, the Greater Wash SPA and The Wash Ramsar and SPA sites which also overlap with a SSSI and NNR ('The Wash designated sites' as described in **Paragraph 6.2.82**).
  - Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC which also overlaps with a SSSI and NNR (as described in **Paragraph 6.2.82**).
  - Gibraltar Point SPA and Ramsar sites which also overlap with a SSSI and NNR ('Gibraltar Point designated sites,' as described in **Paragraph 7.2.172**).
- 10.2.32 Each of these designated sites are hydrologically connected, albeit at some distance, to the LCS siting zones from the network of drains and rivers which lead to the coast. The nearest siting zone is LCS8 which is located 3 km from the Greater Wash SPA to the south of Sutton-on-Sea. The furthest siting zones are those located further inland and comprise siting zones LCS4, LCS5 and LCS12, all located over 8.5 km from the coast. Due to the distance of all the siting zones from the identified designated sites, potential impacts of substation infrastructure are limited to pollution during construction and impacts to functionally connected habitats. However, for overhead line connections to each siting zone, potential impacts also include the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar Sites will be considered in detail within an HRA, as the Project development progresses. Should the HRA identify adverse effects on the integrity of these the emerging preferences identified will be revisited.
- 10.2.33 There are no nationally designated sites within 2 km of the LCS siting zones, except for LCS9 and LCS10 (LCS10 is the closest at approximately 600 m). Within 2 km west and south-west of these siting zones are the Willoughby Meadow SSSI, Willoughby Wood SSSI and Hopland Woods SSSI, predominantly designated for their habitats (woodlands and grasslands) but which also support a range of species including breeding birds and moths. These SSSIs may be hydrologically connected to these sites and therefore there may be adverse impact upon them. Should this occur, the emerging preferences will be revisited.
- 10.2.34 There is only one LNR identified within or in proximity to a LCS siting zone, this is the Willoughby Branch Line LNR which spans siting zone LCS9 across its southern extent. The siting of non-linear infrastructure within LCS9 can avoid the LNR, however its location means that overhead lines (or other connections and their associated connection infrastructure) may result in direct impacts to this designated site.



10.2.35 Habitat within the LCS siting zones is generally agricultural with other habitats, including watercourses, drains, woodland, tree lines and hedges scattered throughout. Woodland habitat includes a mixture of ancient woodlands, priority habitat deciduous woodland, woodland blocks and tree lines along field boundaries. Ancient woodland is present at the edges or adjacent to siting zones LCS5 and LCS7 and impacts on these can be avoided. Other scattered areas of priority habitat identified from priority habitat datasets include:

- Coastal and floodplain grazing marsh present within siting zones LCS2, LCS3, LCS5, LCS8, LCS9 and LCS10. However, following site visits it became apparent that this land is currently under agricultural use in all siting zones.
- River priority habitats present within LCS siting zones LCS8, LCS9 and LCS10.
- Semi-improved grassland habitats present within LCS siting zones LCS9 and LCS10.
- Traditional orchards present within siting zone LCS10.

10.2.36 Given the distribution of these habitats, it is likely that they can be avoided through careful siting. In addition to the habitats identified above there are also areas of 'peaty soils' identified within siting zones LCS9 and LCS10.

### Conclusion

10.2.37 From an ecological perspective there is little to choose between the LCS siting zones when considering designated sites of national or international importance, although those at a greater distance from these designated sites will be generally preferred from an ecological perspective. As LCS9 contains an LNR and may result in direct impacts from the siting of LCS or other infrastructure, it is least preferred. When considering the other LCS siting zones there is little to differentiate between them, however as siting zones LCS1, LCS4, LCS11 and LCS12 contain no priority habitats and are some of the furthest from ecologically designated sites they are generally more preferred.

### LCS-A and LCS-B

10.2.38 It is considered that the siting of LCS-A and LCS-B, alongside other infrastructure required for connections and these other connections to LCS-A and LCS-B, are likely to result in cumulative effects on the receptors identified above. However, it is considered that following careful siting and the implementation of additional mitigation, including but not limited to compensatory planting, this would not alter the preferences for each LCS siting zone, and in fact further emphasise supports the preferences described above.

### Historic Environment

10.2.39 Designated heritage assets are located either within the boundary of and/or within 1 km of each of the LCS siting zones with potential views to proposed infrastructure. Therefore, each siting zone has the potential to affect directly or affect the setting of identified designated heritage assets.

### LCS-A or LCS-B

10.2.40 Identified heritage assets located within the boundary of the LCS siting zones are listed below. Given the distribution of the heritage assets in the siting zones (mostly near their boundaries) it is considered that there is sufficient space within each siting zone to

largely avoid potential direct physical impacts. However, potential impacts upon their setting, even if the assets themselves are avoided, may remain. Further consideration of the impact to the setting of receptors of a higher sensitivity (Grade I listed buildings, Grade II\* listed buildings, Scheduled Monuments) is provided:

- LCS1: One Scheduled Monument (*North Cockerington Hall moated site*) and one Grade II listed building (*Home Farmhouse*). These are both located at the west of LCS1 (within North Cockerington). Existing treelines and hedgerows provide screening to limit the potential impacts upon the setting of the *North Cockerington Hall moated site* Scheduled Monument.
- LCS2: One Grade II listed building (*Eastfield Farmhouse*) located at the west of LCS2, east of Grimoldby.
- LCS6: One Scheduled Monument (*Churchyard Cross St Margarets churchyard*) and five Grade II listed buildings (*Saleby Grange, Church of St Margaret, Cross in Church yard on South side of Church, Manor Farmhouse and The Cottage*). These are at the west and south-west of LCS6 (within Saleby and Thoresthorpe). As the *Churchyard Cross St Margarets churchyard* Scheduled Monument is located near the heart of Saleby, with substantial lots of existing screening, potential impacts on its setting are unlikely.
- LCS7: Two Grade II listed buildings (*Ailby House Farmhouse and Tothby Manor House*). These are both located at the south of LCS7 (within Ailby and Tothby).
- LCS10: One Scheduled Monument (*Castle Hill, motte castle east of Hanby Hall Farm*) and one Grade II listed building (*Hogsbeck House*) are located at the south and west of LCS10, respectively. The *Castle Hill, motte castle east of Hanby Hall Farm* Scheduled Monument would be partially screened by nearby hedgerows and treelines although siting more towards the centre and west of LCS10 may result in residual significant adverse effects.
- LCS11: Three Grade II listed buildings (*Tedder Hall, Barrack Blocks, and Beech Grove Hall*) are at the north-east of LCS11 and within Manby.

10.2.41 Designated heritage assets have also been identified within 1 km of each siting zone. The significance of the potential impact upon the setting of these assets would be limited or could be reduced due to the presence of either intervening woodland, other developments, flexibility of siting within the siting zone and/or the distance from the siting zones where applicable. Identified heritage assets within 1 km of the siting zone are listed below and further consideration of the impact to the setting of receptors of a higher sensitivity (Grade I, Grade II\*, Scheduled Monuments) is provided:

- LCS1: Three Grade I listed buildings; eight Grade II listed buildings and one Grade II\* listed building. The closest is the Grade II listed building *Oak Cottage* located 170 m north-west of LCS1. The remaining are over 670 m from the siting zone. The *Church Of St Adelwold* and *Church of St Mary* Grade I listed buildings (located approximately 700 m north-west) are partially screened by woodland to their south and east which would limit potential effects upon their setting. The *Watermill* Grade II\* listed building (located approximately 840 m north-west) would likely be screened by adjacent agricultural buildings. The *Church Of St Leonard* Grade I listed building (located approximately 710 m south) would likely be screened by the settlement of South Cockerington.
- LCS2: One Grade I listed building; 17 Grade II listed buildings; one Grade II\* listed building and one Scheduled Monument. The closest is the Grade II listed building *16*

*Chapel Lane* which is located 175 m south-west of LCS2. There are two further assets within 200 m, and the remaining are over 250 m from the siting zone. *Church Of St Edith* Grade I listed building and *Cross in St Edith's churchyard* Scheduled Monument are located approximately 350 m west of LCS2, respectively. Existing vegetation within the church grounds and settlement at Grimoldby will help screen the infrastructure from the asset; however, due to the proximity of LCS2, additional mitigation may be required. *Church Of St Mary* Grade II\* listed building is also located approximately 600 m south-west of LCS2; however, existing vegetation, and intervening settlement at Manby is considered to materially reduce potential impacts upon its setting.

- LCS3: Six Grade II listed buildings. The closest is the Grade II listed building *Chestnut Farm House* located 80 m south of the LCS3. The remaining assets are located over 190 m from the siting zone.
- LCS4: Eight Grade II listed buildings and two Scheduled Monuments. The closest is the Scheduled Monument *Moated Site Immediately West of Hall Farm* which is 315 m south of LCS4. All remaining assets are located over 370 m from the siting zone. The *Castle Hill motte and bailey castle, Castle Carlton* Scheduled Monument (located approximately 370 m south-west) is now vegetated, associated with Castle Wood, and partially screened by a pocket of woodland between the asset and LCS4, limiting the potential for impacts to its setting. The *Moated site immediately west of Hall Farm* Scheduled Monument is partially screened by existing vegetation at the monument site and treelines at the south of LCS4 which would limit potential impacts to its setting.
- LCS5: Three Grade II listed buildings and two Scheduled Monuments. The closest is the Grade II listed building *Aby Grange Cottage* listed building which is 138 m west of LCS5. The remaining assets are located over 380 m from the siting zone. The *Toot Hill motte and bailey castle* Scheduled Monument (located 750 m north-west) is mostly woodland (surrounding the Manor House) and although views towards LCS5 are mainly open, the undulating nature of the topography in combination with scattered woodland blocks and treelined hedgerows would limit the potential impacts upon its setting. The *Site of St Mary's Priory, Greenfield* Scheduled Monument (located approximately 880 m south) is separated from LCS5 by Greenfield / Mother Wood and therefore potential impacts upon the setting of this asset are unlikely.
- LCS6: 14 Grade II listed buildings, two Grade II\* listed buildings and two Scheduled Monuments. The closest is the Grade II listed building *Stable Block At Thoresthorpe Manor House* located 137 m south-west of LCS6. The remaining assets are located over 160 m from the siting zone. The *Church Of St Andrew* Grade II\* listed building (located approximately 175 m north), there is little existing vegetation between the asset and LCS6, however siting at the south of this siting zone (at lower topography) is likely to materially reduce potential impacts upon its setting. The *Church Of The Holy Trinity* Grade II\* listed building and *Churchyard cross, Holy Trinity churchyard* Scheduled Monument are in Bilsby (approximately 760 m south) and due to the distance between these assets and LCS6 and intervening vegetation screening, potential impacts to their setting would be limited.
- LCS7: Two Grade I Listed Buildings, 55 Grade II listed buildings, two Grade II\* listed buildings, one Conservation Area and two Scheduled Monuments. The closest is the Grade II listed building *Manor House* which is 200 m east of LCS7. The remaining assets are located over 200 m from the siting zone. The *Windmill* and *Church Of St Wilfrid* Grade I listed buildings, and *The Manor House* and *Hanby Hall* Grade II\*

listed buildings are all located within 600 m of LCS7. They also fall within the Alford conservation area. Intervening settlement at Alford, and isolated pockets of vegetation would mean impacts to settings are unlikely. The *Site of St Mary's Priory, Greenfield* Scheduled Monument (located approximately 130 m west) would experience significant adverse effects to its setting unless siting infrastructure north of Greenfield Lane.

- LCS8: Two Grade I listed buildings, 12 Grade II listed buildings, two Grade II\* listed buildings and two Scheduled Monuments. The closest of which is *Markby Priory* Scheduled Monument which is located 80 m north of LCS8. Remaining assets are located of 500 m from the siting zone. The *Markby Priory* Scheduled Monument and the *Church Of St Peter* Grade II\* listed building (approximately 285 m north) would likely suffer significant adverse effects to their setting unless siting at the south and west of LCS8 (where the undulating and generally lower topography would limit the potential impacts upon their setting). The *Church Of St Andrew* Grade I listed building (located approximately 720 m north) is encircled by trees and this, in combination with the distance from LCS8, is likely to limit the potential impacts to its setting. The *Church Of The Holy Trinity* Grade II\* listed building and *Churchyard cross, Holy Trinity churchyard* Scheduled Monument are in Bilsby (approximately 950 m west) and due to the distance between these assets and LCS8 and intervening vegetation screening, potential impacts to its setting are unlikely. The *Church Of St Margaret* Grade I listed building (located approximately 620 m south-east) is within Hutoft and would be screened from LCS8 by this settlement.
- LCS9: One Conservation Area, one Grade I listed building, 38 Grade II listed buildings, one Registered Park and Garden and two Grade II\* listed buildings. The closest of which is the Grade II listed building *Church of St Andrew* approximately 130 m east of LCS9. The remaining assets are located over 500 m from the siting zone. The *Church Of St Wilfrid* Grade I listed building, and *The Manor House* and *Hanby Hall* Grade II\* listed buildings fall within Alford conservation area. However, these are screened from LCS9 by settlement at Alford and therefore impacts to their settings are unlikely.
- LCS10: Four Grade II listed buildings and two Scheduled Monuments. The closest of which is the Grade II listed building *Boothby Farmhouse* located 40 m south of LCS10. The remaining assets are located over 300 m from the siting zone. The *Butterbump round barrow cemetery* Scheduled Monument (located approximately 285 m north) with generally open views between this asset and the north of LCS10. However, siting towards the south-west and south-east of LCS10 should materially reduce potential impact upon the setting of this asset.
- LCS11: One Scheduled Monument, 11 Grade II listed buildings, one Grade II\* listed building, and one Grade I listed building. The closest is the Grade II listed building *Barrack Block at North West Corner of Square* located 50 m north-east of LCS11. The remaining assets are located over 70 m from the siting zone. The Scheduled Monuments, Grade II\* and Grade I listed buildings are all located within Grimoldby and Manby to the east of LCS11 where they would likely be screened by intervening settlement.
- LCS12: 14 Grade II listed buildings, three Grade II\* listed buildings, and one Scheduled Monument. The closest is the Grade II listed building *Woodthorpe Hall* located 40 m south of LCS12. The remaining assets are located over 130 m from the siting zone. The *Church Of St Andrew* Grade II\* listed building (located approximately 420 m south-east), *Church Of St. Oswald* Grade II\* listed building

(located approximately 690 m north-east), and *Castle Hill: moated site with Civil War earthworks* Scheduled Monument (located approximately 870 m north-west) are unlikely to experience adverse impacts to their setting due to intervening vegetation and settlement. The potential adverse impacts to the setting of the *Church Of All Saints* Grade II\* listed building (located approximately 230 m east) are likely to be limited by siting further west given the presence of existing vegetation around the asset and as development would be set in the context of larger agricultural and airfield buildings (if retained).

## Conclusion

- 10.2.42 Overall, all the siting zones have heritage assets either located within or in proximity to their boundaries. Despite this, there are some differentiating factors between the siting zones given the sensitivity of assets present either within or near the siting zones. Heritage assets have been identified within siting zones LCS1, LCS2, LCS6, LCS7, LCS10, and LCS11. The presence of scheduled monuments within LCS1 and LCS10 would constrain siting such that they would be less preferred overall. Although siting zone LC6 contains a scheduled monument, its location at the heart of Saleby and given that it is surrounded by extensive existing woodland, it is considered that potential impacts upon the setting of this monument would be limited.
- 10.2.43 Siting zones LCS2, LCS7 and LCS11 contain heritage assets within their boundaries and whilst these are solely individual Grade II listed buildings, there are also Grade I listed buildings and/or Scheduled Monuments present within 1 km of these siting zones which would constrain siting or require additional mitigation planting to ensure effects to their setting are materially reduced. As such, in-combination impacts on all the identified heritage assets both within and in proximity of these zones would make them less preferred overall.
- 10.2.44 Of the remaining siting zones (LCS3, LCS4, LCS5, LCS8, LCS9 and LCS12), the potential impacts to identified designated heritage assets are comparatively similar. However as siting zone LCS3 contains no designated heritage assets and is comparatively more remote from designated heritage assets it is preferred from a heritage perspective.

## LCS-A and LCS-B

- 10.2.45 When considering the siting of LCS-A and LCS-B, alongside other infrastructure required for connections, there is sufficient space within the siting zones to allow for careful siting (at a later stage) to avoid direct impacts upon the designated assets identified. However, the cumulative effects of this infrastructure, alongside other connections to the siting zones, will exacerbate the impacts upon the setting of designated heritage assets, especially those within the siting zones. This therefore supports a preference for LCS3 given that it is the most distant zone from heritage receptors and as such, the potential for increased proximity to infrastructure is less likely.

## Socio-economic

### LCS-A or LCS-B

10.2.46 The key socio-economic constraints associated with the LCS siting zones comprise:

- The proposed Viking CCS NSIP which routes along the south-west of siting zone LCS1 and from north-east to south-west across siting zone LCS2.
- Eastfield Farm Airstrip, which is located directly south of siting zone LCS2, and approximately 1 km north of siting zone LCS3.
- North Reston Hall Farm Airstrip, which is located approximately 1.7 km west of siting zone LCS4.
- Manby Showground, a former airfield, lies within the centre of siting zone LCS11.
- An operational waste site identified in the Lincolnshire Minerals and Waste Local Plan is situated in the centre of siting zone LCS11 at the border of Manby Showground.
- A planning application for an anaerobic digestion plant connected to the existing gas network which is currently out for consultation. The boundary for the application is located adjacent (west) to Manby Showground in the centre of siting zone LCS11 before routeing south and through the centre of siting zone LCS4.
- Woodthorpe Hall Golf Club and Woodthorpe Hall Leisure Park (caravan park) at the eastern border of siting zone LCS5 and on the south-western border of LCS12.
- Strubby Airfield and Glider Field, which is fully encompassed by siting zone LCS12, located approximately 550 m north-east of siting zone LCS5, 1.7 km north of siting zone LCS6 and 1.8 km north of siting zone LCS7.
- The Willoughby Branch Line nature reserve located across the south of siting zone LCS9.
- The Well Hall Registered Park and Garden located 260 m west of siting zone LCS9.
- Existing business located at Woodthorpe, including a garden centre and aquarium in the south-west of siting zone LCS12.

### Conclusion

10.2.47 Due to the extent that Manby Showground and Strubby Airfield cover siting zones LCS11 and LCS12 respectively, they are the least preferred from a socio-economic perspective. As siting zone LCS10 contains no key socio-economic receptors it is the preferred siting zone from a socio-economic perspective. When comparing the remaining siting zones, there is little to differentiate between them, although the presence of the Viking CCS NSIP and Eastfield Farm Airstrip within siting zones LCS1, LCS2 and LCS3 will limit flexibility for siting of substation infrastructure and onward overhead line connections.

### LCS-A and LCS-B

10.2.48 The siting of LCS-A and LCS-B, alongside other infrastructure required for connections, is considered to add cumulative effects on the socio-economic receptors identified above. It is considered that subject to requiring additional mitigation this would not alter

the preferences for each siting zone, and in fact further emphasises the preferences described above.

## Other Considerations

10.2.49 Other environmental topics were also considered as part of the options appraisal and include air quality, noise and water.

### LCS-A or LCS-B

10.2.50 For each of the siting zones, there is a potential risk of temporary impacts, limited to localised changes in air quality and noise and vibration during construction, on receptors within the siting zone. No potential adverse air quality impacts are anticipated during operation, however there is the potential for localised changes in noise and vibration on settlements within and adjacent to the siting zones. Nevertheless, each siting zone is considered sufficient in size to allow for careful siting (at a later stage) and to reduce the likelihood and magnitude of these effects.

10.2.51 The distribution of properties located within the boundary of or in proximity to the siting zones are such that they do not constitute a significant differentiating factor in terms of potential air quality and noise impacts. However, it is noted that LCS4 and LCS5 are most remote from properties (with clusters located at distances of over 300 m) and as such, these siting zones would be preferred from an air quality and noise perspective. This contrasts with LCS1, LCS6, LCS10, LCS11 and LCS12 which would not be preferred due to the presence of large clusters of properties within their boundaries.

10.2.52 All LCS siting zones also overlie a principal and/or secondary bedrock aquifer, which cannot be avoided and therefore this is not considered to represent a differentiating factor between the siting zones. In addition, all siting zones mostly overlay areas of medium groundwater vulnerability, with some patches of low groundwater vulnerability and some patches of medium-high groundwater vulnerability within siting zones LCS8, LCS11, and LCS12. However, given the patchiness of the medium-high groundwater vulnerability areas and that all siting zones predominantly overlay areas of medium groundwater vulnerability, groundwater vulnerability is not considered to represent a differentiating factor between the siting zones.

10.2.53 As stated in **Chapter 5**, siting zones have been developed to avoid areas of Flood Zones 2 and 3 wherever possible (in line with the policy tests (sequential and exception tests) as set out in NPS EN-1). However, these areas are present across all the siting zones except for LCS5, LCS11 and LCS12. Flood Zones 2 and 3 areas within the LCS Study Area are primarily attributed to coastal flooding (it is acknowledged that sea defences are in place along the East Lindsey coastline), as well as flooding from the South Dike, Great Eau, Wold Grift Drain, and St Leonards Drain bodies of water. Considering the distribution of Flood Zones 2 and 3 within the siting zones where it is present, they can likely be avoided within all zones excluding LCS8, where their distribution means they are unlikely to be wholly avoided. Flood defences are present along all the aforementioned main rivers (excluding St Leonards Drain) as well as the coastline within the LCS Study Area. Infrastructure required within Flood Zones 2 and 3 will be designed accordingly and further assessment of flood risk for a chosen substation site will be undertaken in more detailed assessments such as a Flood Risk Assessment (FRA) as the Project development progresses. These detailed assessments, alongside stakeholder engagement, will identify the scale of potential impacts and appropriate mitigation.

- 10.2.54 Watercourses (including IDB watercourses) are located within all the siting zones. These watercourses are primarily tributaries associated with the South Dike, Great Eau, Wold Grift Drain and St Leonards Drain. Other watercourses including those as part of the extensive field drainage network within the LCS Study Area or IDB watercourses are present within all siting zones, including LCS5, LCS11 and LCS12. Given the extensive coverage of these watercourses and the field drainage network, interactions are unlikely to be avoidable.
- 10.2.55 Source Protection Zones (identified where there is a distinct level of risk to the groundwater source from contamination) I and II ('SPZ1' and 'SPZ2') are present within and immediately adjacent to several LCS siting zones. An area of SPZ2 covers the south and south-east of siting zone LCS2, with an area of SPZ1 located at the edge of the siting zone to the south (east of Manby) and to the west (within Grimoldby). An area of SPZ2 covers the south-western and south-eastern areas of siting zone LCS8, with an area of SPZ1 located within the south-west (adjacent to the B1449) area and adjacent to the south-east area (north of the B1449) of the siting zone. In addition, an area of SPZ2 is identified at the edge of siting zone LCS10. Within these siting zones the areas of SPZ1 and SPZ2 are considered avoidable but will require further investigation and may limit siting within these siting zones. If these are not avoided, then additional mitigation would be required to limit risks of impacting groundwater as far as practicable.
- 10.2.56 Siting zones LCS2, LCS3, LCS4, LCS5, and LCS11 intersect with a surface water drinking safeguard zone. This safeguard zone completely covers siting zones LCS3, LCS4 and LCS11, and covers approximately 30% of siting zones LCS2 and LCS5 of the southern and north-western areas of the siting zones, respectively. As this safeguard zone is unavoidable for LCS3, LCS4 and LCS11, siting within these zones would require additional mitigation measures to reduce impacts upon surface water quality during construction and operation. Although it is possible to avoid the safeguard zone within LCS2 and LCS5, additional mitigation measures may still be required (subject to further) investigation to limit impacts on surface water quality.

## Conclusion

- 10.2.57 In summary from a water perspective, siting zone LCS8 would be least preferred due to the relative density of features in the siting zone, including a widespread distribution of Flood Zones 2 and 3, watercourses and the presence of a SPZ1 area at the south of the siting zone. Siting zones LCS2, LCS3 and LCS4 would also not be preferred due to the presence of the drinking water safeguard zone across the entirety of the siting zones. Siting zones LCS7 and LCS9 would not be preferred due to the presence of Main River and WFD watercourses (including Flood Zones 2 and 3) routeing through their boundaries. When considering the remaining siting zones (LCS1, LCS5, LCS6, LCS10, LCS11 and LCS12) there is little to differentiate between them.

## LCS-A and LCS-B

- 10.2.58 As with the other environmental themes, the siting of LCS-A and LCS-B, alongside other infrastructure required for connections, are considered to add cumulative effects on the identified features identified above for air quality, noise, vibration and water. Due to the scale of the infrastructure that would be required to locate within the siting zones, development has an increased potential to encroach closer to residential properties, into flood zones and require siting on (or adjacent) to watercourses and drains. This is most likely to occur in siting zone LCS8, where larger areas of Flood Zone 2 and 3 are present, such that an increased level of flood compensation would be required.



## 10.3 Engineering and System Factors

10.3.1 Key engineering factors when considering most preferred siting zone for LCS-A or LCS-B include:

- one which is relatively free from technical and infrastructure constraints (including those arising from environmental and socio-economic factors);
- provision of sufficient capacity for other electrical connections to be in reasonable proximity to the new LCS-A or LCS-B; and
- provision of sufficient opportunities for other connections between their own infrastructure and the siting zone.

10.3.2 Technical constraints including the capacity for siting LCS-A, LCS-B and other infrastructure within the siting zones (i.e., converter stations and substations) are considered below for each siting zone.

### LCS-A or LCS-B

#### Access

10.3.3 Regarding the likely level of road infrastructure required within and/or to reach the siting zones, the distance of each siting zone from nearby A-roads and B-roads is as follows:

- LCS1 – approximately 2.1 km from the nearest A and B-road (B1200).
- LCS2 – B1200 routes through the centre of the siting zone.
- LCS3 – approximately 1.3 km from the nearest A or B-road (A157).
- LCS4 – approximately 250 m from the nearest A or B-road (A157).
- LCS5 – approximately 200 m from the nearest A or B-road (B1373).
- LCS6 – The A1104 routes through the west of the siting zone.
- LCS7 – The A1104 routes through the east of the siting zone.
- LCS8 – The A1111 routes through the west of LCS8 and the B1449 is located adjacent to the south.
- LCS9 – The B1196 routes north to south through the north-west of the siting zone.
- LCS10 – The B1196 routes north to south approximately 400 m west of the siting zone.
- LCS11 – The B1200 routes west to east through the siting zone.
- LCS12 – The B1373 routes west to east through the siting zone.

10.3.4 It is considered that siting zones which are over 250 m from A-roads and/or B-roads would require an increased level of infrastructure for a new permanent access road and/or upgrades to existing roads to make them suitable to support AIL. Those with A-roads located within the siting zones (LCS6, LCS7 and LCS8) are considered (subject to further detailed assessments at a later date) to require the least infrastructure for a new permanent access road and/or upgrades to existing roads and would be more preferred from an engineering perspective. Specifically, siting zone LCS8 would be most preferred in terms of access due to the presence of A1111 within the west of siting

zone and the B1449 adjacent to the south, allowing for suitable access to the siting zone from multiple directions.

### Security

- 10.3.5 As identified within **Chapter 4**, part of the requirement for two 400 kV substations as part of the LCS (LCS-A and LCS-B) is to ensure necessary system resilience, to manage security risks, reduce operational complexity and to ensure the most efficient solution is selected for both the system and the local community to maintain compliance with NGET SQSS without triggering the requirement for additional circuits in the area. It is considered that the identified siting zones could site either LCS-A or LCS-B individually whilst also remaining compliant with NGET SQSS.

### Settlements and Residential Properties

- 10.3.6 As discussed in **Paragraph 10.1.3**, there are numerous villages, small towns and scattered residential, commercial and industrial properties across the LCS Study Areas. The presence of residential properties both within and in proximity to the siting zones will limit the area available and increase the technical complexity of infrastructure arrangements for all the siting zones. Specifically, LCS1, LCS6, LCS8 and LCS11 would be particularly constrained given the presence of villages either partially or wholly within the siting zones. However, the identified settlements and properties would not preclude any of siting zones from further consideration.

### Existing and Proposed Infrastructure

- 10.3.7 The Viking CCS NSIP which routes along the south-west of siting zone LCS1 and from north-east to south-west across siting zone LCS2 poses a siting constraint. If progressed, the Viking CCS NSIP should be avoided with sufficient stand-off distances employed, or routeing overhead line entries, in proximity. Due to the location of the Viking CCS NSIP in each of these siting zones, it is considered a potentially significant constraint to siting from an engineering perspective.
- 10.3.8 Existing buried statutory undertaker assets have been identified across the siting zone study area. Existing buried statutory undertaker assets are present within siting zones LCS1, LCS3, LCS4, LCS6, LCS7, and LCS8 which will therefore limit siting in these areas. Should any of these siting zones be identified as an emerging preference, it is considered that additional technical solutions may be required, for example removal or re-routeing of assets prior to construction of the Project. These include:
- LCS1 – a 33 kV underground cable passes through the southern edge of the siting zone.
  - LCS3 - the Theddlethorpe to Hatton high pressure gas pipeline ('Theddlethorpe to Hatton pipeline') passes through the centre of the siting zone.
  - LCS4 - the Theddlethorpe to Hatton pipeline passes through the south of the siting zone.
  - LCS6 –Viking Link Interconnector which passes through the south of the siting zone.
  - LCS7 - Viking Link Interconnector passes through the centre of the siting zone.
  - LCS8 – Viking Link Interconnector passes through the north of the siting zone.

- 10.3.9 The most significant of these is the Theddlethorpe to Hatton pipeline and Viking Link Interconnector. The Theddlethorpe to Hatton pipeline passes through LCS4 and LCS5, which will significantly limit siting flexibility, and overhead line routeing flexibility, within the siting zone. Viking Link intersects with the southern, central, and northern areas of siting zones LCS6, LCS7 and LCS8, respectively. Viking Link should be avoided with sufficient stand-off distances employed if siting, or routeing overhead line entries, in proximity. Given the location of Viking Link within the centre siting zones LCS6 and LCS7, it would increase the complexity of connections to and from the siting zone. Within siting zone LCS8 it is less of a constraint as it is sited closer to the edge of the zone, however it would still increase the complexity of connections to and from the zone.
- 10.3.10 A planning application for a proposed anaerobic digestion plant at Manby Showground (“Manby Anaerobic Digestor”) is located within the centre of siting zone LCS11 and an associated access road intersects with siting zone LCS4. If progressed without discussions with the promoter of the Manby Anaerobic Digestor project, the location of this project would likely significantly constrain siting within siting zone LCS11 due to its orientation in the centre of the siting zone. Additionally, the access road proposed within siting zone LCS4 routes from the north to the centre of the zone increasing complexity of siting within the zone.

### Ground Conditions

- 10.3.11 As described above, Flood Zones 2 and 3 are present across all the siting zones except for siting zones LCS5, LCS11 and LCS12. These are primarily attributed to coastal flooding (although sea defences are in place along the East Lindsey coastline) as well as fluvial flooding associated with South Dike, Great Eau, Wold Grift Drain, St Leonards Drain and other minor drains and watercourses present across the study area. Notably, siting zone LCS8 is the only siting zone identified where areas of Flood Zones 2 and 3 are unlikely to be wholly avoidable and therefore additional technical solutions and flood compensation would be required. However, this would not preclude siting of infrastructure within LCS8. Infrastructure required within areas of Flood Zones 2 and 3 will be designed accordingly and further assessment of flood risk for a chosen substation site will be undertaken in more detailed assessments such as an FRA as Project development progresses which will identify appropriate design solutions.
- 10.3.12 As described in **Paragraph 10.2.54**, watercourses including tributaries associated with the South Dike, Great Eau, Wold Grift Drain and St Leonards Drain and/or IDB watercourses and minor drains are present within all the siting zones and given their distribution they cannot be avoided. Substations will need to be offset from the banks of any watercourse by 50 m where possible. Where this is not possible, technical solutions including culverting and potentially diverting watercourses may be required.
- 10.3.13 Additionally, other constraints that may influence the technical complexity of design within the LCS siting zones include areas of peaty soils located at the north and south of LCS9 and the south of LCS10, and operational waste sites located within LCS11 and LCS12. However, considering their locations it is likely that these features could be avoided.

### LCS-A and LCS-B

- 10.3.14 When considering the siting of both LCS-A and LCS-B, alongside other infrastructure required for connections, within the same siting zone, there is sufficient space within all the siting zones for all required infrastructure. However, this would increase the overall

technical complexity of design and associated construction methodologies. Furthermore, additional technical solutions would be required to alleviate the engineering constraints, identified within the previous section. Additionally, siting both LCS-A and LCS-B within the same siting zone increases the risk of non-compliance with the NGET SQSS. As such, it is not considered that siting LCS-A and LCS-B, alongside other infrastructure, entirely within any one of the identified siting zones alone is preferred.

## 10.4 Other Connections

10.4.1 In addition to the 400 kV overhead line corridor that connects to each of the identified LCS siting zones (and is appraised separately within **Chapter 6**), other connections (those for customers and other planned transmission projects) will be required to connect into both LCS-A and LCS-B. These other connections currently include several customer and planned transmission connections from the Lincolnshire Coast (to the east of the LCS siting zones). The LCS siting zones are located within 12 km in a straight line of from the Lincolnshire Coast, the closest is LCS8 (approximately 3 km) and the furthest is LCS11 (approximately 10 km). The type of technology to be used for these other connections is not yet known and could be made via an overhead line or underground cable. The below sets out factors affecting the ability for other connections (i.e., overhead line and / or underground cables) to connect into each of the LCS siting zones.

### Overhead Line Connections

10.4.2 When considering overhead line connections to the LCS siting zones from the areas immediately surrounding the siting zones, the features identified affecting the ability for connections to the LCS siting zones include:

- Siting zone LCS1 - entries to LCS1 from the west and south are constrained by the presence of North and South Cockerington.
- Siting zone LCS2 - entries to LCS2 from the north-west, west and south are constrained by the presence of properties and Eastfield Farm Airstrip, Grimoldby, Manby, and the Viking CCS NSIP.
- Siting zone LCS3 - entries to LCS3 from the north, west, south-west, south and south-east are constrained by the presence of properties, Great Carlton, Gayton le Marsh, Eastfield Farm Airstrip and the presence of the existing gas pipeline. Connections from other directions would have to be considerate of scattered constraints.
- Siting zone LCS4 - entries to LCS4 from the north, north-east, east, south and south-west are constrained by the presence of properties, Great Carlton, Little Carlton, Castle Carlton and South Reston. Connections from other directions (north-west, west and south-east) would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS5 - entries to LCS5 from north, north-east, east and south are constrained by the presence of woodland (including ancient woodland), properties, Woodthorpe, Woodthorpe Hall Golf Club, Woodthorpe Hall Leisure Park and, for overhead lines, the presence of Strubby Glider Field. Connections from other directions would have to be considerate of scattered constraints but are largely unconstrained.

- Siting zone LCS6 - entries to LCS6 from the north, west and south-west are constrained by the presence of properties, Beesby, Saleby and Thoresthorpe. Connections from other directions would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS7 - entries to LCS7 from the west are constrained by the AONB and ancient woodland, and entries from the north-east to south are constrained by Alford, Thoresthorpe, Bilsby and Saleby. Connections from the north would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS8 - entries to LCS8 from the north are constrained by the Markby and Markby Priory scheduled monuments. Entries from the north-east and south-east are constrained by the settlements of Hannah and Huttoft. Connections from the other directions would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS9 - entries are significantly constrained for an overhead line due to the amount of settlement around the siting zone such that only entries from the north-west and south-east are relatively unconstrained. Overhead line entries would be constrained by the AONB such that technical solutions in the form of underground cabling may be required.
- Siting zone LCS10 - overhead line entries are significantly constrained due to the proximity to the AONB and Saleby such that an underground cable may be required.
- Siting zone LCS11 - entries to LCS11 are significantly constrained due to the proximity and extent of linear settlement (Manby, Grimoldby, South Cockerington and Little Carlton) which limit connections from the north-east to south-east and properties along Manby Middlegate which will limit connections from the north.
- Siting zone LCS12 – overhead line entries would be significantly constrained should the operational glider field at Strubby remain active, however if it ceases operations before construction there are limited constraints to these entries.

## Underground Cable Connections

10.4.3 When considering underground connections to the LCS siting zones (most likely to be made from the Lincolnshire Coast) from the areas immediately surrounding the siting zones, the features identified affecting the ability for connections to the LCS siting zones include:

- Siting zone LCS1 - Connections from directions other than west and south would have to be considerate of scattered constraints such as Viking CCS NSIP and residential properties but are largely unconstrained.
- Siting zone LCS2 – Connections from directions other than north-west, west and south would have to be considerate of scattered constraints but are otherwise relatively unconstrained.
- Siting zone LCS3 – Connections from the south-east would need to be considerate of properties at Gayton le Marsh. Connections from other directions would have to be considerate of scattered constraints.
- Siting zone LCS4 – Connections from the east and south-east would need to be considerate of properties at Gayton le Marsh and Great Carlton.

- Siting zone LCS5 – Connections from the east would need to be consideration of properties at Woodthorpe alongside Woodthorpe Hall Golf Club, Woodthorpe Hall Leisure Park, otherwise connections from other directions are largely unconstrained.
- Siting zone LCS6 – The presence of settlement at Beesby, Saleby and Thoresby constrains accessibility from the north, west and south-west. The Viking Link Interconnector passes through the south of the siting zone, constraining accessibility from the south-east. Connections from other directions would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS7 – The Viking Link Interconnector passes through the centre of the siting zone, constraining accessibility from the east and west. The settlements of Alford and Saleby constrain accessibility from the south and north-east of the siting zone. Greenfield / Mother Wood ancient woodland also poses accessibility constraints from the west. Connections from other directions would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS8 - The Viking Link Interconnector passes through the north of the siting zone, constraining accessibility from the north to north-east, respectively. Connections from the other directions other than north would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS9 – Connections are significantly constrained due to the amount of settlement around the siting zone such that only entries from the north-west and south-east are relatively unconstrained.
- Siting zone LCS10 – Connections from the east would need to be considerate of settlement at Sloothby. Connections from directions other than east would have to be considerate of scattered constraints but are largely unconstrained.
- Siting zone LCS11 – Connections would need to avoid the anaerobic digester and scattered constraints to the east and north but are generally unconstrained from the north-west and south.
- Siting zone LCS12 – Connections would need to consider scattered settlements and properties to the south-west, north and north-east.

10.4.4 Overall, when considering both overhead line and underground cable connections into the siting zones, LCS8 is comparatively the least constrained siting zone, especially those from the coast. Siting zone LCS6 also offers similar benefits for both overhead line and underground cable connections but is marginally more constrained by settlements to the west and south. Conversely, LCS10 is the most constrained siting zone for overhead lines and underground cables due to its proximity to the AONB and constraints (primarily settlement) to the east, limiting access to the siting zone. As such, it is considered that potentially siting LCS-A and LCS-B within the same siting zone at either LCS6 or LCS8 would be preferred when considering other connections perspective. Siting both LCS-A and LCS-B, alongside other infrastructure, would increase the complexity of routeing, and proximity to features, to any single siting zone but could be achievable.

## 10.5 Holford and Horlock Rules

10.5.1 The following paragraphs provide commentary of the extent to which the appraised options accord with the Holford Rules and Horlock Rules, NGET's guiding principles for

the routing and siting of new energy transmission infrastructure and the primary mechanism by which compliance with national policy is assured.

10.5.2 At this early stage of development Horlock Rules 7, 9, 10 and 11 are not considered applicable as they are primarily concerned with detailed design of substations following site selection. In relation to the siting zones for the LCS, only Holford Rules 1 and 2 are considered applicable as these primarily relate to avoiding areas of highest amenity value.

10.5.3 When reviewed against the applicable Horlock and Holford Rules:

- The definition of the siting zones has taken into consideration environmental features and potential impacts upon identified features (Horlock Rule 1).
- All siting zones, and the connections for each siting zone from NGET projects in the surrounding area, have been defined to exclude areas of highest amenity value and interest in the area (Horlock Rules 2 and 3, and Holford Rules 1 and 2).
- Sufficient space has also been included within the siting zones to enable micro-siting of LCS-A and LCS-B alongside other infrastructure to avoid other identified environmental and socio-economic constraints and further reduce impacts on receptors present (Horlock Rules 4 and 5). However, when considering the distribution of constraints, it may not be possible to co-locate all the infrastructure required if siting LCS-A and LCS-B, alongside other infrastructure within siting zones identified.
- The siting zones are generally flat with few areas of existing screening. Only siting zones LCS3 and LCS5 are contained by several woodland blocks or offer good opportunities for screening infrastructure utilising existing vegetation (Horlock Rule 4) during detailed siting (at a later stage) to reduce the severity of impacts. Except for the identified residential areas and recreational receptors such as Woodthorpe Hall Golf Club and Woodthorpe Hall Leisure Club the land within the siting zones is predominantly agricultural land and therefore most of the siting zones do not perform well against Horlock Rule 6 (reducing effect on agricultural land and drainage). However, siting zones LCS11 and LCS12 perform well against Horlock Rule 6 as they utilise existing and/or available brownfield land in the form of Manby Showground and Strubby Airfield and Glider Field, respectively.

## 10.6 Comparative Appraisal and Conclusion

10.6.1 The options appraisal of the LCS siting zones has reviewed each of the siting zones from an environmental, socio-economic, engineering and policy perspective. It has also considered the ability for other connections (requiring connecting to the 400 kV substations at LCS-A and LCS-B) to reach each of the siting zones.

10.6.2 From an environmental perspective, there are different preferences for each topic (for example, siting zones LCS5, LCS6, LCS8, LCS11 are more preferred from a landscape and visual perspective but may not be preferred from other perspectives) such that no one LCS siting zone emerges as the clearly preferred option. However, considering the scale of the infrastructure to be sited for the LCS (including the potential implications of overhead line entries) those impacts related to landscape and visual are considered to have most weight. Therefore, the least preferred siting zones are LCS9 and LCS10 due to their proximity to the AONB as well as the presence of a LNR (within siting zone LCS9), scheduled monuments (within siting zone LCS10) and the presence of larger clusters of properties within and surrounding these siting zones. When considering the

remaining siting zones, it is considered that the combination with the overhead line corridors will assist in identifying a preferred siting zone and overhead line corridor combination from both an environmental and technical perspective and when considering the Holford and Horlock Rules.

- 10.6.3 From a technical standpoint, those siting zones which perform the worst and are least preferred (working numerically from LCS1 – LCS12) are:
- Siting zone LCS1, due to the presence of settlement which, when excluded from potential siting areas, limits available space within the siting zone and Viking CCS NSIP limiting the space and increasing technical complexity of siting and the distance of the siting zone from a major road.
  - Siting zone LCS3, due to the presence of the Theddlethorpe to Hatton pipeline limiting the space and increasing technical complexity of siting and the distance of the siting zone from a major road.
  - Siting zone LCS4, due to the presence of the Theddlethorpe to Hatton pipeline and the Manby Anaerobic digester limiting the space and increasing technical complexity of siting and the identified constraints to both overhead line and underground cables connections to the siting zone due to the surrounding settlements.
  - Siting zone LCS9, due to the technical complexity of siting due to the presence of the AONB and LNR, in combination with constraints to connections to the siting zone from the east due to surrounding settlement.
  - Siting zone LCS10, due to the technical complexity of siting due to the presence of the AONB and peaty soils, constrained offshore transmission infrastructure connecting to the siting zone from the east due to surrounding settlement and the distance of the siting zone from a major road.
- 10.6.4 Although there are constraints that will increase the technical complexity of siting within the remaining siting zones (LCS2, LCS5, LCS6, LCS7, LCS8, LCS11 and LCS12) no one siting zone is considered preferred.
- 10.6.5 Overall, when considering the environmental and technical appraisal outcomes alongside the potential ability for other connections to reach the siting zones, those siting zones most preferred for the siting of LCS-A or LCS-B (alongside other infrastructure) **are siting zones LCS2, LCS5, LCS6, LCS8 and LCS11**. Whilst all the siting zones hold the capacity to site LCS-A or LCS-B (alongside other infrastructure), many of the siting zones are in proximity to features that, in seeking to avoid or reduce the potential for significant adverse effects, would considerably limit flexibility of substation siting and the routing of customer connections. The siting of both LCS-A and LCS-B (alongside other infrastructure) within a single siting zone would alter the approach to settlements and (considering the rural landscape context) the availability of wide expansive open views such that it is not preferable.
- 10.6.6 Therefore, when considered in isolation (i.e., without the consideration of the 400 kV overhead line connections for the Project to LCS-A and LCS-B and without consideration of potential in-combination impacts of siting within these siting zones), siting zones LCS2, LCS5, LCS6, LCS8 and LCS11 are the emerging preferences. The final emerging preferences of the LCS siting zone(s) will be considered alongside the findings of the appraisal of corridors between Grimsby West and Burgh le Marsh (presented within **Chapter 6**) and reviewed as part of the end-to-end solution within **Chapter 14**.



# **11. Options Appraisal – Weston marsh Substation**

# 11. Options Appraisal - Weston Marsh Substation

## 11.1 Introduction

11.1.1 This Chapter details the outcomes of the Options Appraisal (Step 7 as described in **Chapter 4**) for the preliminary siting zones for the new Weston Marsh substation. The Weston Marsh siting zones have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6). They have been developed to accommodate an AIS substation that could extend to approximately 7600 m by 200 m (approximately 12ha). The siting zone options progressed for appraisal (shown on **Figure 11-1**) comprise:

- Siting zone WMZ1 - an area, approximately 3.8 km by 1.7 km, located north of the River Welland. The RiseGate Eau waterbody crosses from north-west to south-east, and the A16 and 400 kV 4ZM overhead line crosses the west of the siting zone;
- Siting zone WMZ2 – an area, approximately 5.2 km by 2.1 km, located east of the River Welland (which is at the west of WMZ1) and at the Spalding Tee-Point. The 400 kV 4ZM and 2WS overhead lines cross the centre and east (respectively) of the siting zone;
- Siting zone WMZ3 – an area, approximately 3.4 km by 2.3 km, located adjacent to the Spalding Tee-point. The 400 kV 4ZM overhead line crosses the centre of the WMZ3 and the 400 kV 2WS overhead line is adjacent to the east of the siting zone; and
- Siting zone WMZ4 – an area, approximately 3.2 km by 3.7 km, located north-east of the Spalding Tee-Point. The B1357 and A17 cross the centre of the WMZ4 from north to south.

11.1.2 The appraisal of the siting zones has considered the potential effects of the overhead line entry connections into and out of each siting zone. These connections, as detailed in **Chapter 5**, include the new 400 kV transmission line from the LCS, the 400 kV 4ZM and 2ws overhead lines.

11.1.3 The appraisal of environmental, socio-economic and technical issues for the new Weston Marsh substation has considered, as detailed in **Chapter 5**, the potential impacts on relevant receptors, and whether such effects could be avoided or mitigated through careful siting. Where impacts cannot be avoided or mitigated by careful routing and siting, other forms of mitigation have been considered in accordance with NGET's mitigation hierarchy.

11.1.4 For the current Project stage, the relevant data to inform the appraisal comprises desk study information, supplemented by a site visit to select locations, on important receptors.

Figure 11-1 – Weston Marsh Substation Zone locations

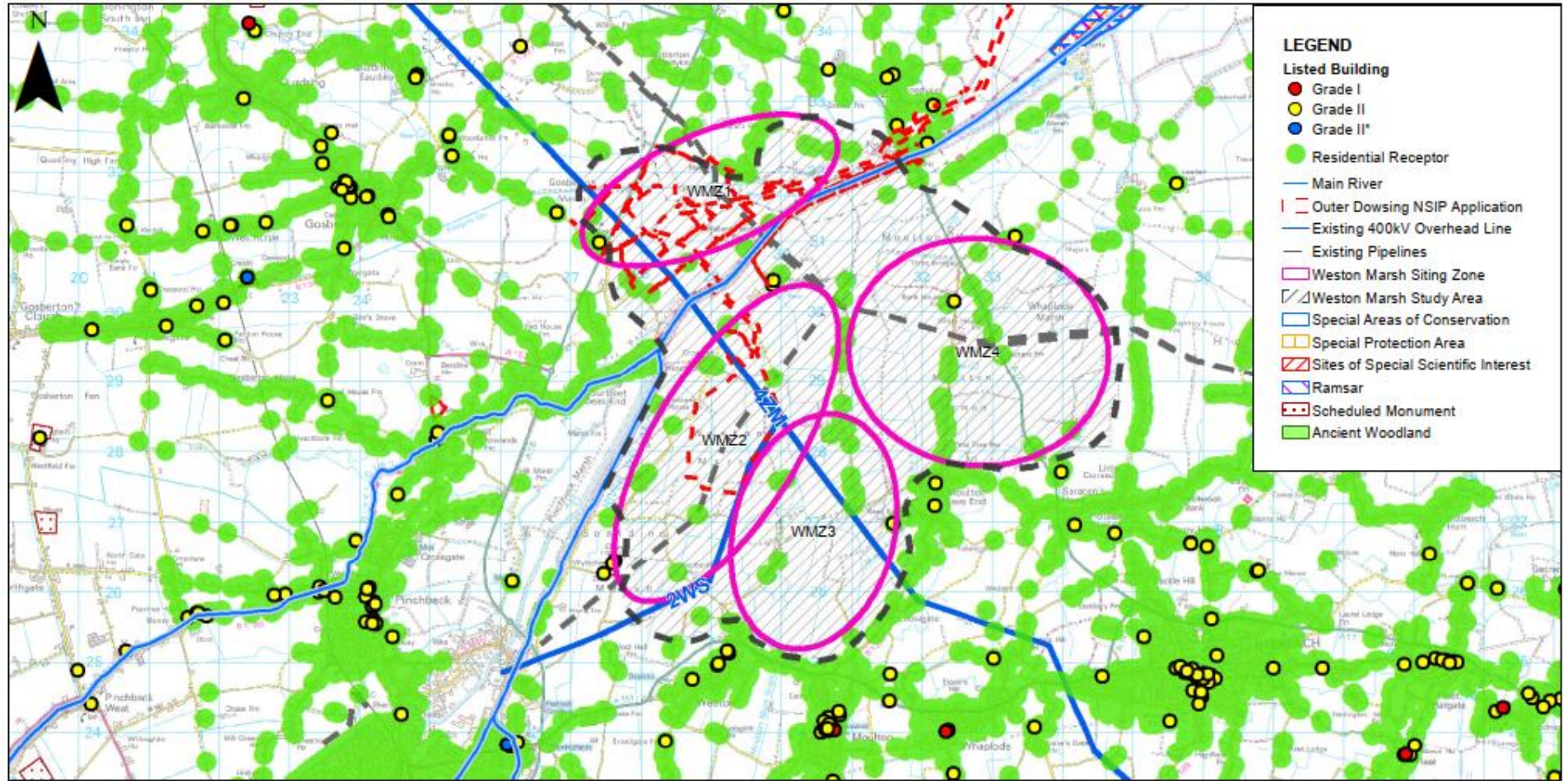
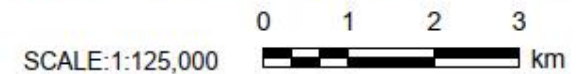


Figure 11-1-Weston Marsh Siting Zones Locations, Existing Infrastructure and Environmental Constraints

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## 11.2 Environmental Factors

### Landscape and Visual

- 11.2.1 The Western Marsh siting zones are located within approximately 4 km of each other and therefore there is less to differentiate with regards to the potential effects of the new Weston Marsh substation upon the surrounding landscape. All the siting zones are located:
- within the Fens NCA (NCA 46), characterised by a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary and notable for its large-scale, flat, open landscape with extensive vistas to level horizons;
  - over 28 km away from the North Norfolk AONB (the nearest nationally designated landscape) and are therefore unlikely to affect this nationally designated landscape; and
  - within an open arable field landscape, with a mix of regular and irregular field patterns, a strong rural character, and level topography offering flexibility for siting.
- 11.2.2 Similar to the potential effects on the surrounding landscape, the potential visual impact of a new Weston Marsh substation within each siting zones was comparatively similar. For all the siting zones:
- Settlement comprises a small number of residences, predominantly isolated farmhouses within siting zones WMZ1 and WMZ2 and a mixture of farmhouses and residential dwellings along A and B-roads within siting zones WMZ3 and WMZ4.
  - Vegetation is sparse and limited to occasional small woodland blocks, field boundary trees, and vegetation at the roadside or edge of settlements. Within WMZ3 there is also a notable woodland belt and parkland running north-south at Hall Gate.
  - The views are generally open and expansive, to distant treed horizons, with the existing 400 kV overhead lines (4ZM and 2WS) and Spalding Power Station prominent features on the horizon. The proposed Outer Dowsing OWF, if built, would also become a prominent feature in the landscape.
  - The River Welland runs through the centre of the Weston Marsh Study Area. Its raised banks contains views for each siting zone (south-east for WMZ1 and west/north-west for WMZ2, WMZ3 and WMZ4) but offers views from the Macmillan Way long distance footpath which routes along the banks.
- 11.2.3 Although there are many similarities between the siting zones, WMZ1 is not overlooked by larger settlements. The western boundary of siting zone WMZ2 is overlooked by settlement at the north of Surfleet Seas End, although the banks of the River Welland and existing vegetation would limit views. Siting zone WMZ3 is overlooked by larger villages around the edges to the east and south, and linear development along the B1357 to the east and along the A151 to the south. Siting zone WMZ4 is overlooked from the edges of the villages of Moulton Seas End immediately to the south and Saracen's Head to the south-east.
- 11.2.4 Diversions of the 4ZM and 2WS 400 kV overhead lines (required to connect at the new Weston Marsh substation) will be of differing distances depending on the location of each siting zone. The diversions themselves would impact upon the visual amenity of the surrounding areas. Siting zone WMZ1 is adjacent to the 4ZM 400 kV overhead line

but is comparatively distant from the 2WS 400 kV overhead line. In addition, the crossing of the River Welland by the 2WS 400 kV overhead line to reach WMZ1 may require taller towers. Siting zones WMZ2 and WMZ3 are adjacent to the 4ZM and 2WS 400 kV overhead lines. Siting zone WMZ4 is comparatively distant from both the 4ZM and 2WS 400 kV overhead lines. As WMZ1 and WMZ4 would require longer diversions of the 2WS and / or 4ZM 400 kV overhead lines, they are likely to have a comparatively greater visual impact than siting within WMZ2 or WMZ3.

- 11.2.5 The Outer Dowsing OWF substation is proposed within siting zone WMZ1. The siting of this infrastructure and the new Weston Marsh substation within the same zone (if possible) would assist in limiting the spread of non-linear infrastructure although it would have a cumulative effect on nearby receptors. Although siting within WMZ2, WMZ3 and WMZ4 would potentially increase the spread of non-linear infrastructure, potential cumulative impacts would be limited by raised banks of the River Welland (helping to contain views).
- 11.2.6 Overall, the scale of development is such that there will be adverse visual effects. Siting within WMZ4 is the least preferred as the extent of the 400 kV overhead line (2WS and 4ZM) diversions required to reach this siting zone is likely to have as great (if not greater) adverse landscape and visual impacts than the development of the new Weston Marsh substation itself. Siting within WMZ1 would help to limit the spread of effects by collocating (if possible) infrastructure with the Outer Dowsing OWF, however as it would also require a lengthy diversion of the 2WS 400 kV overhead line and may require taller pylons (thus more visually prominent) to cross the River Welland, and as such it is less preferred. Careful siting within WMZ2 and WMZ3 (nearer the Spalding Tee-Point) would help to limit the spread of infrastructure and are therefore would have similar scale impacts. As it is more remote, and with the River Welland containing most views north and west, siting zone WMZ2 is marginally preferred (subject to onward routes towards the new Walpole substation).

## Ecology

- 11.2.7 All the siting zones for the new Weston Marsh substation are located over 3 km from NSN or Ramsar sites. The nearest is The Wash and North Norfolk Coast SAC, and The Wash SPA and Ramsar sites which also overlap with SSSIs and a NNR ('The Wash designated sites,' as described in **Paragraph 6.2.82**) located at the mouth of the River Welland in The Wash estuary. The Wash designated sites are hydrologically connected to the River Welland and its tributaries. Due to the distance of the siting zones from The Wash designated sites, potential impacts of substation infrastructure are limited to pollution during construction and impacts to functionally connected habitats. However, for overhead line connections to each siting zone, potential impacts also include the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar Sites will be considered in detail within an HRA, as the Project development progresses.
- 11.2.8 Priority habitat datasets identified priority habitat in the form of deciduous woodland and coastal and floodplain grazing marsh, as present within siting zone WMZ1, WMZ2 and WMZ3. Site walkovers confirmed the presence of deciduous woodland and that the areas identified as coastal and floodplain grazing marsh were in use as agricultural land. Following the site visits and ground truthing, it is considered that any priority habitat could be avoided and therefore this was not considered a differentiating factor.

11.2.9 There is little to differentiate from an ecological perspective between each of the Weston Marsh siting zones. However, given the comparatively further distance from The Wash designated sites, siting zones WMZ2 and WMZ3 are preferred.

## Historic Environment

11.2.10 There are few designated heritage assets located within the Weston Marsh siting zones. Siting zone WMZ1 contains one asset, WMZ2 contains three assets, and WMZ3 and WMZ4 both contain one asset. In addition to the designated heritage assets within the siting zones there are several designated heritage assets present within 1 km. Given the distribution and availability of space within the siting zones, physical impacts to these assets can be avoided by careful siting. However, given the limited presence of intervening woodland or other development, the new Weston Marsh substation is likely to have impacts on the setting of these assets and those in the surrounding area. Identified heritage assets within 1 km of each siting zone comprise:

- Siting zone WMZ1: four Grade II listed buildings; *The Gables* is located within the siting zone at Gosberton, South Holland. The remaining are located over 400 m from the siting zone.
- Siting zone WMZ2: one scheduled monument; four Grade II listed buildings and one Grade I listed building. The *Wykeham Chapel: a moated monastic grange and retreat house* Scheduled Monument (and associated listed buildings) is at the southern boundary of the siting zone at Wykeham, and the Grade II *Pigeoncote to The South of Wraggmarsh House* and Grade II *Wraggmarsh House Farmhouse* are adjacent to the boundary along Marsh Road in the north. The remaining are located within 300 m of the siting zone.
- Siting zone WMZ3: one scheduled monument, one conservation area, eleven Grade II listed buildings and one Grade I listed building. The Grade II *Seasend Hall* is located within the siting zone near Moulton Seas End, with the remaining located over 450 m from the siting zone.
- Siting zone WMZ4: five Grade II listed buildings; the Grade II listed *Farmhouse at Rh Scrimshaw and Sons* is located within the siting zone along Common Road. The Grade II listed building *The Farmhouse* is located within 100 m of the siting zone, with the remaining located over 350 m from the siting zone.

11.2.11 Siting at the centre of WMZ1, centre of WMZ2, west of WMZ3 and to the centre or west of WMZ4 would help to limit the potential impacts to the settings of identified heritage assets. The settings of those assets identified are likely to be affected by existing electrical transmission infrastructure (the 4ZM and / or 2WS 400 kV overhead line). Careful siting should seek to minimise the potential for cumulative impacts upon the setting of assets in the open expansive views. As WMZ1 has comparatively fewer designated assets within and surrounding the siting zone, WMZ1 is marginally preferred. Siting within WMZ2 would be least preferred should infrastructure be located to the south of the siting zone, locating towards the Spalding Tee-Point would be preferred.

## Socio Economics

11.2.12 The key socio-economic constraint associated with the siting of the new Weston Marsh substation is the Outer Dowsing OWF. Discussions with Outer Dowsing OWF have been undertaken to collaborate on substation site identification search areas for

onshore substations. The Outer Dowsing OWF boundary overlaps with siting zone WMZ1. The presence of this infrastructure may cause conflict with the use of this siting zone if they are taken forward alongside the Outer Dowsing OWF infrastructure. Therefore, WMZ1 is least likely to be less preferred from a socio-economic perspective.

## Other considerations

- 11.2.13 Other environmental topics were also considered as part of the options appraisal and include air quality, noise and water.
- 11.2.14 Within the Weston Marsh Study Area, the residential properties are mostly located at Wykeham, Weston, Moulton Marsh and Moulton-Seas-End. There are properties within and surrounding each of the siting zones, generally consisting of residential properties and agricultural properties. There is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality impacts are anticipated during operation, however there is the potential for localised changes in noise and vibration on settlements within and adjacent to the siting zones. However, each siting zone is considered sufficient in size to allow for careful siting (at a later stage) and to materially reduce the likelihood and magnitude of these effects.
- 11.2.15 Flood Zone 2 and 3 are present across the entire Weston Marsh Study Area and is also present in the wider area (and therefore no reasonably available alternative sites are identified) and it is therefore not a differentiating factor between the siting zones. However further assessment of flood risk for a chosen substation site will be undertaken in more detailed assessments such as an FRA as the Project development progresses which will identify appropriate mitigation. Minor watercourses including IDB watercourses are present in all siting zones. These watercourses are potentially avoidable through careful siting; however, the ability to avoid them is likely to be more difficult within WMZ1 and WMZ3 due to their distribution within these siting zones.
- 11.2.16 Overall, when considering air quality, noise and water, there is little to differentiate between the siting zones. However, when considering the works required for the overhead line diversion into the siting zones, WMZ4 is less preferred as longer diversions are likely to increase the potential for noise effects on properties during operation.

## 11.3 Engineering and System Factors

- 11.3.1 The key factors when considering a best performing siting zone at Weston Marsh include the proximity to the Spalding Tee-Point (closer being better as it would reduce/minimise the length of diversions for the 4ZM and 2WS 400 kV overhead lines) and the minimisation of system outages required to facilitate construction.
- 11.3.2 The Outer Dowsing OWF overlaps with the siting zones WMZ1 and if constructed may cause conflict with the using of this siting zone. Further discussion would Outer Dowsing OWF be required. Existing petroleum pipelines (as identified on OpenInfra mapping) routes through siting zones WMZ1, WZM2 and WZM4. Therefore, with regards to this aspect, the WMZ3 is preferred.
- 11.3.3 All the siting zones are within Flood Zones 2 and 3 and the placement of infrastructure within these areas of flood risk is unavoidable. Infrastructure required within Flood Zones 2 and 3 will be designed accordingly and the mitigation required will be

determined as the Project progresses, however, at this stage it is not considered to be a differentiating factor between siting zones.

- 11.3.4 For all siting zones, construction sequencing will be rationalised to reduce the potential for system outages. The new Weston Marsh substation, the 400 kV transmission connection and diversions of existing 400 kV overhead line will be built offline as far as practicable. The final 400 kV transmission turn ins and connections to the existing apparatus and existing overhead lines completed under outages. The new Weston Marsh substation will require connections to the 400 kV 4ZM and 2WS overhead lines. With regards to this aspect, the preferred siting zones are those located closest to the Spalding Tee-Point thereby limiting the amount of diversion works required. Siting zones WMZ2 and WMZ3 are located closest to the Spalding Tee-Point.
- 11.3.5 Siting zones WMZ1 and WMZ4 both have major roads (A-roads or B-roads) which route through them. This will reduce the level of infrastructure required for the construction of a new permanent access road and/or upgrades to existing roads to make them suitable to support ALLs. Siting zone WMZ3 is within 300 m of the B1357 and A151, therefore the length of access road and associated levels of infrastructure is not considered to be significant. Siting zone WMZ2 is located over 1.1 km from the nearest major roads and therefore will require comparatively more infrastructure for new permanent access.
- 11.3.6 Overall, siting zones WMZ2 and WMZ3 are more preferred as they limit the complexity of connections with the 400 kV 4ZM and 2WS overhead lines. Of these two siting zones, WMZ3 is marginally the preferred (subject to onward routing of the overhead line) due proximity to major roads and the absence of existing petroleum pipelines through the siting zone.

## 11.4 Holford and Horlock Rules

- 11.4.1 The following paragraphs provide commentary of the extent to which the appraised options for siting the new Weston Marsh substation accord with the Horlock Rules, and with regards to overhead line entries, the Holford Rules (NGET's guiding principles for the routing/siting new energy transmission infrastructure and a primary mechanism by which compliance with national policy is assured).
- 11.4.2 At this early stage of development Horlock Rules 7, 9, 10 and 11 are not considered applicable as they are primarily concerned with detailed design of substations following site selection. In relation to the siting zones for the new Weston Marsh substation, only Holford Rules 1 and 2 (which relate to avoiding areas of amenity value) are considered applicable as the remaining Holford Rules related to routing of overhead lines.
- 11.4.3 When reviewed against the applicable Horlock and Holford Rules:
- The definition of siting zones has taken into consideration environmental features and potential impacts upon identified features (Horlock Rule 1).
  - All siting zones have been defined to exclude areas of highest amenity value and interest in the area (Horlock Rules 2 and 3, and Holford Rules 1 and 2). There are designated cultural heritage assets located within all siting zones. However, these are avoidable through careful siting.
  - Sufficient space is available within the siting zones to enable micro-siting to avoid identified socio-economic constraints and further reduce impacts on environmental features present (Horlock Rules 4 and 5). Given the proximity to the Spalding Tee-Point, siting zone WMZ2 and WMZ3 will help to limit the intrusion of infrastructure



(both substation and connecting overhead lines) into surrounding areas in line with Horlock Rule 4.

- All siting zones offer the opportunity to utilise screening provided by existing features to reduce intrusion into surrounding areas (Horlock Rule 4). Given the open landscape with sparse vegetation there is little existing screening available, therefore, given the limited distance from receptors the use of screening by mounding or planting may be necessary.
- All siting zones are predominantly located on agricultural land (Horlock Rule 6 - reducing effect on agricultural land and drainage), although this is considered to be unavoidable. All siting zones contain drains, however given the distribution of drains within siting zones WMZ1 and WMZ3, it will be more difficult to avoid drains, which makes these siting zones less preferred when considering such features.
- No vacant or available brownfield land for substation siting has been identified within the Weston Marsh Study Area, however proximity to existing 400 kV infrastructure has been considered (in line with Horlock Rule 8 – space to be used effectively to limit the area required for development). Given the proximity to the Spalding Tee-Point, WMZ2 and WMZ3 would help to limit the area required for development.

## 11.5 Comparative Appraisal and Conclusion

- 11.5.1 Siting zone WMZ4 is overall the least environmentally preferred due to its proximity to The Wash designated sites and length of the diversions required to connect the existing 400 kV overhead lines (2WS and 4ZM). Siting in WMZ4 would result in greater intrusion of infrastructure into the surrounding environment. When comparing the other siting zones there is less to differentiate between them. WMZ1 is more distant from heritage assets but would require a longer diversion of the 2WS 400 kV overhead line (over the River Welland which may be on taller pylons) and may interact with siting of the Outer Dowsing OWFI. Therefore, siting in WMZ1 is likely to be less preferred. Siting zones WMZ2 and WMZ3 are closest to the Spalding Tee-Point and, if siting near it, generally distant from surrounding receptors which would help to limit the spread of infrastructure into the surrounding area. From a technical perspective, there are notable factors to differentiate the Weston Marsh siting zones. Siting zones WMZ2 and WMZ3 will limit the works and complexity for overhead line diversions (2WS and 4ZM) given their proximity to the Spalding Tee-Point, whereas these will be increased at WMZ1 and WMZ4. However, WMZ2 and WMZ3 are comparatively distant from the major road network. Overall, WMZ3 is marginally preferred as it is slightly closer to the major road network.
- 11.5.2 Overall, when considering all features and constraints relevant to the siting of the new Weston Marsh substation there is little to choose between WMZ2 and WMZ3 (assuming careful siting). WMZ2 is marginally preferred from an environmental perspective and WMZ3 is marginally preferred from a technical perspective. Both siting zones offer the best opportunities for flexible siting whilst reducing the intrusion of infrastructure, and therefore environmental impacts (in line with the Horlock Rules), into the surrounding area.
- 11.5.3 Therefore, when considered in isolation, siting zones WMZ2 and WMZ3 are the emerging preferences for the new Weston Marsh Substation subject to the findings of the appraisal of corridors between Burgh le Marsh and Walpole (presented within **Chapters 7 and 8**). The emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14**.

# 12. Options Appraisal - Walpole

# 12. Options Appraisal - Walpole substation

## 12.1 Introduction

12.1.1 This Chapter details the outcomes of the Options Appraisal (Step 7 as described in **Chapter 4**) for the preliminary siting zones for the new Walpole substation. The Walpole siting zones have been developed through definition of a study area (Step 1), mapping and weighting of features (Step 2 and Step 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6). They have been developed to accommodate a 400 kV AIS substation, which could extend approximately 800 m by 200 m (approximately 16 ha), and two converter stations (one for each of the EGL 3 and EGL 4 projects), each of which could require areas in order of 400 m by 200 m (approximately 8 ha). The siting zone options progressed for appraisal (**shown on Figure 12-1**) comprise:

- Siting zone WLP1 – an area, approximately 1.8 km by 1.4 km, located west of the A1101, south-east of the North Level Main Drain and north of Newton – in – the – Isles.
- Siting zone WLP2 - an area, approximately 1.3 km by 1.1 km, located west of the River Nene, east of the A1101, north-west of the Wisbech Compressor Gas (Wisbech Compressor) Station and south-west of Foul Anchor.
- Siting zone WLP3 - an area, approximately 1.7 km by 0.9 km, located west of the River Nene, east of the A1101 and Newton, north-west of the Wisbech Compressor Station and south-west of Foul Anchor.
- Siting zone WLP4 – an area, approximately 2.5 km by 0.9 km, located east of the River Nene, south-east of the existing Walpole substation and north-west of West Walton.
- Siting zone WLP5 - an area, approximately 2.7 km by 1.5 km, located directly south of the Rose and Crown Farm solar farm, north of Walton Highway and West Walton.
- Siting zone WLP6 - an area, approximately 2.5 km by 1.6 km, located south-west of Emneth, north-east of Outwell and east of Friday Bridge.

12.1.2 The appraisal of the Walpole siting zones has considered the potential effects of the overhead line diversion required for the 400 kV 4ZM overhead line (which routes between Burwell and Walpole), in and out of each siting zone. Additionally, the appraisal has considered the infrastructure required for the EGL 3 and EGL 4 projects (outlined in paragraph 12.1.1). Ultimately the Walpole siting zone emerging as preferred should balance the following to provide the best overall location:

- the requirements of the overhead line corridor developed for the Project (discussed in **Chapter 8**);
- suitable locations for the new Walpole 400 kV substation,
- suitable locations for the converter stations required for the EGL 3 and EGL 4 projects near the new Walpole 400 kV substation; and

- the ability for planned transmission connections ('other connections'), including those from the EGL 3 and EGL 4 projects, to reach the new Walpole 400 kV substation.

12.1.3 The appraisal of environmental, socio-economic and technical factors for the Walpole siting zones, has considered, as detailed in **Chapter 5**, the potential impacts on relevant features, and whether such effects could be avoided or mitigated through careful siting. Where impacts cannot be avoided or mitigated by careful routeing and siting (and routeing of overhead line entries), other forms of mitigation have been considered in accordance with NGET's mitigation hierarchy.

12.1.4 For the current Project stage, the relevant data to inform the appraisal comprises desk study information, supplemented by site visits.

Figure 12-1 – Walpole Siting Zone Locations, Existing Infrastructure and Environmental Constraints

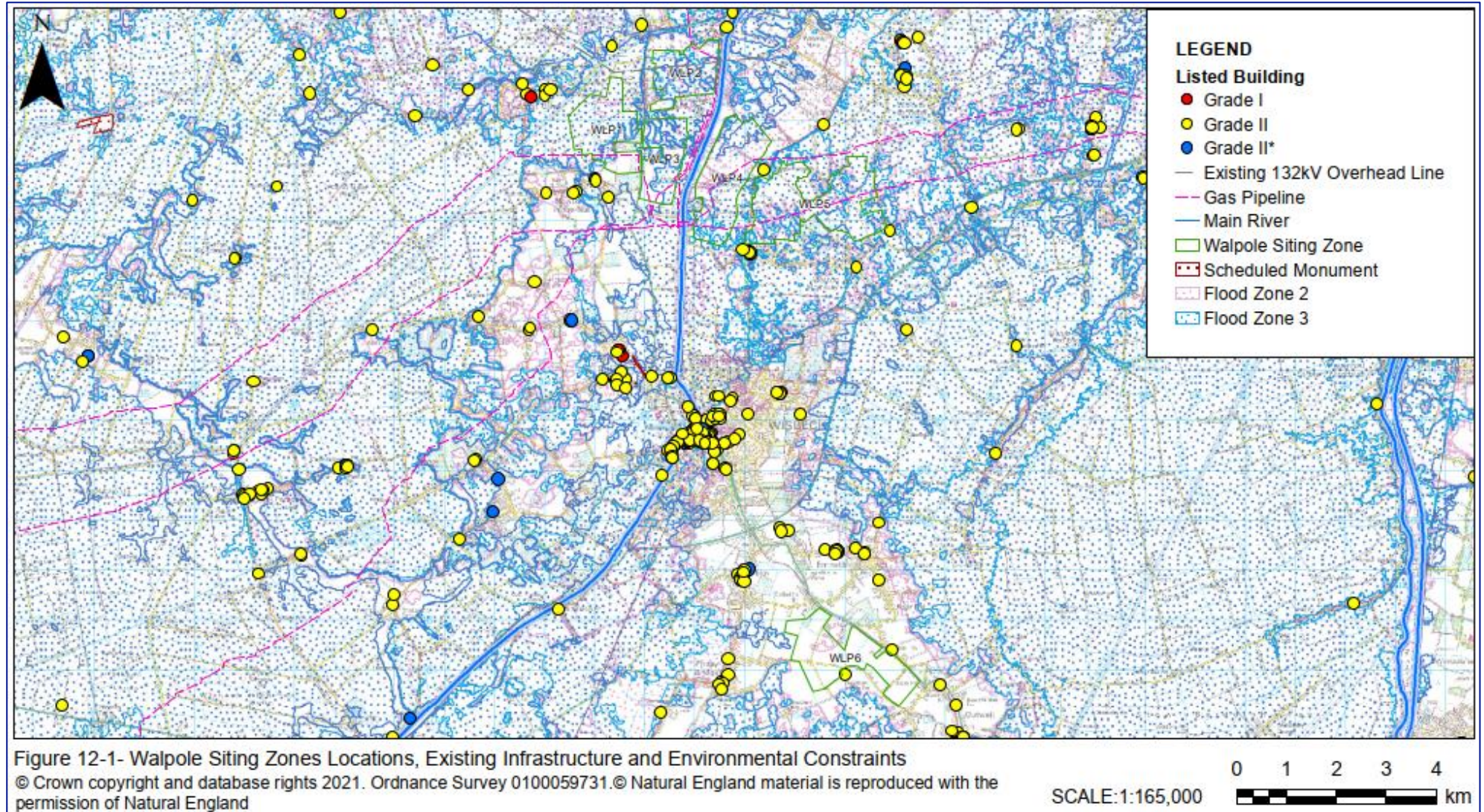


Figure 12-2 – Siting Zone WLP1-WLP5 Location, Existing Infrastructure and Environmental Constraints

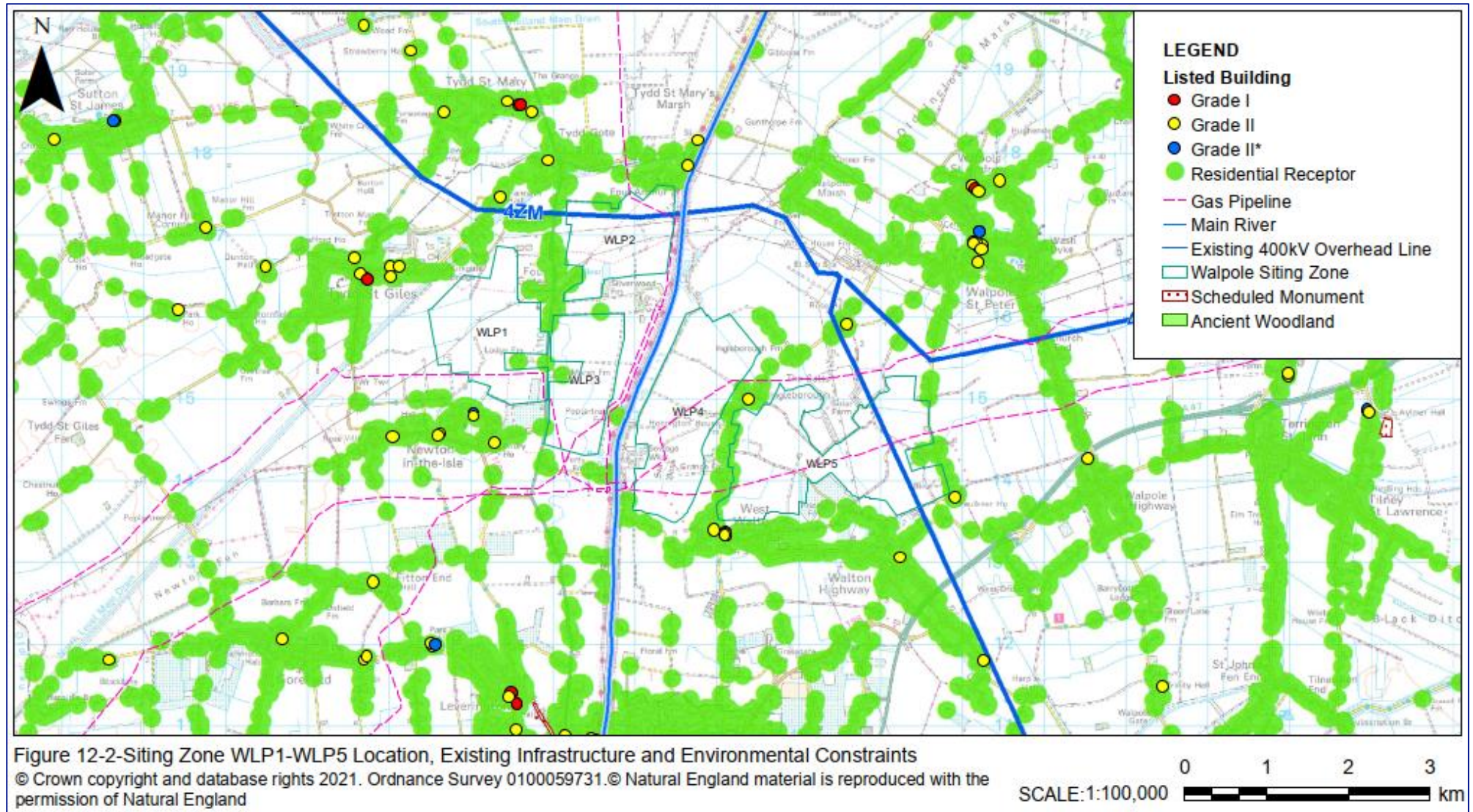


Figure 12-3 – Siting Zone WLP6 Location, Existing Infrastructure and Environmental Constraints



**LEGEND**

**Listed Building**

- Grade I
- Grade II
- Grade II\*

- Residential Receptor
- Existing 400kV Overhead Line
- - - Gas Pipeline
- Main River
- ▭ Grantham to Bexwell Pipeline
- ▭ Walpole Siting Zone
- - - Scheduled Monument
- Ancient Woodland

Figure 12-3-Siting Zone WLP6 Location, Existing Infrastructure and Environmental Constraints

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## 12.2 Environmental Factors

### Landscape and Visual

- 12.2.1 Siting zones WLP1 to WLP5 are located within approximately 7 km of each other. Siting zone WLP6 which is located approximately 7 km further to the south. However, all siting zones are located:
- within the Fens National Character Area (NCA) (No. 46), characterised by a distinctive, historic and human-influenced wetland landscape lying to the west of The Wash estuary. The NCA is notable for its large-scale, flat, open landscape with extensive vistas to level horizons;
  - over 13 km from the North Norfolk AONB (the closest nationally designated landscape). Siting zone WLP6 is located furthest away at approximately 23 km) and are therefore unlikely to affect this nationally designated landscape; and
  - in an open and flat arable landscape with a mix of regular and irregular field patterns often bounded by drainage ditches, a strong rural character, scattered urban areas, existing transmission infrastructure and level topography offering flexibility for siting.
- 12.2.2 Each siting zone will also require overhead line connections to the siting zones (diversions of the existing 4ZM 400 kV overhead line and the proposed overhead line for the Project). The locations of the siting zones will influence the lengths of these connections and therefore the potential scale of landscape and visual impacts of siting within each siting zone. For example, those located further west will require longer connections of the 400 kV 4ZM overhead line (between Burwell and Walpole) but shorter connections of the proposed overhead line for the Project (from the new Weston Marsh substation).
- 12.2.3 Siting zone WLP1 is characterised by open fields of varied size and smaller field pattern in places, enclosed by drainage ditches. Urban elements in the landscape comprise scattered settlement around the edges of the siting zone along the A1101, North Level Main Drain and at Newton-in-the-Isle, and prominent existing 132 kV overhead line pylons through the siting zone and within distant views to the north. Views within the siting zone and in the surrounding area, are generally wide and expansive due to sparse vegetation cover, however an orchard in the south (part of which outside WLP1 is identified as traditional orchard) is enclosed by dense field edge trees which contrasts with the openness elsewhere. In the areas surrounding WLP1 the main visual receptors include residents living in properties at the northern edge of the village of Newton-in-the-Isle to the south, residents living in properties along the A1101 (Sutton Road) to the east, Swallow Lane and Sandy Lane (along the banks of the North Level Main Drain) to the north.
- 12.2.4 Siting zone WLP2 is characterised by moderate to large, irregular sized open arable fields. Vegetation is generally sparse, comprising occasional hedgerows. Views within the siting zone and in the surrounding area, are generally open, with layered distant vegetation associated with surrounding settlement, and the Wisbech Compressor to the south. As with siting zone WLP1, the urban elements in the landscape comprise scattered settlements around the edges of the siting zone and pylons associated with existing overhead lines (the 400 kV 4ZM overhead line and two 132 kV overhead lines) but also includes the Wisbech Compressor. The raised banks of the River Nene to the east and North Level Main Drain to the north also provide some enclosure. Settlement is scattered around the edges of the WLP2, largely concentrated to the north at Foul



Anchor and Tydd Gote, and west along the A1101 Sutton Road. In addition to residents within these settlements, visual receptors in the surrounding area also include recreational users of the Nene Way Long Distance Footpath (the 'Nene Way'), located to the east along the banks of the River Nene.

- 12.2.5 Siting zone WLP3 is characterised by large, open, broadly rectilinear flat arable fields bisected by a raised winding drain. Like WLP1 and WLP2, vegetation is sparse and comprises of occasional hedgerows as well as dense planting around the Wisbech Compressor to the north-east. Views are wide and expansive, punctuated by occasional surrounding tree belts, including that around the Wisbech Compressor, and shortened to the east by the raised banks of the River Nene. Urban elements in the landscape comprise scattered settlements, the Wisbech Compressor and distant pylons associated with existing overhead lines to the north and north-west. The pylons of the existing overhead lines on the horizon are a prominent feature in views, providing comparatively more visual clutter in an otherwise simple landscape. Settlement form comprises several farms scattered around the edges of the siting zone, largely concentrated along the A1101 Sutton Road. Like siting zone WLP2, visual receptors in the surrounding area also include recreational users of the Nene Way to the east.
- 12.2.6 Siting zone WLP4 is characterised by flat, open arable farmland. Views are generally open and punctuated with layers of vegetation. These include occasional small blocks of woodland, screening associated with the sewage works to the west, trees and hedges associated with scattered settlement around the edges (along Mill Road and the outskirts of West Walton to the east and south-east), and vegetation associated with the River Nene to the west, which combines with elevated banks to screen views to the east. Urban elements in the landscape comprise linear settlement, the sewage works (Anglian Water Pump Station) to the west and pylons associated with existing overhead lines (routing into the existing Walpole substation) to the north. Settlement pattern comprises those along Mill Road to the east and the outskirts of West Walton to the south-east. To the west, the Nene Way is located along the western banks of the River Nene, however views are partially screened by the banks of the River Nene and vegetation.
- 12.2.7 Siting zone WLP5 is characterised by large, irregular sized open arable fields, contrasting with orchards (part of which outside the siting zone is identified as traditional orchard) set in small, enclosed paddocks in the south. WLP5 is surrounded by solar development to the north, scattered farms and residential properties to the east and west, and the villages of West Walton and Walton Highway to the south. Field boundaries are largely open in the east and north, however there is some enclosure in the west by dense hedgerows, particularly located around orchards, as well as vegetation associated with settlement. This creates localised visual enclosure, contrasting with open views experienced elsewhere in the Walpole Substation Study Area. Pylons associated with existing 132 kV and 400 kV overhead lines are prominent on the horizon in open views to the north, as is the tower of *St Mary's Parish Church* (Grade I listed building) visible above the trees in West Walton. Residential receptors include those living in properties along Mill Road, on the outskirts of West Walton and Walton Highway, and along West Drove North to the east.
- 12.2.8 Siting zone WLP6 is characterised by moderate to large arable fields bound by a network of drainage ditches. Field boundaries are largely unmarked, although rows of poplars, and orchards enclosed by dense hedgerows to the north combine to create treed skylines. Views are generally open, featuring scattered farm buildings and the occasional large barn. Urban elements in the landscape are generally limited to settlements and distant pylons associated with existing overhead transmission lines to

the east (4ZM 400 kV overhead line) and west (UKPN 132 kV overhead line). Residential receptors include those living in properties along the Outwell Road to the north-east, Needham Bank to the south-west, and on the western edge of Outwell to the south-east and more distantly scattered residences to the west.

- 12.2.9 The scale of development is such that there will be adverse landscape and visual effects from siting the new Walpole substation and EGL 3 and ELG4 converter stations, in any of the siting zones. Careful siting would seek to avoid key landscape features, such as the orchards to the south of WLP1, the distinctive drainage pattern in WLP3, the small field pattern where orchards are present in WLP5, as well as vegetation within and surrounding the siting zones. Careful siting would also seek to retain offsets from visual receptors (where practicable) to limit the risk of impacts to visual amenity and disrupting the strong sense of openness and expansive views associated with all siting zones. However careful siting of the new 400 kV substation alongside consideration of connections to the siting zone are unlikely to fully mitigate the increased likelihood of wirescape impacts within and surrounding the siting zones.
- 12.2.10 Crossing of the River Nene will require taller towers (like those for the 4ZM 400 kV overhead line currently located adjacent to its banks) to achieve required clearances and these will have a significant impact on the surrounding area. For those siting zones located to the west of the River Nene (WLP1, WLP2, WLP3) the diversion of the 400 kV 4ZM overhead line (Burwell to Walpole) will be required to cross the river twice (going into, then back out of the siting zone) which will further increase the potential for adverse landscape and visual impacts and the likelihood of a wirescape. In comparison, siting zones located to the east of the River Nene (WLP4, WLP5 and WLP6) will only require a single crossing of the River Nene to accommodate the proposed 400 kV overhead line from Weston Marsh. The influence of multiple crossings at the River Nene by overhead line is considerable when determining a preferred siting zone and therefore those siting zones to the west of the River Nene are less preferred. When comparing the other siting zones (WLP4, WLP5 and WLP6) situated to the east of the River Nene, there is less to differentiate between them when considering landscape impacts. However, WLP5 provides the best opportunity to limit the diversions of the 400 kV 4ZM overhead line as it is located within WLP5, and because WLP5 would, limit visual intrusion into the surrounding areas.
- 12.2.11 When considering the siting of converter stations for the EGL 3 and EGL 4 projects, sufficient space is available within the siting zones. However, given the open landscape characteristics associated with each of the siting zones (described above) adverse landscape and visual effects will likely be exacerbated by this additional infrastructure (and its connections) despite the implementation of mitigation (such as landscape planting). The cumulative effect of siting the EGL 3 and EGL 4 converter stations is particularly acute for siting zones WLP1, WLP2, and WLP3 where the infrastructure would be perceived in the context of the taller pylons associated the River Nene crossings. Therefore, siting zones WLP1, WLP2 and WLP3 are less preferred.

## Ecology

- 12.2.12 All the Walpole siting zones are located over 9 km from NSN or Ramsar sites. The nearest designated sites to siting zones WLP1 to WLP5 are The Wash and North Norfolk Coast SAC, the Greater Wash SPA and The Wash Ramsar and SPA sites which also overlap with SSSIs and a NNR ('The Wash designated sites', as described in **Paragraph 6.2.82**) located at the mouth of the River Nene. The Wash designated sites are hydrologically connected to the River Nene and its tributaries. Siting zones WLP5

and WLP6 are located furthest from the Nene and its tributaries. The nearest designated sites to WLP6 are the Nene Washes SPA, SAC, Ramsar sites which also overlap with a SSSI ('The Nene Wash designated sites', as described in **Paragraph 8.2.112**) located adjacent to the River Nene between Peterborough and Guyhirn but are over 8.5 km from WLP6.

- 12.2.13 Due to the distance of the siting zones from The Wash designated sites and The Nene Washes designated sites, potential impacts of substation infrastructure are limited to pollution during construction and impacts to functionally connected habitats. However, for overhead line connections to each siting zone, potential impacts also include the risk of collision, flight path disruption, injury and mortality for vulnerable bird species, if present. The potential impact on NSN and Ramsar sites will be considered in detail within an HRA, as the Project development progresses.
- 12.2.14 Priority habitat datasets identified priority habitat, in the form of deciduous woodland, as present only within WLP1 (at its north-east corner). This was confirmed as present from site walkovers. However, this is located at the very edge of the siting zone and therefore could be avoided. As such, this was not considered a differentiating factor. There are also other important habitats, in the form of coastal floodplain and grazing marsh priority habitat, deciduous woodland and traditional orchards located near the siting zones.
- 12.2.15 There is little to differentiate from an ecological perspective between the each of the Walpole siting zones. However, given their distance from designated sites and potential sources of hydrological connectivity to these sites, siting zones WLP5 and WLP6 are preferred. When considering the siting of the EGL 3 and EGL 4 converter station infrastructure and its required connections, the potential cumulative effects upon adjacent priority habitats and designated sites is increased. This further increases the preference for siting zones WLP5 and WLP6 from an ecological perspective.

## Historic Environment

- 12.2.16 There are no designated assets located within the Walpole siting zones, however designated heritage assets are present within 1 km. Therefore, each siting zone has the potential to affect the setting of identified designated heritage assets. The significance of the potential impact upon the setting of these assets is limited due to the presence of either intervening woodland, other development, and/or the distance from the siting zones. Identified designated heritage assets within 1 km of each siting zone comprise:
- Siting zone WLP1: one Grade I listed building; two Grade II\* listed buildings; and eight Grade II listed buildings. The Grade II\* *Church Of St James* and Grade II *War Memorial In Churchyard South Of Church Of St James* are those located closest (approximately 300 m south) with the remaining assets located over 500 m from the siting zone. The identified assets within 1 km are predominantly located within Tydd St Giles (north-west) and Newton-in-the-Isles (south) where existing development and/or vegetation screening would (following careful siting) partially or fully limit impacts to the settings of assets.
  - Siting zone WLP2: four Grade II listed buildings. one of the Grade II listed buildings; and one Conservation Area. The Grade II *County Boundary Post* is located closest (approximately 300 m north-east) with the remaining assets located over 500 m from the siting zone. The identified assets within 1 km are predominantly located within Tydd Gote (north-west) and Foul Anchor (north) where existing development and/or vegetation screening would (following careful siting) partially or fully limit impacts to the settings of assets.

- Siting zone WLP3: one Grade II\* listed building; and two Grade II listed buildings. The Grade II *Priory House* is located closest (approximately 550 m west) with the remaining assets located over 900 m from the siting zone. The identified assets within 1 km are predominantly located within Newton-in-the-Isles (west) where existing development and/or vegetation screening would (following careful siting) partially or fully limit impacts to the settings of assets.
- Siting zone WLP4: two Grade I listed buildings; and eight Grade II listed buildings. The Grade II *Ingleborough Mill* is located closest (approximately 330 m east) with the remaining assets located over 400 m from the siting zone. The identified assets within 1 km are predominantly located within West Walton (west) where existing development and/or vegetation screening (following careful siting) would partially or fully limit impacts to the settings of assets. Siting to the north of the siting zone would adversely impact the setting of *Ingleborough Mill*, however as it is set in the context of large agricultural sheds, careful siting and use of mitigation planting would limit potential adverse impacts to its setting.
- Siting zone WLP5: two Grade I listed buildings; and 11 Grade II listed buildings. Two of the Grade II listed buildings (*Ingleborough Mill* and *Faulkner House*) are located closest (approximately 110 m north-west and south-east); there is a further cluster of five listed buildings at West Walton located within 300 m, the remaining assets are located over 500 m from the siting zone. The identified assets within 1 km are predominantly located within West Walton (south-west) where existing development and/or vegetation screening would (following careful siting) partially or fully limit impacts to the setting of assets. Siting to the north-west and south-east of the siting zone would adversely impact the setting of *Ingleborough Mill* and *Faulkner House*, respectively, however as these listed buildings are set in the context of large agricultural sheds, careful siting and use of mitigation planting would limit potential adverse impacts to their settings.
- Siting zone WLP6: four Grade II listed buildings scattered around the siting zone, the closest are *Dial Farmhouse* and *Needham Lodge* (both located within 100 m) with the remaining located over 500 m from the siting zone. Most of the identified assets within 1 km are screened (either partially or fully) by existing development and/or vegetation screening which would partially or fully limit impacts to the setting of assets. For *Dial Farmhouse* and *Needham Lodge*, siting to the west and south-east would adversely impact their settings, however as these listed buildings are set in the context of large agricultural sheds, careful siting and use of mitigation planting would limit potential adverse impacts.

12.2.17 Overall, all siting zones have designated heritage assets in proximity which are set in the context of existing development (including overhead lines, solar farms and largescale agricultural operations) and therefore do not present a significant constraint to siting. As WLP3 is the most distant zone from heritage receptors (which are partially or fully screened from the siting zone) it is preferred. WLP6 and WLP5 are least preferred as they are closest to heritage receptors.

12.2.18 When considering the siting of EGL 3 and EGL 4 converter infrastructure, no direct impacts to designated assets are likely (as no assets are present within the siting zones). However, the cumulative effects of this converter station infrastructure (and the associated underground cable connections) will exacerbate the impacts upon the setting of identified designated heritage assets, especially those closest. This therefore supports a preference for WLP3 as it is the most distant zone from heritage receptors.

WLP6 and WLP5 remain the least preferential due to their proximity to heritage receptors.

## Socio Economics

12.2.19 The key socio-economic constraints associated with the Walpole siting zones are the Rose and Crown Solar Farm, located adjacent to WLP5, and the Grantham to Bexwell NSIP (an application for a new 90 km water pipeline), that intersects the south of WLP6. The proximity of the Rose and Crown Solar Farm will increase technical complexity of siting infrastructure at the north of WLP5, however sufficient space is considered to be available within the remainder of the siting zone to accommodate the new Walpole substation and the EGL 3 and EGL 4 converter stations without permanently impacting the solar farm. The presence of the Grantham to Bexwell NSIP within WLP6 may cause conflict with the use of this siting zone. Avoiding interactions with the NSIP would limit siting opportunities and may require complex engineering solutions or complex land negotiations to agree settlement for removing portions of the proposed infrastructure. As only WLP5 and WLP6 contain or are adjacent to relevant socio-economic features, they are less preferred, with WLP6 the least preferred.

## Other considerations

12.2.20 Other environmental topics were also considered as part of the options appraisal and include air quality, noise and water.

12.2.21 There are scattered properties (residential, commercial and agricultural) surrounding the siting zones; most notably at Fore Gotes, Newton-in-the-Isles, Tydd St Giles, Kirkgate, West Walton, Walton Highway and Walpole Highway for siting zones WLP1 to WLP5. For WLP6, of similar nature receptors are located at Elm, Emneth and Friday Bridge.

12.2.22 For each of the siting zones, there is a potential risk of temporary impacts limited to localised changes in air quality and noise and vibration during construction. No potential adverse air quality impacts are anticipated during operation, although there is the potential for localised changes in noise and vibration on settlements adjacent to the siting zones. However, each siting zone is considered sufficient in size to allow for careful siting of the required infrastructure (at a later stage) to therefore reduce the likelihood and magnitude of these effects.

12.2.23 Scattered properties are in the vicinity of each siting zone such that they do not constitute a differentiating factor in terms of potential air quality and noise impacts. However, it is noted that WLP3 has the fewest properties in its immediate vicinity and is therefore preferred with regards to air quality, noise and vibration. WLP6 also has three residential dwellings located immediately adjacent the siting zone itself whereas no residential dwellings fall specifically within siting zones WLP1 to WLP5 and therefore siting zone WLP6 is least preferred with regards to air quality, noise and vibration.

12.2.24 Flood Zone 3 is present across all siting zones except for siting zone WLP6. Flood Zone 2 is present across all siting zones, with WLP6 having the least coverage. The areas of Flood Zones 2 and 3 are attributed to coastal flooding, the River Nene, North Level Main Drain and their tributaries. Flood defences are present along the banks of the River Nene; however, the floodplain is not identified to be defended up to the usual 'design event' for fluvial or tidal flooding. Given that WLP1 to WLP5 are relatively flat, it is considered that a potential flood event is unlikely to be to a substantial depth (subject to further investigation). Further work and stakeholder engagement will be undertaken to identify the scale of potential impacts and any mitigation and compensation required.

Although siting zone WLP6 (on an area approximately 1 m higher than sites WLP1 to WLP5) is located within Flood Zone 1 (except for a small area of Flood Zone 2 to the north-west), Flood Zones 2 or 3 surround the entire siting zone. For siting zones WLP1 to WLP5 it is considered that flood compensation for new infrastructure (the new Walpole substation and converter stations for EGL 3 and EGL 4 projects), would be required as Flood Zones 2 and 3 are unavoidable.

- 12.2.25 Minor watercourses are located within WLP1, WLP3, WLP4, WLP5, and WLP6. These are primarily tributaries associated within the River Nene and/or field drainage ditches. Interactions between proposed infrastructure and these watercourses would be unavoidable within the siting zones. Other watercourses including IDB watercourses may also impact all siting zones.
- 12.2.26 When considering the potential impacts upon water features, siting zone WLP6 is preferred (although it contains a denser draining network) as it is located outside of areas designated as Flood Zone 3.

## 12.3 Engineering and System Factors

- 12.3.1 The key factors when considering a best performing Walpole siting zone include the overall length of overhead line from the new Weston Marsh substation, feasibility of co-location of required NGET infrastructure, ability of other transmission connections to reach the siting zones, proximity to the 4ZM (Burwell to Walpole) 400 kV overhead line, minimisation of system outages required to facilitate construction and reducing the amount of road infrastructure required.

### Access

- 12.3.2 Due to their comparatively greater distance from major roads, siting zones WLP4 and WLP5 (the closest major road is the A47 which is located approximately 850 m from WLP5 and 2.6 km from WLP4) would require an increased level of road infrastructure. The additional infrastructure would be required for construction of a new permanent access road for operational purposes and/or upgrades to existing roads to make them suitable to support AILs. Siting zones WLP1, WLP2, WLP3, and WLP6 are adjacent to A-roads and therefore minimal infrastructure would be required for new permanent access or upgrades to existing roads.

### Outages and diversion of the 4ZM 400 kV overhead line

- 12.3.3 For all siting zones, construction sequencing will be rationalised to reduce the potential for system outages. The new Walpole substation, converter stations (associated with the EGL 3 and EGL 4 projects) and additional connection infrastructure will be built offline as far as practicable.
- 12.3.4 Within WLP2 an outage may be required on the 400 kV 4ZM (Bicker Fenn to Walpole) overhead line which crosses the north of the siting zone. This is due to the significant works expected to reroute this overhead line during construction which would be unavoidable given the scale of the new Walpole substation and the EGL 3 and EGL 4 converter station infrastructure. Minimal outages are envisioned during construction for the other siting zones.
- 12.3.5 The new Walpole substation will be required to connect to the existing 4ZM (Burwell to Walpole) 400 kV overhead line. The diversion of this overhead line into the substation

will require two overhead line double circuits from the existing overhead line to connect to the preferred siting zone from the east. Siting zones WLP1, WLP2 and WLP3 are all located west of the River Nene and the overhead line diversions would be required to cross this watercourse, increasing the amount of infrastructure required. WLP4 and WLP5 are located east of the River Nene and therefore do not require the incoming and outgoing circuits of the 400 kV 4ZM overhead line diversion to cross the River Nene. As the 4ZM 400 kV overhead line routes through within WLP5 significantly less connection infrastructure would be required. WLP6 is located approximately 2.6 km west of the 4ZM 400 kV overhead line and would require the second longest diversions (WLP1 has the longest diversions), increasing the amount of infrastructure required. Diversions of the 4ZM 400 kV overhead line connecting to WLP6 would require routing through narrow areas along the A1101 (associated with residential properties and designated heritage assets) south of Friday Bridge and may require oversailing curtilages. In contrast, connections from the other Walpole siting zones to the 4ZM 400 kV overhead line are comparatively less constrained.

## Existing and Proposed Infrastructure

- 12.3.6 The Rose and Crown Solar Farm borders siting zone WLP5 to the north, creating a narrow area between western and eastern areas of the zone where it is also bounded to the south by traditional orchards. Whilst the solar farm does not overlap WLP5, its presence would increase the technical complexity of the design at the siting zone.
- 12.3.7 The proposed Grantham to Bexwell pipeline NSIP overlaps with WLP6. Given the location where the pipeline would cross the zone, siting would be restricted in approximately 15% of the siting zone to the south-east. This pipeline may cause conflict with the use of this siting zone, limiting the flexibility and increasing the complexity of design for siting infrastructure.
- 12.3.8 Existing 132 kV and 400 kV overhead lines are also present within WLP1 (contains a singular UKPN 132 kV overhead line), WLP2 (contains the 4ZM (Bicker Fenn to Walpole) 400 kV overhead line, a NGED 132 kV overhead line and a UKPN 132 kV overhead line) and WLP5 (contains a UKPN 132 kV overhead line and the 4ZM (Burwell to Walpole) 400 kV overhead line).
- 12.3.9 There are existing high pressure gas mains within WLP1, WLP2, WLP3, WLP4 and WLP5, the locations of which are outlined below. Given the potential safety risk of construction within proximity to these assets, these gas mains represent a constraint to siting:
- WLP1 – one gas main routes west to east at the south of the siting zone parallel to Church Lane.
  - WLP2 – one gas main crosses the north-eastern corner of the siting zone, south of Foul Anchor, before routing parallel to the eastern border of the siting zone.
  - WLP3 – two gas mains intersect the south of the siting zone east of Chapel Lane.
  - WLP4 – one gas main runs parallel to the southern border of the siting zone whilst another crosses the siting zone from south-west to the north-east.
  - WLP5 – one gas main crosses from the south-west to the east of the siting zone, passing south of the narrow area present within the siting zone (underneath orchard habitat).

12.3.10 Due to the combined density and locations of existing and proposed infrastructure identified within the siting zones, WLP1 and WLP2 are least preferred and WLP3 is most preferred.

## Flooding

12.3.11 Flood Zone 3 is present across all siting zones except for siting zone WLP6. Flood Zone 2 is present within all siting zones with WLP6 having the least coverage. The placement of infrastructure within these areas of flood risk is unavoidable within siting zones WLP1 to WLP5 due to the amount of infrastructure required. Infrastructure required within Flood Zones 2 and 3 will be designed accordingly and the mitigation and compensation required will be determined as the Project progresses. The King's Lynn and West Norfolk Strategic Flood Risk Assessment (SFRA) and South Holland SFRA mapping identifies the areas around WLP1 to WLP5 as having a most likely flood risk source from surface water and the highest flood risk source from tidal. It is noted that flood defences are present along the River Nene and the River Great Ouse, with the area also identified (in part) as an area benefiting from flood defences which should help mitigate the risk of this essential infrastructure becoming flooded during a flood event. In addition, high risk watercourses associated with the River Nene are located adjacent to siting zones WLP3 and WLP4, further increasing the complexity of construction, design and operational requirements of infrastructure in these siting zones. Further assessment of flood risk (such as an FRA) for a preferred substation site will be undertaken in more detail at a later stage of Project development and will identify appropriate mitigation.

## Siting converter station and 400 kV substation infrastructure

12.3.12 All the identified siting zones hold the capacity to site the new 400 kV Walpole substation alongside the EGL 3 and EGL 4 converter station infrastructure. Siting all this infrastructure within one siting zone would help to reduce the spread of infrastructure and limit the lengths of new roads and/or upgrades to existing roads. However, siting all this infrastructure within a single siting zone may increase the technical complexity of infrastructure designs (for example by potentially limiting orientations) subject to the outcomes of further detailed siting work following non-statutory consultation.

## 12.4 Holford and Horlock Rules

12.4.1 The following paragraphs provide commentary on the extent to which the appraised options for siting the new 400 kV Walpole substation accord with the Horlock Rules, and with regards to line entries, the Holford Rules (NGET's guiding principles for the routing/siting new energy transmission infrastructure and a primary mechanism by which compliance with national policy is assured).

12.4.2 At this early stage of development Horlock Rules 7, 9, 10 and 11 are not considered applicable as they are primarily concerned with detailed design of substations following site selection. In relation to the siting zones for the new Walpole substation, Holford Rules 1 and 2 (as these primarily relate to avoiding areas of highest amenity value), and Holford Rules 3 and 6 (as these primarily relate to seeking shorter, more direct routes which have fewer changes of direction and seek to avoid a wirescape) are considered applicable.

12.4.3 When reviewed against the applicable Horlock and Holford Rules:



- Definition of the siting zones has taken into consideration environmental features and potential impacts upon identified features (Horlock Rule 1).
- All siting zones have been defined to exclude areas of highest amenity value and interest in the area (Horlock Rules 2 and 3, and Holford Rules 1 and 2).
- Siting zones WLP1 to WLP5 are best located to connect to the proposed Weston Marsh to Walpole 400 kV overhead line using the most direct route, whereas the connection to WLP6 results in a significantly longer route and is generally less direct, making it less compliant than alternative corridors when considering with Holford Rule 3.
- All siting zones could keep the proposed high voltage overhead line distant from existing lower voltage overhead lines to avoid a concentration of assets and possible development of a wirescape (Holford Rule 6).
- Sufficient space is available within the siting zones to enable micro-siting to avoid identified socio-economic constraints and further reduce impacts on environmental features present, even when considering the converter stations required by the EGL 3 and EGL 4 projects (Horlock Rules 4 and 5). Given the proximity to the existing Burwell to Walpole 400 kV 4ZM overhead line, WLP5 offers the greatest opportunity to limit the intrusion of infrastructure (both substation, converter stations and connecting overhead lines) into surrounding areas.
- All siting zones offer the opportunity to utilise screening provided by existing features where possible to reduce intrusion of the associated connection infrastructure into surrounding areas (Horlock Rule 4); with the greatest opportunity offered by WLP5 should nearby orchards be retained. Given the open landscape with sparse vegetation, there is little existing screening available and therefore seeking to achieve greater distances from receptors and use of screening (most likely by planting) will be necessary.
- All siting zones are predominantly located on agricultural land Horlock Rule 6 (reducing effect on agricultural land and drainage), although this is considered to be unavoidable. All siting zones contain drains, however given the distribution of drains within siting zones WLP3 and WLP6, it will be more difficult to avoid drains, which makes these siting zones less preferred when considering such features.
- No vacant or available brownfield land for siting of the required infrastructure has been identified within the Walpole Substation Study Area. However, when considering proximity to existing 400 kV infrastructure (in line with Horlock Rule 8 – space to be used effectively to limit the area required for development) the proximity of WLP2 and WLP5 will help to limit the area required for development.

## 12.5 Comparative Appraisal and Conclusion

12.5.1 Environmentally there were few factors to differentiate between each of the siting zones when considering the siting of the new Walpole substation in isolation. However, when also considering the required diversions of the 4ZM (Burwell to Walpole) 400 kV overhead line to the siting zones, there is a strong preference for siting zones that avoid multiple overhead line crossings of the River Nene. Therefore, WLP4, WLP5 and WLP6 are more preferred. Each of these siting zones present different opportunities for siting; WLP5 and WLP4 will reduce the length of diversions of the 4ZM 400 kV overhead line and limit the spread of impacts into the surrounding areas, whereas WLP6 is likely to

result in a spread of impacts into the surrounding areas but is wholly located outside of Flood Zone 3 areas (albeit upon a denser drainage network).

- 12.5.2 From a technical perspective, there are notable factors to differentiate the siting zones. Most notably, the closer proximity of WLP4 and WLP5 to the 400 kV 4ZM (Burwell to Walpole) overhead line would necessitate significantly less connection infrastructure compared with the other siting zones. Though it is noted that more infrastructure would be required to develop permanent accesses (or upgrade existing roads) to these siting zones compared to others given their distance from nearby A-roads.
- 12.5.3 The concentration of existing infrastructure within WLP1, WLP2, and WLP3 would limit the flexibility for siting (such as orientations), increase the complexity of construction and, in the case of WLP2, would likely result in outages being required during construction. It is recognised that the Rose and Crown Solar Farm may pose a slight technical challenge for siting within WLP5 and that the proposed Grantham to Bexwell pipeline NSIP may conflict with siting in WLP6.
- 12.5.4 On balance, when considering engineering and system factors altogether, siting zones WLP4 and WLP5 would be preferred as they offer flexible siting which would not necessitate a complex infrastructure design compared with the other siting zones and would limit the diversions of the 4ZM (Burwell to Walpole) 400 kV overhead line. Overall, it is considered that when taking into account all identified features and constraints, siting zones WLP4, WLP5 and WLP6 offer the best opportunity for flexible siting. WLP4 and WLP5 reduce the amount of connection infrastructure required and intrusion into the surrounding environment (in line with the Horlock Rules) and WLP6 is located outside of areas of Flood Zone 3 (and partially outside areas of Flood Zone 2). WLP4 and WLP5 perform slightly better than WLP6 given their potential to limit the length of the overhead line connection from Weston Marsh and underground cable connections for the EGL 3 and EGL 4 projects. Therefore, when considered in isolation, siting zones WLP4, WLP5 and WLP6 are the emerging preferences for the new Walpole Substation. This however will be subject to the findings of the appraisal of corridors between Weston Marsh and Walpole (presented within **Chapter 8**). As such, the emerging preferences will be reviewed as part of the end-to-end solution within **Chapter 14**.

# 13. Option Selection

# 13. Option Selection

## 13.1 Introduction

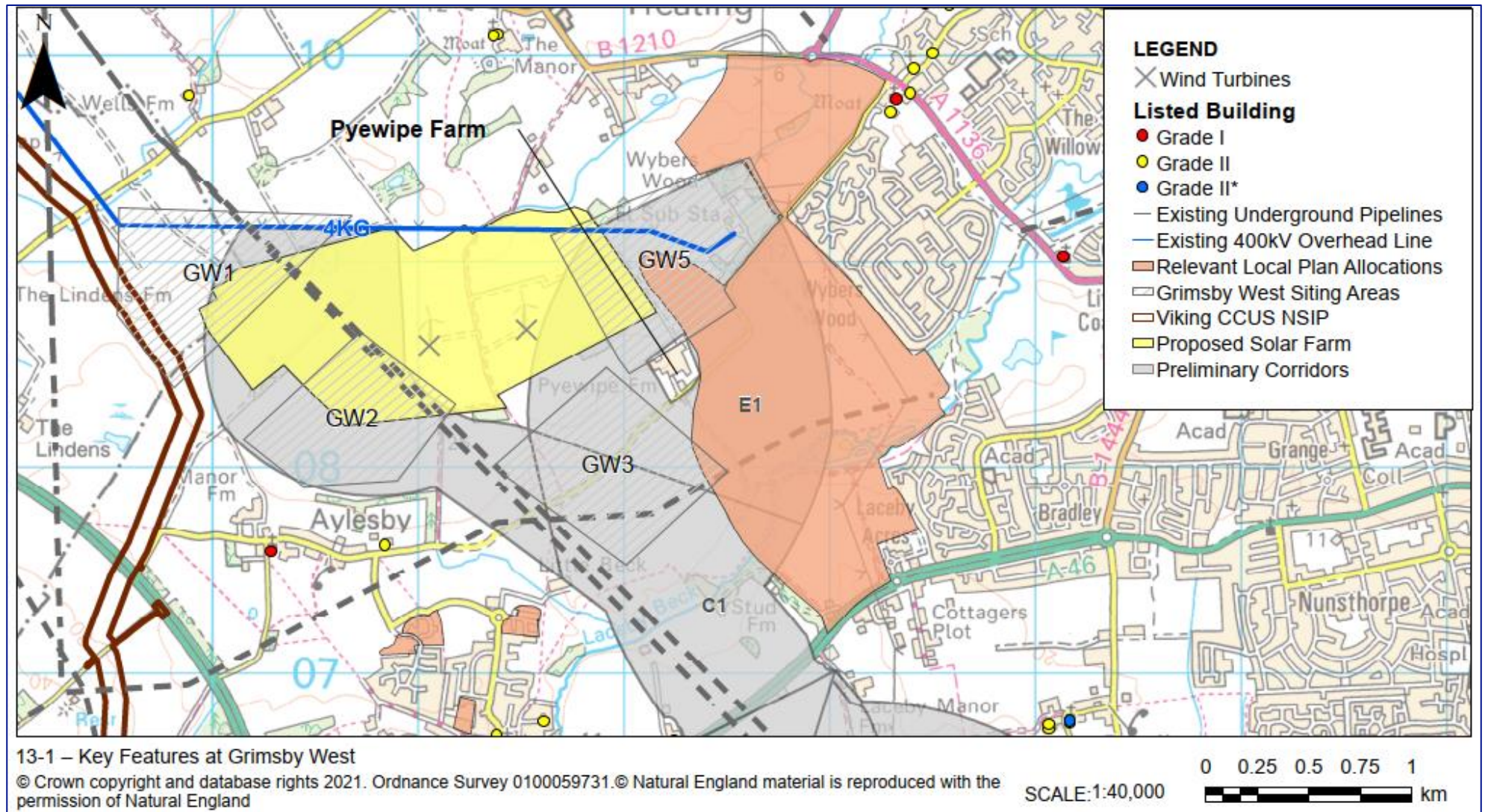
- 13.1.1 The Options Appraisal and a comparative appraisal for each component of the Project (listed below from north to south) is presented in **Chapter 6 to Chapter 12**:
- a new 400 kV Grimsby West substation;
  - a new 400 kV connection between Grimsby West and Burgh le Marsh via the LCS;
  - a LCS (comprising two new 400 kV substations – LCS-A and LCS-B);
  - a new overhead line 400 kV connection between Burgh le Marsh and Weston Marsh;
  - a new 400 kV Weston Marsh substation;
  - a new overhead line 400 kV connection between Weston Marsh and Walpole; and
  - a new 400 kV Walpole substation.
- 13.1.2 Each of the comparative appraisals identified a single or set of emerging preferences for each component of the Project in isolation whilst considering the various constraints and opportunities alongside the cost performance, relevant National Planning Policy and NGET's statutory duties.
- 13.1.3 This Chapter summarises the outcomes of the comparative appraisals in **Chapter 6 to 12** and considers all components as an end-to-end solution to ensure that there were no circumstances where an accumulation of smaller constraints in a 'discarded' option might justify reconsidering decisions in identification of the components.
- 13.1.4 The need to use underground cables in any part of the route will be reviewed as the design process progresses, in response to survey findings to obtain baseline data and stakeholder and community feedback.
- 13.1.5 As the design progresses, regular reviews will be undertaken to ensure the emerging preferences taken forward at this stage remain the optimum solution when all environmental, socio-economic and technical aspects are considered.

## 13.2 Stage 1 - Grimsby West

- 13.2.1 Stage 1 considered the emerging preferences for the new Grimsby West substation (as identified in **Chapter 9**) and for the 400 kV connection between Grimsby West and Burgh le Marsh via the LCS (as identified in **Chapter 6**).
- 13.2.2 At Grimsby West, the emerging preference for a new Grimsby West substation is to use siting area GW5. The emerging preference for the 400 kV connection between Grimsby West and Burgh le Marsh via the LCS, where it overlaps with the potential Grimsby West substation siting areas, is to use an overhead line within Sections E1 and C1.

These two emerging preferences overlap (shown on **Figure 13-1**) and therefore form part of the end-to-end solution.

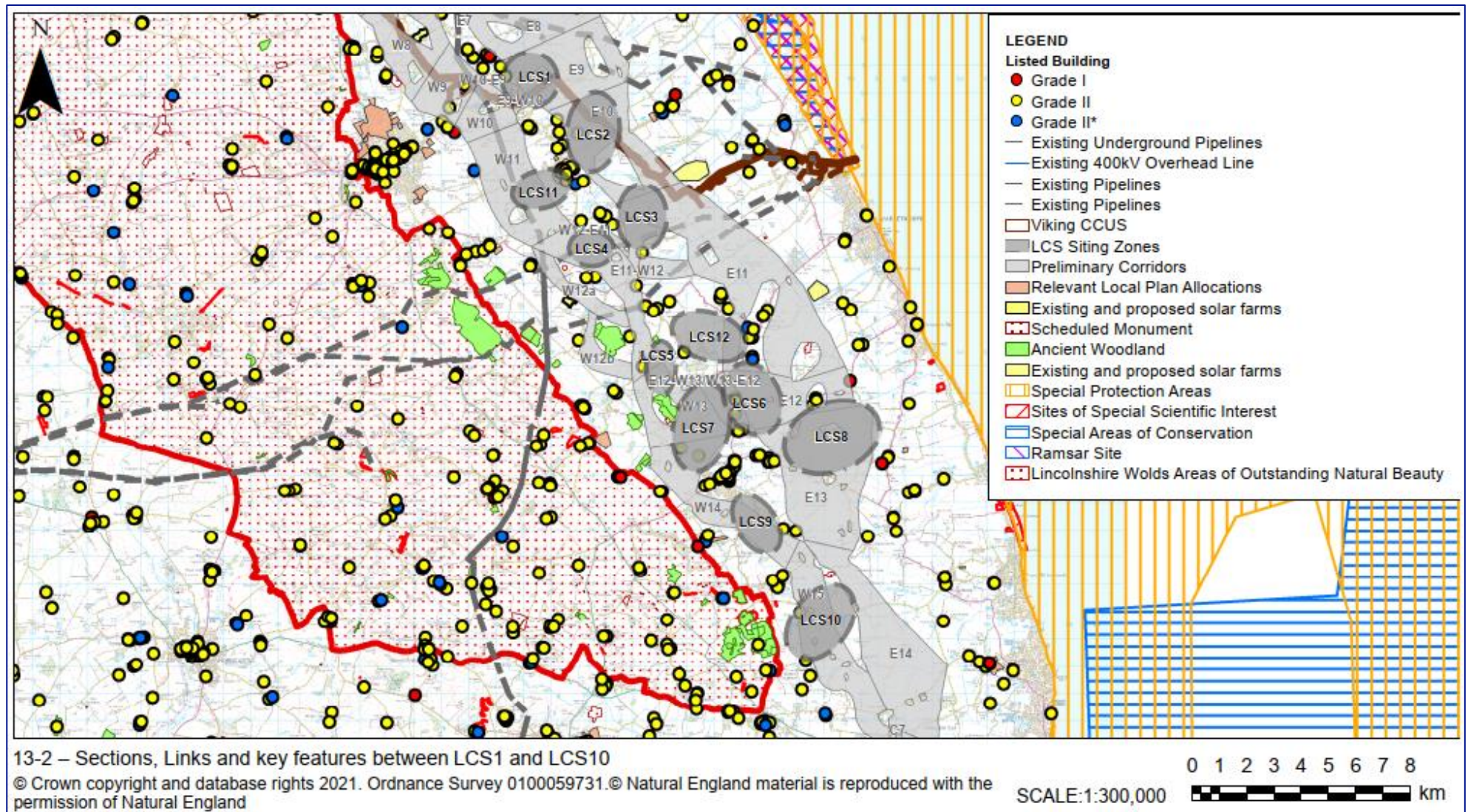
Figure 13-1 – Key Features at Grimsby West



## 13.3 Stage 2 – the LCS

- 13.3.1 Stage 2 considered the emerging preferences for the 400 kV connection between Grimsby West and Burgh le Marsh via the LCS (as identified in **Chapter 6**) and for the LCS (as identified in **Chapter 10**).
- 13.3.2 As identified in **Chapter 10**, the distribution of constraints within each LCS siting zone limits the flexibility for siting one of either LCS-A or LCS-B (alongside customer and other transmission connection infrastructure ('other infrastructure')) within a siting zone. However, there is sufficient capacity within all the LCS siting zones to site one of either LCS-A or LCS-B (alongside other infrastructure) whilst avoiding or reducing the potential scale of impacts upon receptors except LCS9 and LCS10. The siting zones LCS9 and LCS10 are least preferred primarily due to proximity of LCS9 and LCS10 to the AONB, as well as the presence of a LNR (within siting zone LCS9), scheduled monuments (within siting zone LCS10) and the presence of larger clusters of properties within and surrounding these siting zones. From an environmental perspective, predominantly driven by the potential to limit landscape and visual effects, the LCS siting zones that would be preferred are LCS5, LCS8 and LCS11. When considering the potential landscape and visual impacts and the other environmental and socio-economic features, there is little to differentiate environmentally between other LCS siting zones. Technically those LCS siting zones which are least preferred are LCS1, LCS3, LCS4, LCS9 and LCS10. Overall, the preferred siting zones for siting either LCS-A or LCS-B (alongside other infrastructure) are siting zones LCS5, LCS8 and LCS11.
- 13.3.3 Siting both LCS-A and LCS-B (alongside the other infrastructure for each of LCS-A and LCS-B) within any of the identified siting zones would increase the potential for significant effects on associated receptors even when taking into consideration likely mitigation. From a landscape perspective the impact of siting all the infrastructure within any one of the siting zones would alter the views on approach to settlements from local roads and recreational routes, adversely impacting on their character and setting, and would impact upon wide expansive open views. Siting both LCS-A and LCS-B within any of the siting zones would also increase the technical complexity of siting. Therefore, siting both LCS-A and LCS-B (alongside the other infrastructure) within the same siting zone is not a preferred approach. However, a coordinated approach (in line with NPS EN-5 Paragraph 2.13.16) to siting within two of the identified LCS siting zones is considered the preferred approach. Therefore, an appraisal of the potential effects of siting within combinations of the LCS siting zones has been undertaken to identify an emerging preference for a combination of LCS siting zones.

Figure 13-2 – Sections, Links and Key Features between LCS1 and LCS10





- 13.3.4 The LCS siting zones least preferred (for siting of either LCS-A or LCS-B) are LCS1, LCS3, LCS4, LCS9 and LCS10. Therefore, the starting point for the comparative appraisal of the LCS siting zones will consider the remaining siting zones (LCS2, LCS5, LCS6, LCS7, LCS8, LCS11 and LCS12).
- 13.3.5 The emerging preference for the 400 kV connection from Grimsby West to Burgh le Marsh (the area that overlaps with the LCS siting zones, see **Figure 13-2**) are Sections W7 to W12, Section W13, Link E12-W13/W13-E12 and Sections E12 to E14 and Section C7. As the preferred end-to-end solution seeks a combination of the best combination of overhead line corridors and substation siting zones, siting zone LCS2 was not taken forward as part of the comparative appraisal. Use of siting zone LCS2 would require a significant deviation from the emerging preferred corridor and therefore would require additional connection infrastructure, resulting in a less direct route and therefore a less Holford compliant solution.
- 13.3.6 As a result of the above, a comparative appraisal has been undertaken of siting zones LCS5, LCS6, LCS7, LCS8, LCS11 and LCS12. The comparative appraisal has considered the potential environmental, socio-economic, technical, Holford and Horlock Rules implications of siting the LCS-A and LCS-B in the various combinations of these identified LCS siting zones. The combinations of siting zones are:
- LCS5 – this LCS siting zone could be combined with either LCS6, LCS7, LCS8, LCS11 or LCS12.
  - LCS6 – this LCS siting zone could be combined with either LCS5, LCS7, LCS8, LCS11 or LCS12.
  - LCS7 – this LCS siting zone could be combined with either LCS5, LCS6, LCS8, LCS11 or LCS12.
  - LCS8 – this LCS siting zone could be combined with either LCS5, LCS6, LCS7, LCS11 or LCS12.
  - LCS11 – this LCS siting zone could be combined with either LCS5, LCS6, LCS7, LCS8 or LCS12.
  - LCS12 – this LCS siting zone could be combined with either LCS5, LCS6, LCS7, LCS8 or LCS11.
- 13.3.7 The comparative appraisal, considering the environmental factors, engineering factors and the Holford and Horlock Rules is detailed below.

## Environmental Factors

- 13.3.8 Environmentally, the driving factor for the emerging preferences are related to landscape and visual considerations. As outlined in **Chapter 10**, and above, the preferred LCS siting zones for either of LCS-A and LCS-B (alongside other infrastructure) are siting zones LCS5, LCS8 and LCS11. These siting zones would also be preferred combinations of siting zones as they are sufficiently separate to limit the potential for receptors to view multiple siting zones within the same view; LCS11 is approximately 6.3 km from LCS5 and 11.8 km from LCS8, and LCS5 is approximately 4.5 km from LCS8. The emerging landscape and visual preference would be to utilise LCS11 with either of LCS5 or LCS8 given the greater separation between LCS siting zones. In addition, there is the potential for some receptors to experience

cumulative/combined views of LCS5 and LCS8 at Saleby and Thoresthorpe, however given the separation distance, topography (a slight rise near the A1104 that descends to the east and west), the presence of existing screening and use of careful siting and landscape mitigation planting, the number of cumulative/combined views experienced by receptors could be materially limited. When considering the combinations of the other siting zones, the use of the following combinations are likely to have significant visual in-combination effects:

- LCS8 with LCS6, LCS7 or LCS12 is likely to have significant visual in-combination effects for residential receptors including those at Saleby, Asserby, Bilsby, Beesby and potentially individual receptors at Maltby le Marsh and Alford.
- LCS6 with LCS7, LCS5 or LCS12 is likely to have significant visual in-combination effects for residential receptors including those at Saleby, Beesby, Maltby le Marsh and Alford and potentially individual receptors at Bilsby.
- LCS7 with LCS5 or LCS12 is likely to have significant visual in-combination effects for residential receptors including those at Saleby, Beesby, Galley Hill and potentially individual receptors at Maltby le Marsh.
- LCS5 with LCS12 is likely to have significant visual in-combination effects for residential receptors including those at Woodthorpe, Withern and potentially individual receptors at Beesby, Saleby and Tothill.

13.3.9 When considering other environmental and socio-economic features the emerging preferences of each are:

- ecological – emerging preferences are focused upon those LCS siting zones that contain lesser amounts of priority habitat and are at a greater distance from the NSN and Ramsar sites located along the Lincolnshire coastline. Therefore, the emerging preferences are a combination of siting zones LCS11 and LCS12.
- historic environment – emerging preferences focused upon those LCS siting zones that are likely to impact the setting of fewer designated heritage assets, especially those with a greater sensitivity to change (assumed to be scheduled monuments and Grade I listed buildings). A combination of LCS6 and LCS8 is least preferred due to the potential impacts upon the setting of the Markby Priory scheduled monument and surrounding listed buildings. In addition, combinations that utilise LCS siting zones LCS7, LCS6 and LCS8 are less preferred due to the proximity of scheduled monuments (and therefore an increased potential for impacts upon their settings, following mitigation). LCS5 and LCS12 are both located approximately 1.5 km from the *Toot Hill motte and bailey castle*, and with careful siting and implementation of mitigation, potential impacts could be materially mitigated. Therefore, the emerging preferences are combinations that use LCS5, LCS11 and LCS12.
- socio-economic – those siting zone combinations that utilise siting zones LCS11 and LCS12 are least preferred due to the presence of Manby Showground (within LCS11), an operational waste site (within LCS11), Strubby Airfield and Glider Field (within LCS12), existing business located at Woodthorpe (within LCS12) and a planning application for an anaerobic digestion plant (within LCS11). Overhead line connections to each of siting zones LCS5, LCS6, LCS7 and LCS8 would likely impact upon the Strubby Glider Field, however due to the closer proximity of LCS5 with this feature, and due to its proximity to the Woodthorpe Hall Golf Club and

Woodthorpe Hall Leisure Park (adjacent to the east of LCS5), LCS5 is less preferred. Therefore, the emerging preferences are combinations that use LCS6, LCS7 and LCS8.

- water – emerging preferences are focused upon those LCS siting zones which contain fewer watercourses and have lesser extents of medium-high groundwater vulnerability areas, Flood Zones 2 and 3 and areas of SPZ1 and SPZ2. Therefore, the emerging preferences are combinations that utilise LCS5, LCS6, LCS11 and LCS12.
- air quality, noise and vibration – those siting zone combinations that utilise siting zones LCS6, LCS11 and LCS12 are least preferred due to the presence of large clusters of properties within their boundaries. There is also a preference to seek LCS siting zone combinations that are sufficiently separated to reduce the potential for cumulative impacts on common receptors. Therefore, the emerging preference would be the use of siting zones LCS5, LCS7 and LCS8.

## Engineering Factors

13.3.10 All the LCS siting zones have major roads within, or within 200 m of, their boundaries and therefore this is not considered a differentiating factor.

13.3.11 When considering the presence of features that would increase the technical complexity and limit the space for the siting of infrastructure, those identified are:

- Viking Link Interconnector within siting zones LCS6, LCS7 and LCS8;
- Flood Zones 2 and 3 at the edges of siting zones LCS6 and LCS7, and more widespread within siting zone LCS8;
- a proposed anaerobic digester and existing waste site at siting zone LCS11; and
- the Strubby Glider Field at siting zone LCS12.

13.3.12 Each of the LCS siting zones will require overhead line entries for the Project, and either overhead line or underground cable connections (primarily from the east i.e., towards the Lincolnshire coast) for customer and other connection infrastructure ('other infrastructure'). Use of the siting zones which are more distant from Sections identified as part of the emerging preferred Corridor (i.e., siting zones LCS11, LCS12 and LCS7), are likely to result in less direct overhead line routes and are likely to require the use of additional angle pylons, increasing complexity of the overhead line entries and existing for the Project connecting to these zones.

13.3.13 As detailed in **Paragraph 4.5.5**, the connection of the projects which require 'other infrastructure' at or in the vicinity of the two new LCS is a key project driver and in line with NPS EN-5 (Paragraph 2.13.16). LCS siting zones with limited space for other overhead line or underground cable connections (those to connect other infrastructure) surrounding the zones would be more likely to increase the concentration of connection infrastructure in a limited number of places and therefore the complexity of routing connections through these areas. **Chapter 10** details the constraints for other connections for each of the siting zones. When considering LCS siting zones LCS5, LCS6, LCS7, LCS8, LCS11 and LCS12:

- LCS11 would be most constrained for other overhead line and underground connections due to the proximity and extent of linear settlement (Manby, Grimoldby, South Cockerington and Little Carlton).
- LCS12 would also be significantly constrained for other overhead line connections should the operational glider field at Strubby remain active, although other underground cable connections to LCS12 are not significantly constrained.
- Siting zones LCS5 and LCS7 would be the next most constrained siting zones for other overhead line and underground cable connections. These connections would primarily route from the coast and would have to avoid features (linear settlements and woodland) to the east of these siting zones. In addition, the proximity of the AONB to LCS7 would also constrain potential other overhead line connections from the west of the zone.
- Siting zones LCS6 and LCS8 offer the best opportunities for connections. Both these siting zones have constraints to connections from nearby villages (Beesby, Saleby and Thoresthorpe for LCS6 and Hannah and Huttoft for LCS8) but are generally free from constraints for other connections.

13.3.14 Overall, from a technical perspective the presence of Strubby Glider Field results in siting zone LCS12 being least preferred. Compared to the other siting zones (LCS5, LCS6, LCS7, LCS8 and LCS11) this siting zone is comparative more constrained for siting of infrastructure within the zone, requires a diversion from the emerging preferred Corridor, and is more constrained for other overhead line connections. Siting zone LCS11 is less preferred from a technical perspective as, although it has few constraints to siting within the zone, it requires a diversion from the emerging preferred Corridor and is more constrained (compared to LCS5, LCS6, LCS7 and LCS8) constrained for other overhead line and/or underground cable connections. From a technical perspective there is little to differentiate between LCS5, LCS6, LS7 and LCS8 and therefore a combination of these siting zones is preferred.

## Holford and Horlock Rules

13.3.15 Each of the individual LCS siting zones has been reviewed against the applicable Horlock and Holford Rules (as set out in **Chapter 10**). When reviewing the combinations of siting zones for the LCS against the applicable Horlock and Holford Rules, the following are considered differentiating factors between the zones:

- Sufficient space has been included within the siting zones to enable micro-siting of infrastructure to avoid other identified environmental and socio-economic constraints and further reduce impacts on receptors present (Horlock Rules 4 and 5). However, as detailed above, the potential in-combination effects of siting infrastructure within certain zones are greater for some than for others. Those which result in lesser in-combination effects align better with Horlock Rules 4 and 5.
- The use of siting zone LCS5 most aligns with Horlock Rule 4 as it is contained by several woodland blocks which offer good opportunities for screening infrastructure, and utilising existing vegetation during detailed siting (at a later stage) to reduce the severity of impacts.

- The use of siting zones LCS11 and LCS12 best align with Horlock Rule 6, as they utilise existing and /or available brownfield land in the form of Manby Showground and Strubby Airfield and Glider Field.

13.3.16 In addition to the above, the use of the siting zones which are more distant from Sections identified as part of the emerging preferred Corridor (i.e., siting zones LCS11, LCS12 and LCS7), are likely to result in less direct overhead line routes and are likely to require the use of additional angle pylons which aligns less with Holford Rule 3.

## Conclusion

13.3.17 Overall, the driving factors for the emerging preference when considering LCS siting zones are related to landscape and visual. Therefore LCS11, LCS5 and LCS8 would be the preferred siting zones. However, when considering the potential impacts upon the Manby Showground, a proposed anaerobic digester, surrounding Grade II listed buildings and an existing operational waste site, in combination with limitations when considering the routes of other connections to the siting zone and the greater distance from the preferred corridor, LCS11 was, on balance, considered less preferred.

13.3.18 For LCS5, it is noted that two areas immediately adjacent to the south-east and south-west of the siting zone would also provide additional flexibility for siting and without significantly increasing the potential for significant environmental affects and / or technical complexity of siting (see **Figure 13-2**). Therefore, these areas were added to the LCS5 siting zone.

13.3.19 When considering the merits of LCS8, it is noted that a larger area of the siting zone is covered by Flood Zones 2 and 3. The north of this siting zone is in proximity to the scheduled monument Markby Priory and the siting zone also has the Viking Link Interconnector running through it. However, it is considered that by combining LCS8 with LCS6 (and to include the area between the two siting zones, measuring approximately 450 m), to form one siting zone, in addition to using LCS5, this would help to limit the technical complexity of siting, limit potential impacts upon the water environment (in seeking to site outside of medium and high risk flood zones in line with the policy tests set out on EN-1) and limit potential impacts upon designated heritage assets. The area between the LCS6 and LCS8 is generally free from constraints (predominantly consisting of the A1111, Viking Link Interconnector, Flood Zones 2 and 3, and scattered residential properties) and is at a low topography. It is relevant to note that given the increased area available through combining LCS6 and LCS8, the siting zone would therefore provide the opportunity to reduce potential effects on these features, whilst providing greater flexibility for the siting of infrastructure within this larger zone (see **Figure 13-2**).

13.3.20 The emerging preferences for the LCS siting zone are the above hybrid zone of LCS6 and LCS8 (described in this report as 'LCS6/8') and the amended LCS5 siting zone (described above). The use of LCS6/8 would allow for:

- alignment with the emerging preferred corridor Sections E12 and E13 (limiting the length of the overhead line and the need for angle pylons or sharp changes in direct in line with Holford Rule 3);
- additional flexibility for customer and other transmission connections from the Lincolnshire Coast;

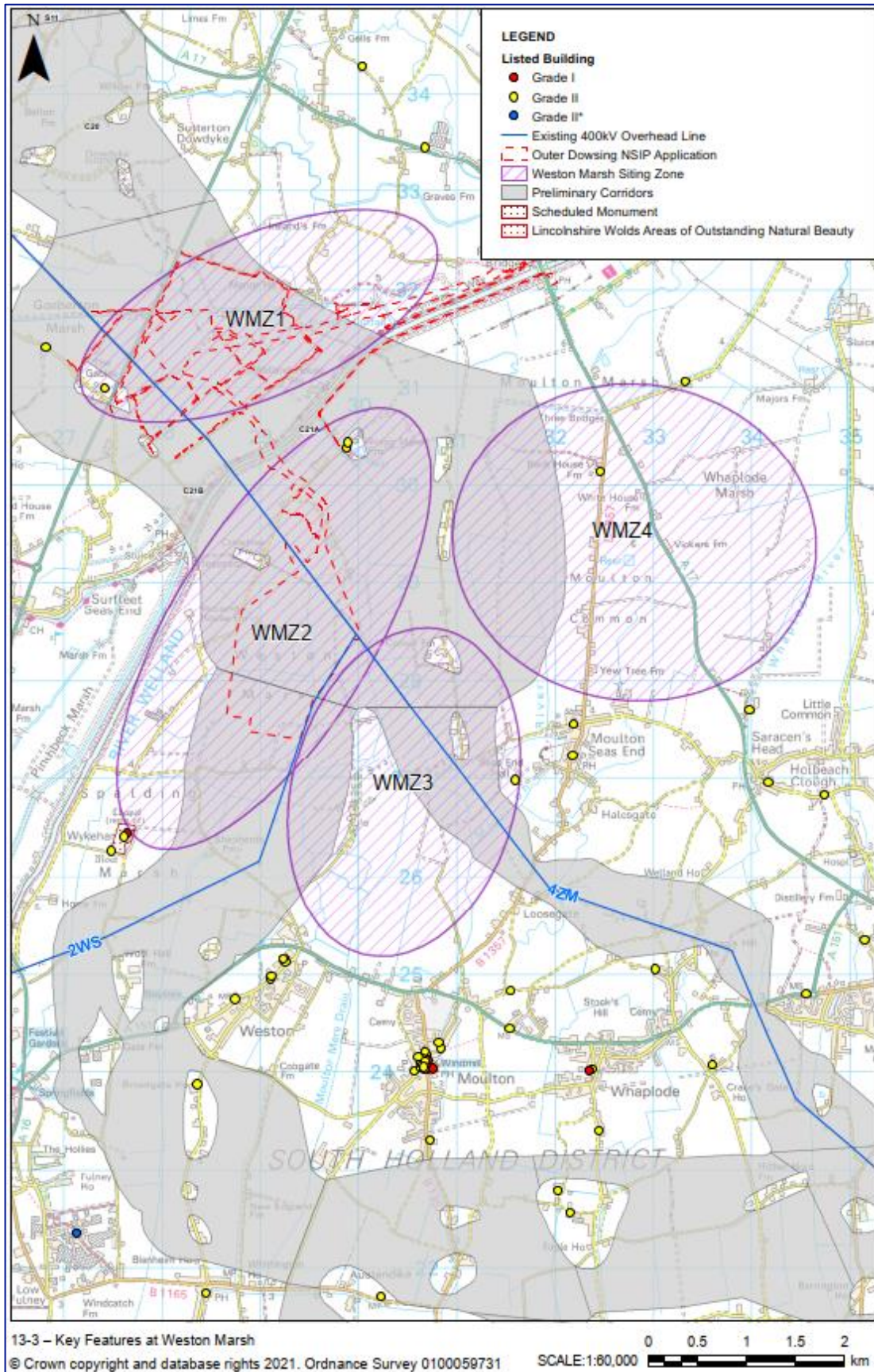
- additional flexibility to limit potential landscape and visual impacts (by siting in areas of lower topography in line with Horlock Rule 4), limit impacts to the setting of designated assets and reduce the need to site infrastructure within areas of Flood Zones 2 and 3; and
- the opportunity to reduce technical complexity of siting in proximity to Viking Link Interconnector, watercourses and Flood Zones 2 and 3.

13.3.21 Overall, after considering the emerging preferences of the Corridor and LCS siting zones in combination a combination of siting zones LCS6/8 and LCS5 are the emerging preference for the LCS siting zones. These siting zones overlap with the emerging preferred corridor which routes from Grimsby West to Burgh le Marsh through Section E1, Sections C1 to C6, Sections W7 to W13, Link W13-E12, Sections E12 to E14 and Section C7. These are shown in **Figure 13-6**.

## 13.4 Stage 3 - Weston Marsh

- 13.4.1 Stage 3 considered the emerging preferences for the 400 kV overhead line between Burgh le Marsh and Weston Marsh (as identified in **Chapter 7**), for the new Weston Marsh substation (as identified in **Chapter 11**) and for the 400 kV overhead line between Weston Marsh and Walpole (as identified in **Chapter 8**).
- 13.4.2 At Weston Marsh, the corridor emerging as preferred routes from Section C20 into Section C21A and then into Section C22.
- 13.4.3 Within the Weston Marsh substation siting zones are 400 kV overhead lines of the 4ZM and 2WS. The new Weston Marsh substation will require connections to both these overhead lines. As identified in **Chapter 11**, when considering all features and constraints within the Weston Marsh siting zones, WMZ2 and WMZ3 offer the best opportunities for flexible siting whilst reducing the intrusion (in line with the Horlock Rules) of infrastructure, and therefore environmental impacts, into the surrounding area. These siting zones overlap with Sections C21A, C21B, C22 and N16 (see **Figure 13-3**).

Figure 13-3 - Key Features at Weston Marsh



- 13.4.4 There is little to differentiate between the two Weston Marsh siting zones as part of a preferred end-to-end solution as both overlap with the emerging preferred Corridor from Burgh le Marsh to Weston Marsh (Section C21A) and Weston Marsh to Walpole (Section C22) and both siting zones emerge as preferred when considered in isolation. A cluster of properties is situated at the north of siting zone WMZ3 (east, south-east and south of the Spalding-Tee Point) which, when seeking to limit potential landscape and visual impacts of the Project infrastructure is likely to push the siting of the new 400 kV substation further south which, when compared to siting zone WMZ2 would increase the spread of infrastructure into the surrounding areas.
- 13.4.5 Overall, after considering the emerging preferences of the Corridor and Weston Marsh siting zones in combination, siting zone WMZ2 is the emerging preference. This siting zone overlaps with the emerging preferred corridor which routes from Burgh le Marsh to Weston Marsh and from Weston Marsh to Walpole through Section C8 to C13, Sections N6 and N7, Sections C14 to C16, a Link from Sections C16 to S8, Sections S8 to S10A, Section S11, Sections C20, C21A and Sections C22 to C28A.

## 13.5 Stage 4 – Walpole

- 13.5.1 As detailed in **Chapter 12**, when considering all features and constraints within the Walpole Substation Study Area, siting zones WLP4, WLP5 and WLP6 offer the best opportunity for flexible siting. Siting zones WLP4 and WLP5 reduce the amount of connection infrastructure required for a new overhead line and the diversion of the 4ZM 400 kV overhead line, whereas siting zone WLP6 is located outside of Flood Zones 2 and 3 albeit within an area of extensive field drainage. Siting zones WLP4 and WLP5 perform slightly better than siting zone WLP6 on technical perspective given their closer proximity to the 400 kV 4ZM overhead line, and the existing Walpole substation, despite additional road infrastructure being required.
- 13.5.2 As detailed in **Chapter 8**, the Central Corridor (routeing through Sections C22 to C28A) was the preferred overall route when considered in isolation. The Northern Corridor was less preferred due to the potential for acquisition the implications for dispossession and direct oversail of residences from routeing an overhead line in this Corridor. The Southern Corridor was less preferred as use of Sections and Links to reach siting zone WLP6 would require between approximately 6 km and 12 km (subject to detailed alignments) of additional overhead line infrastructure to reach it.
- 13.5.3 When considering the emerging preferences above, the Central Corridor and Northern Corridor overlap with WLP4 and WLP5; should either of these siting zones be used then the emerging preference of the Central Corridor would remain. The Southern Corridor overlaps with siting zone WLP6. When reviewed alongside the Corridors, using Sections and Links to reach a siting zone at WLP6 is less preferred due to the additional overhead line (for the Project) and underground cables (for the EGL 3 and EGL 4 Projects) infrastructure to reach it. The requirement for this additional infrastructure, which routes primarily through areas of Flood Zones 2 and 3 and also through areas at risk from reservoir flooding, in combination with the constraints, listed below, which are faced by routeing via the Southern Corridor to WLP6 are considered to overall outweigh the benefits of siting within WLP6:
- proximity to the Fenland Airfield;



- comparatively more crossings of linear features (watercourse, drains, roads and the Grantham to Bexwell water pipeline NSIP);
- routing through narrower areas which may require oversailing residential properties or the use of multiple angle pylons in proximity to residences;
- closer proximity to the Nene Washes designated sites; and
- potential impacts to numerous areas of traditional orchard priority habitat.

13.5.4 Both siting zones WLP4 and WLP5 overlap with the emerging preferred Corridor (Section C28A) between Weston Marsh and Walpole, and there is considered little to differentiate between the two (both having adjacent boundaries). WLP5 provides the opportunity to limit the length of diversion to the 4ZM 400 kV overhead line, whilst WLP4 is more remote from visual receptors at West Walton and Walton Highway. Therefore, it is considered that both are taken forward as a hybrid zone (described in this report as siting zone 'WLP4/5') for non-statutory consultation and subject to more detailed studies and design work following consultation.

## Conclusion

13.5.5 After considering the emerging preferences of the Corridor and Walpole siting zones in combination, a combination of siting zones WLP4 and WLP5 (resulting in WLP4/5) is the emerging preference for the Walpole siting zone. This siting zones overlap with the emerging preferred corridor which routes from Weston Marsh to Walpole through Sections C22 to C28A.

## 13.6 Stage 5 - End-to-End Solution

- 13.6.1 The emerging preference for the siting area at Grimsby West was GW5. The emerging preferred siting zones for the LCS was LCS5 and a second at the hybrid siting zone LCS6/8. The emerging preference for Weston Marsh was siting zones WMZ2 or WMZ3. The emerging preference for Walpole siting zones was the hybrid siting zone WLP4/5.
- 13.6.2 The Corridor emerging as preferred includes Section E1, Sections C1 to C6, Sections W7 to W13, a Link from Sections W13 to E12, Sections E12 to E14, Sections C7 to C13, Sections N6 and N7, Sections C14 to C16, a Link from Sections C16 to S8, Sections S8 to S10A, Section S11, Sections C20, C21A and Sections C22 to C28A.
- 13.6.3 When considering all components as an end-to-end solution, there were considered no circumstances where an accumulation of smaller constraints in a 'discarded' option might justify reconsidering decisions in identification of the components. The emerging preferences, shown on **Figure 13-4** through **Figure 13-10**, were then taken through to Step 8 (development of graduated swathe) as detailed in **Chapter 15**.

Figure 13-4 – Preferred Grimsby West Siting Area

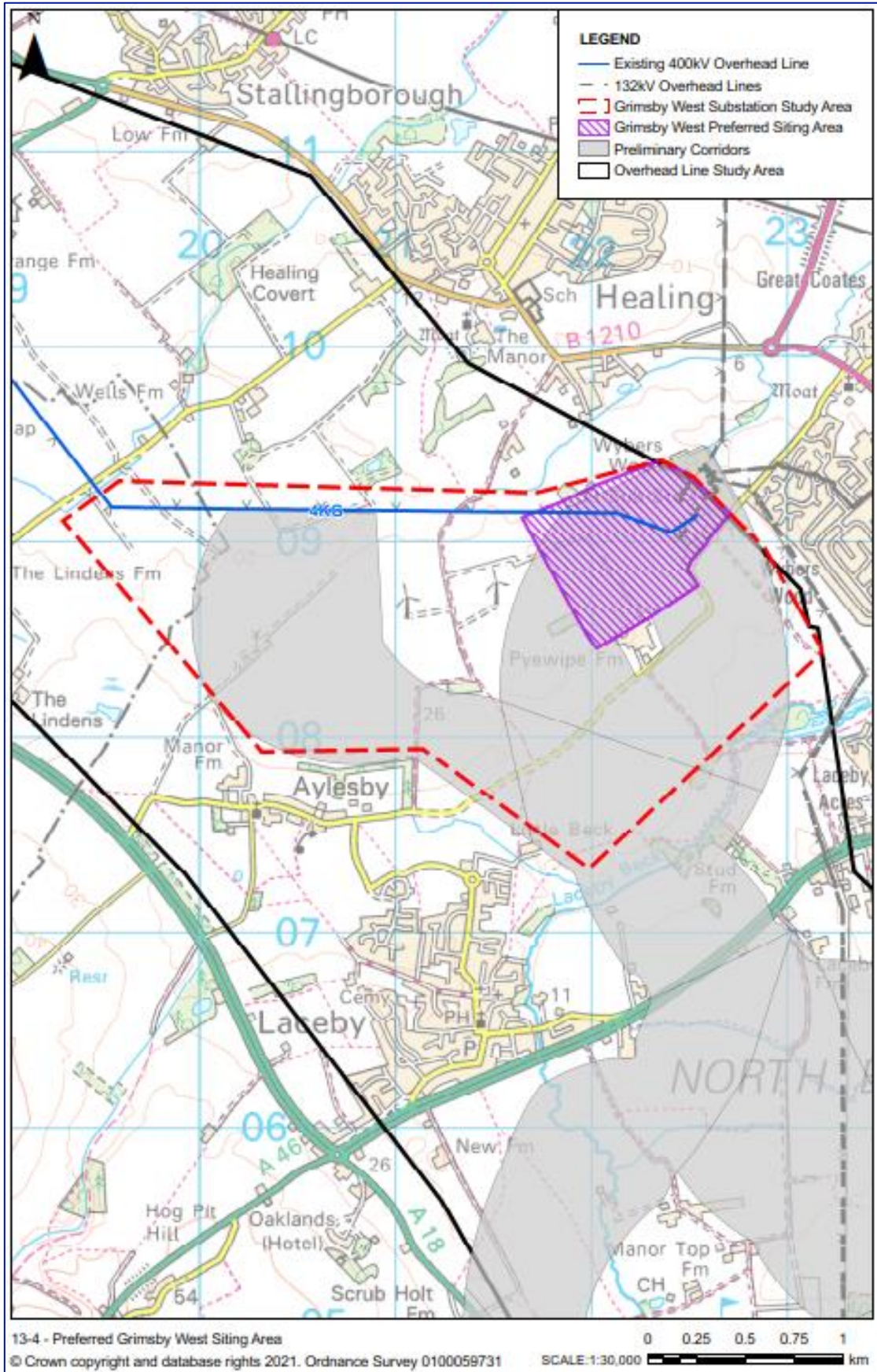


Figure 13-5 – Preferred Corridor from Grimsby West to Burgh le Marsh

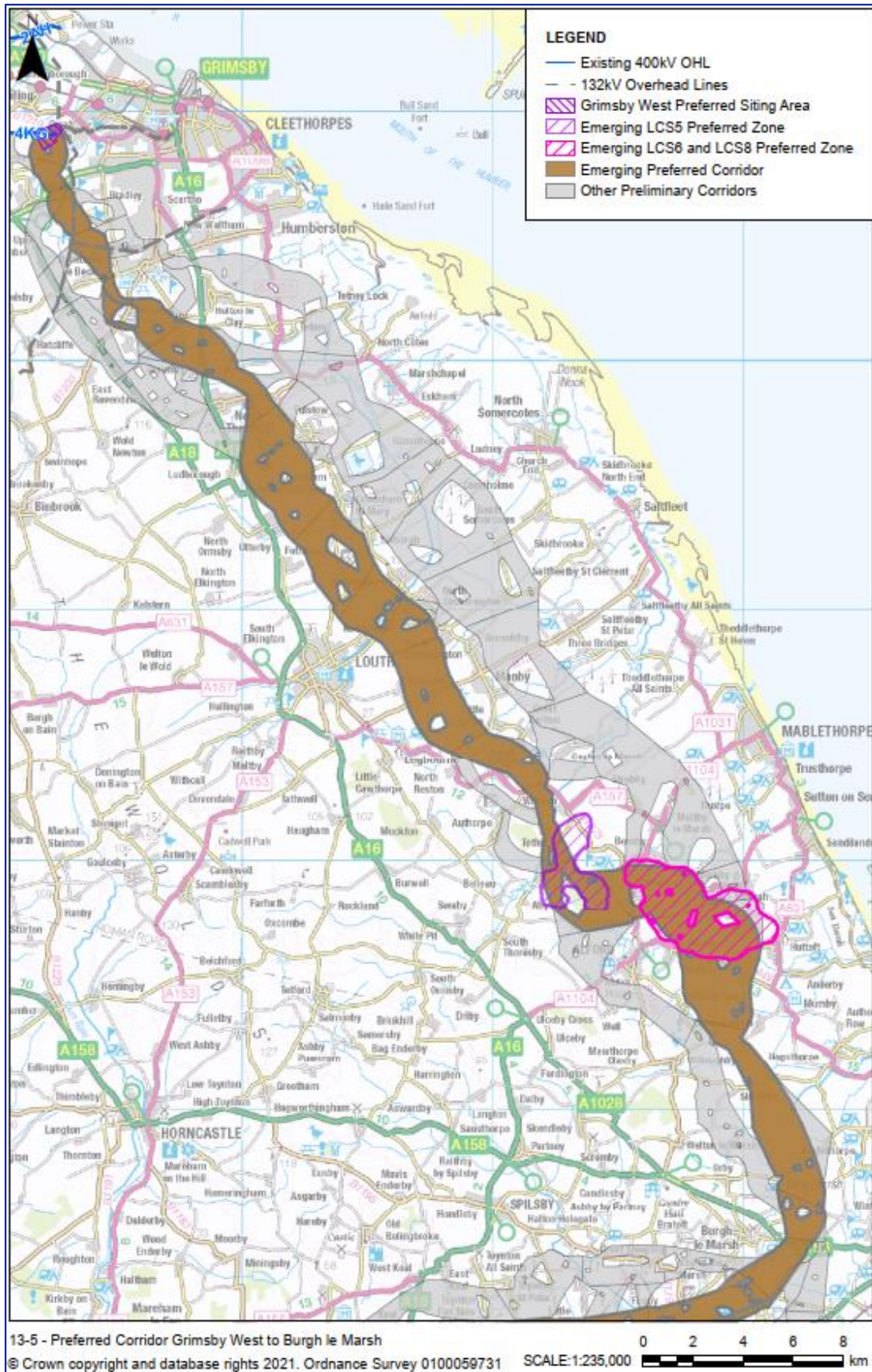


Figure 13-6 – Preferred LCS substations siting zones

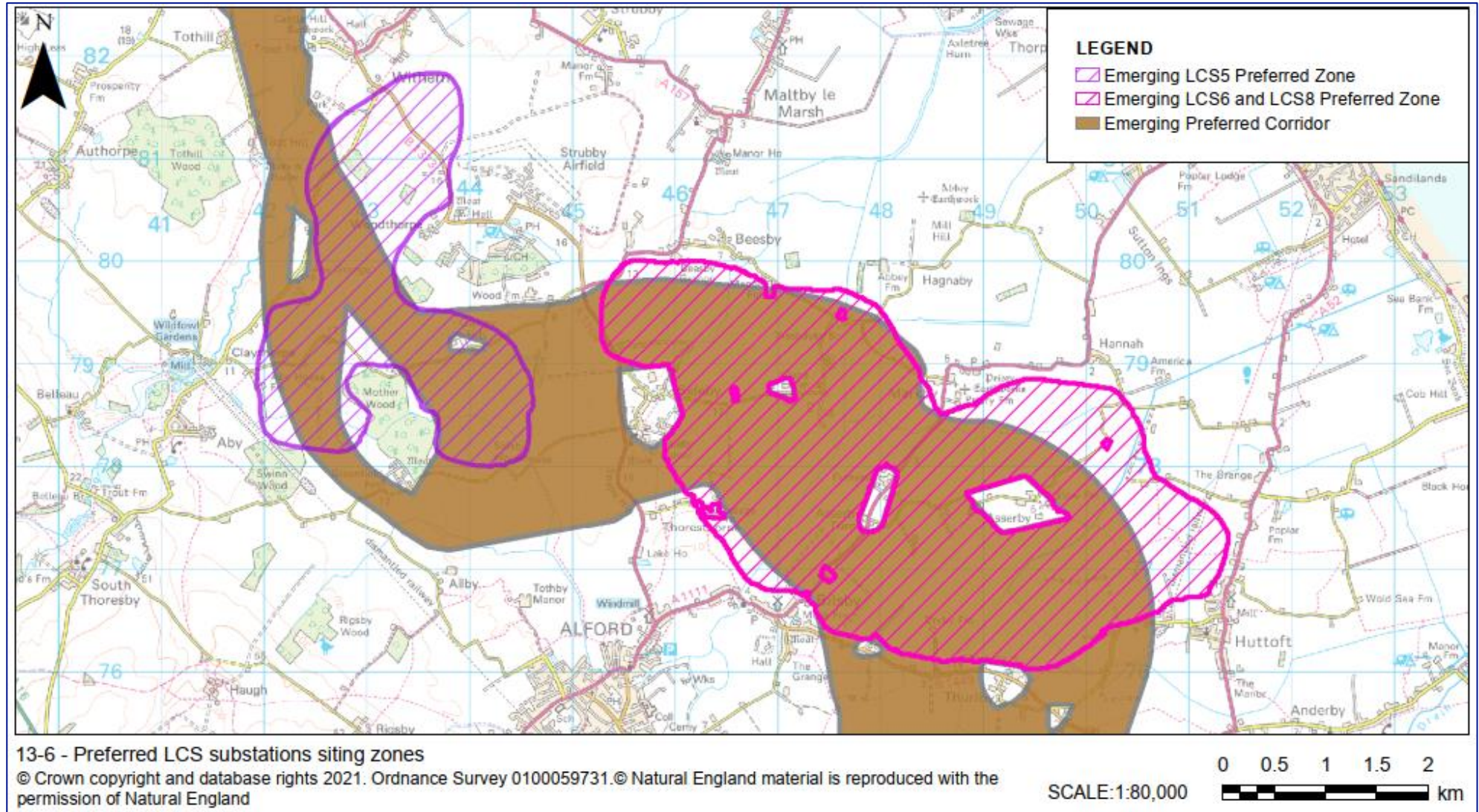


Figure 13-7 – Preferred Corridor from Burgh le Marsh to Weston Marsh

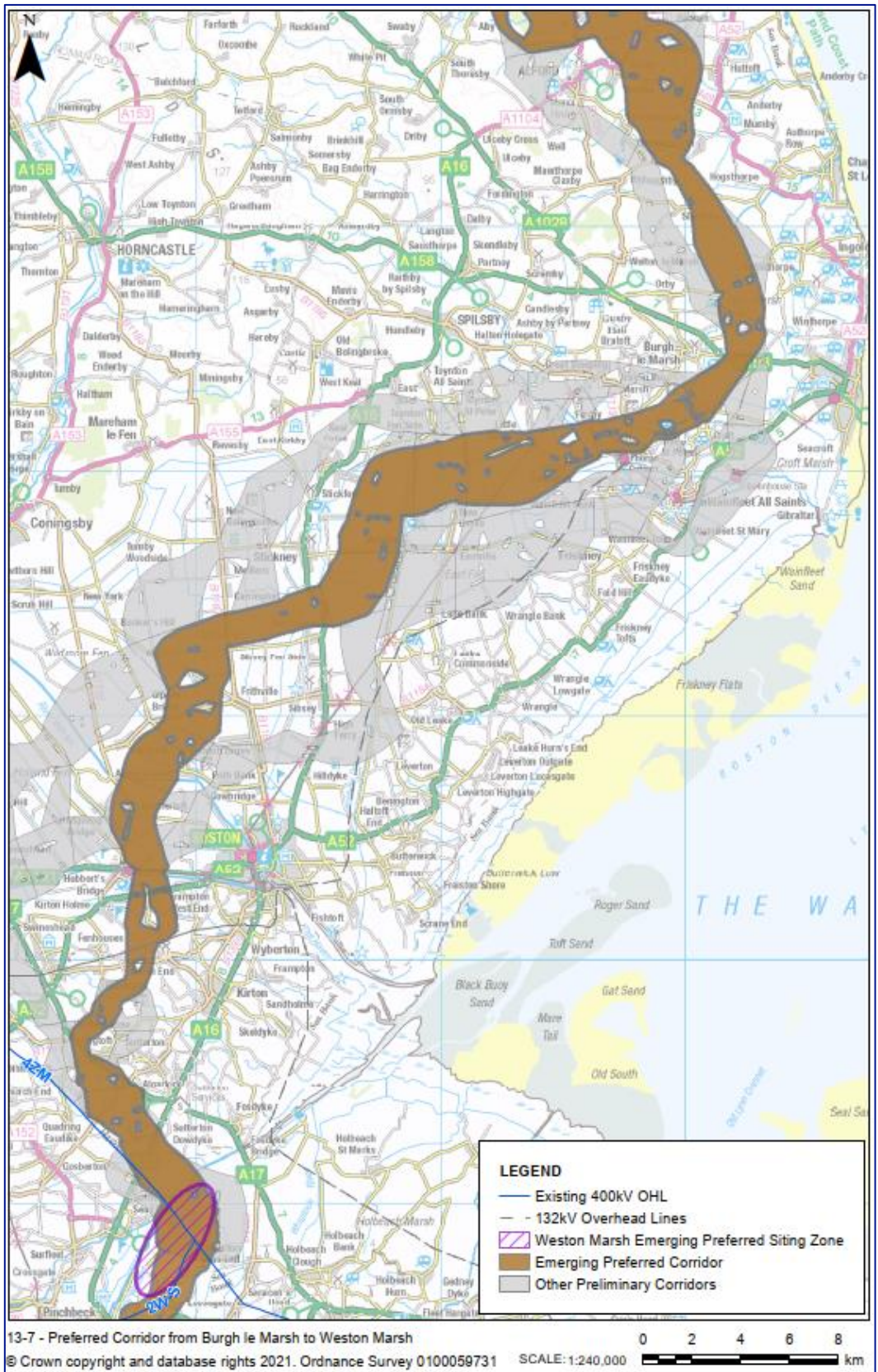


Figure 13-8 – Preferred Weston Marsh substation siting zone

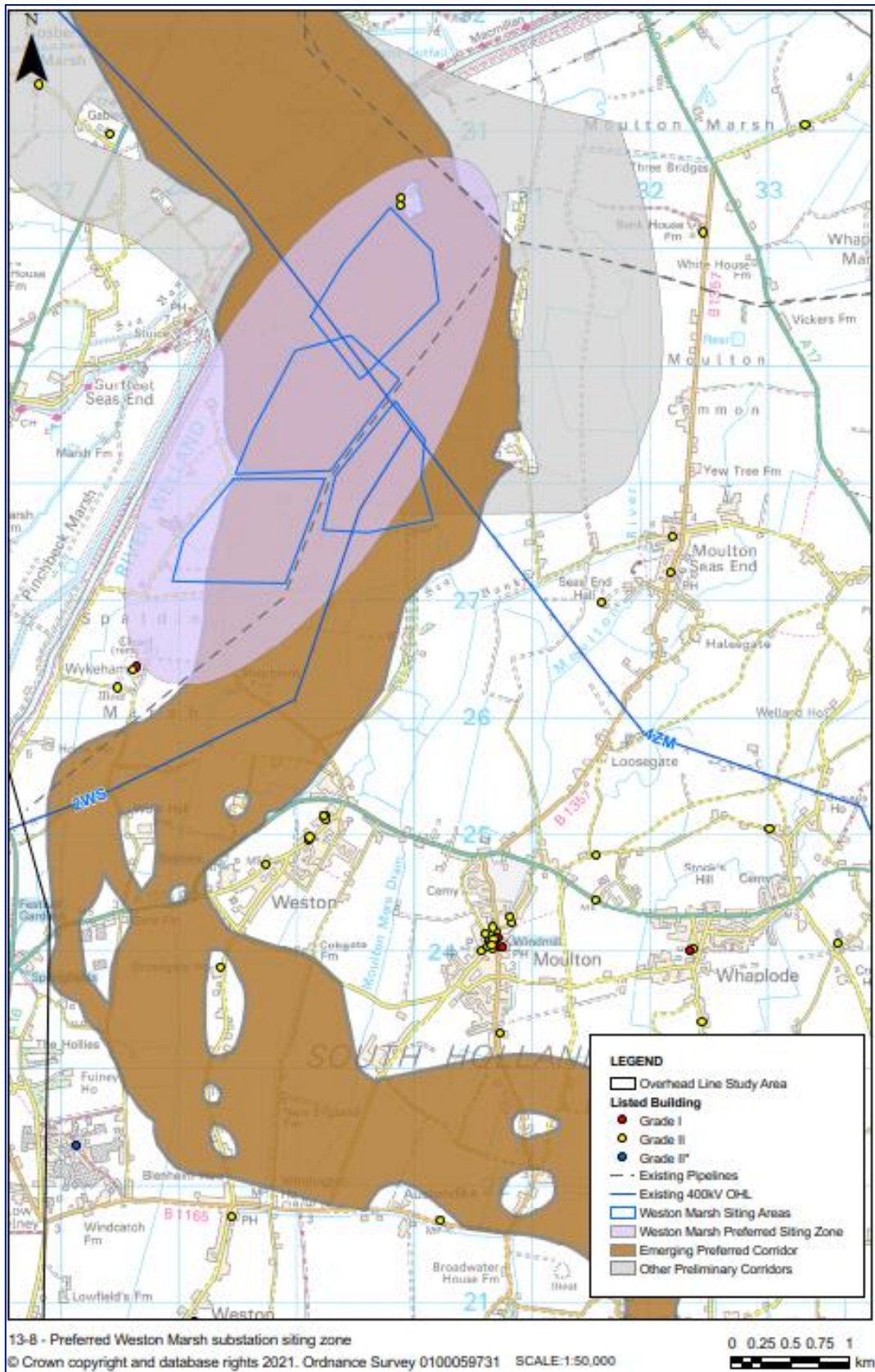


Figure 13-9 – Preferred Corridor Weston Marsh to Walpole

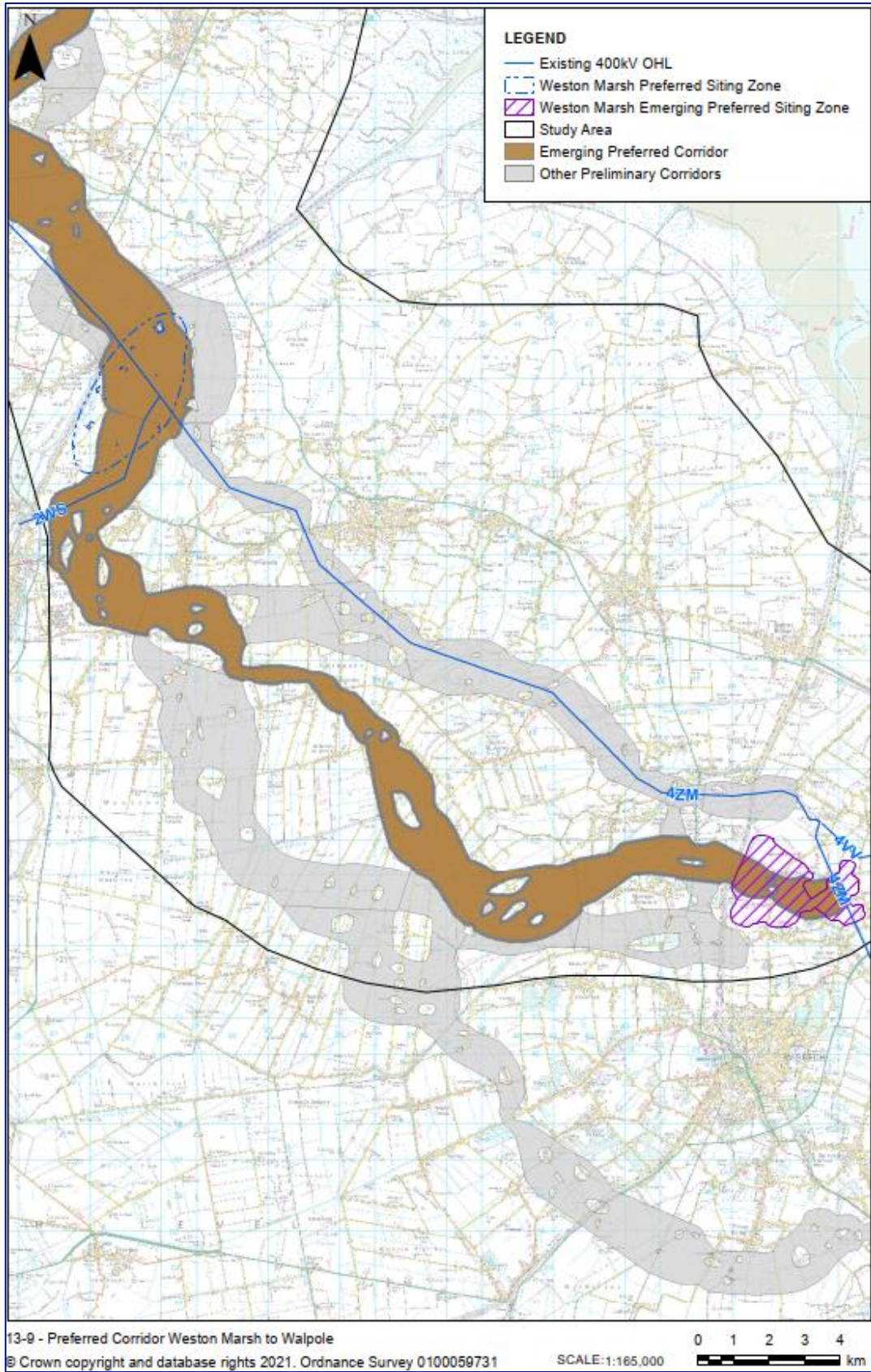
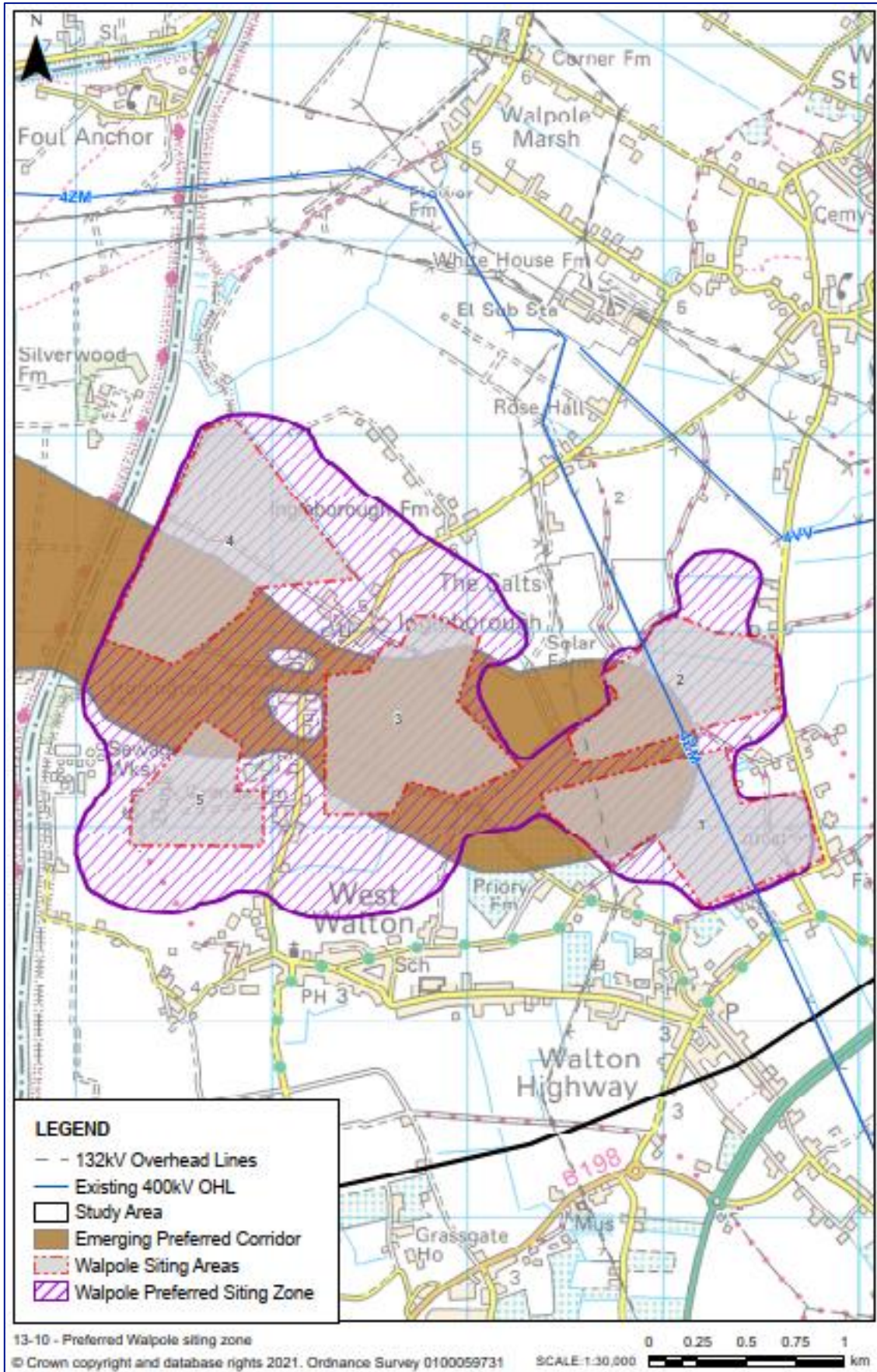


Figure 13-10 – Preferred Walpole siting zone





# 14. Cost and Programme

# 14. Cost and Programme Performance

## 14.1 Introduction

- 14.1.1 As detailed in section 3.2, Section 9 of the Electricity Act requires National Grid to develop and maintain an '*efficient, co-ordinated and economical*' transmission network, amongst other things. Therefore, due regard should be given to the potential cost associated with different options for each Project component.
- 14.1.2 In line with the methodology identified within **Chapter 5**, following the corridor appraisal process, the Corridors were costed and an outline, activity-based schedule was produced for each one to provide an estimate of the likely earliest operational date (in-service date). This Chapter describes the analysis undertaken to determine the difference in cost and programme estimates of different options for the overhead line components.
- 14.1.3 Cost and programme estimates in relation to the proposed substations (for Grimsby West, the LCS, Weston Marsh and Walpole), are not considered materially different when 400 kV connections are excluded, between each siting zone or siting area. Substation costs are primarily driven by the number of circuits and the level of generation they must connect into the wider transmission system. These drivers are not affected by the choice of siting zones and siting areas, and as such are common across all options for each of the new substations considered. Substation costs and the duration of their construction are therefore not a differentiating factor. As a result, the siting zones or siting areas are not considered further in this Chapter.
- 14.1.4 Cost and programme estimates are high level at this stage as they are based on simple indicative overhead line/underground cable distances which will ultimately change as the detailed design is developed during further stages of the Project. The cost and programme estimates are subject to further design, survey work and are also highly subject to market forces such as resource availability and external market rates.

## 14.2 The Cost and Programme Estimate Options

- 14.2.1 A model has been built to determine the cost and programme estimates associated with the potential transmission connections between the proposed substations. The model consists of connection points (at Grimsby West, the LCS, Weston Marsh and Walpole, as shown in **Figure 14-1**) and connection lines (between these connection points). The resulting route lengths are costed using the National Grid cost tool as based on historic project outturn data.
- 14.2.2 For each option it was assumed that the connection line would follow the most direct path possible within each Section that makes up each option, whilst considering key routing constraints and professional overhead line and/or underground cable design judgement (as shown in **Figure 14-2**). Except for Links C16-S8 and N16-C28A, to create comparable end-to-end solutions, Links were not considered as part of the costing estimates as the inclusion of these would result in hundreds of permutations; however, if Links were to be used, their costs would be within the cost envelopes used for the corridor options which have been considered.

Figure 14-1 – Cost Option Connection Points



Figure 14-2 – Example Indicative Straight Line Route



Figure 14-2 – Example Indicative Straight Line Route

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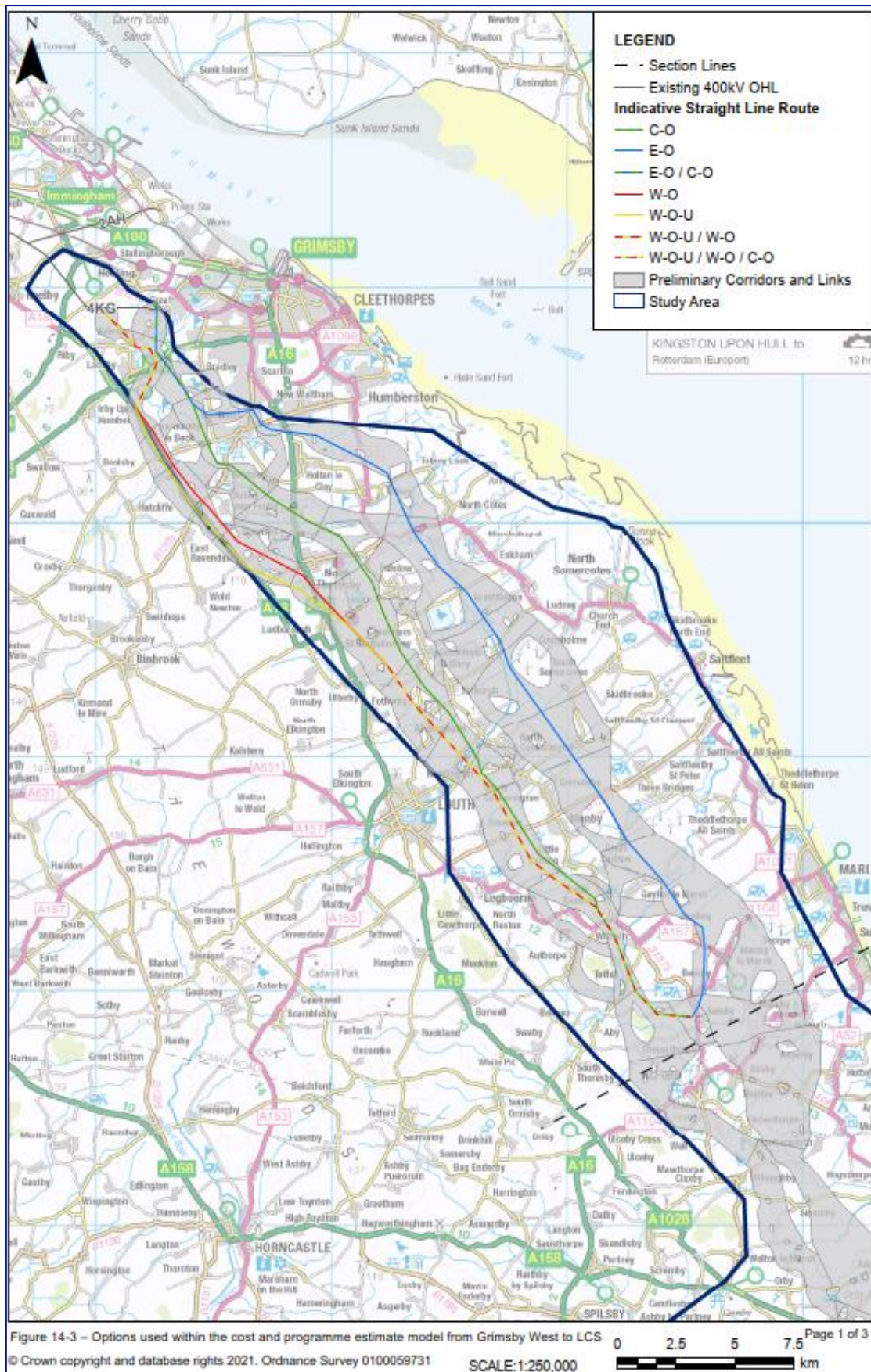
0 0.5 1  
SCALE: 1:50,000 km

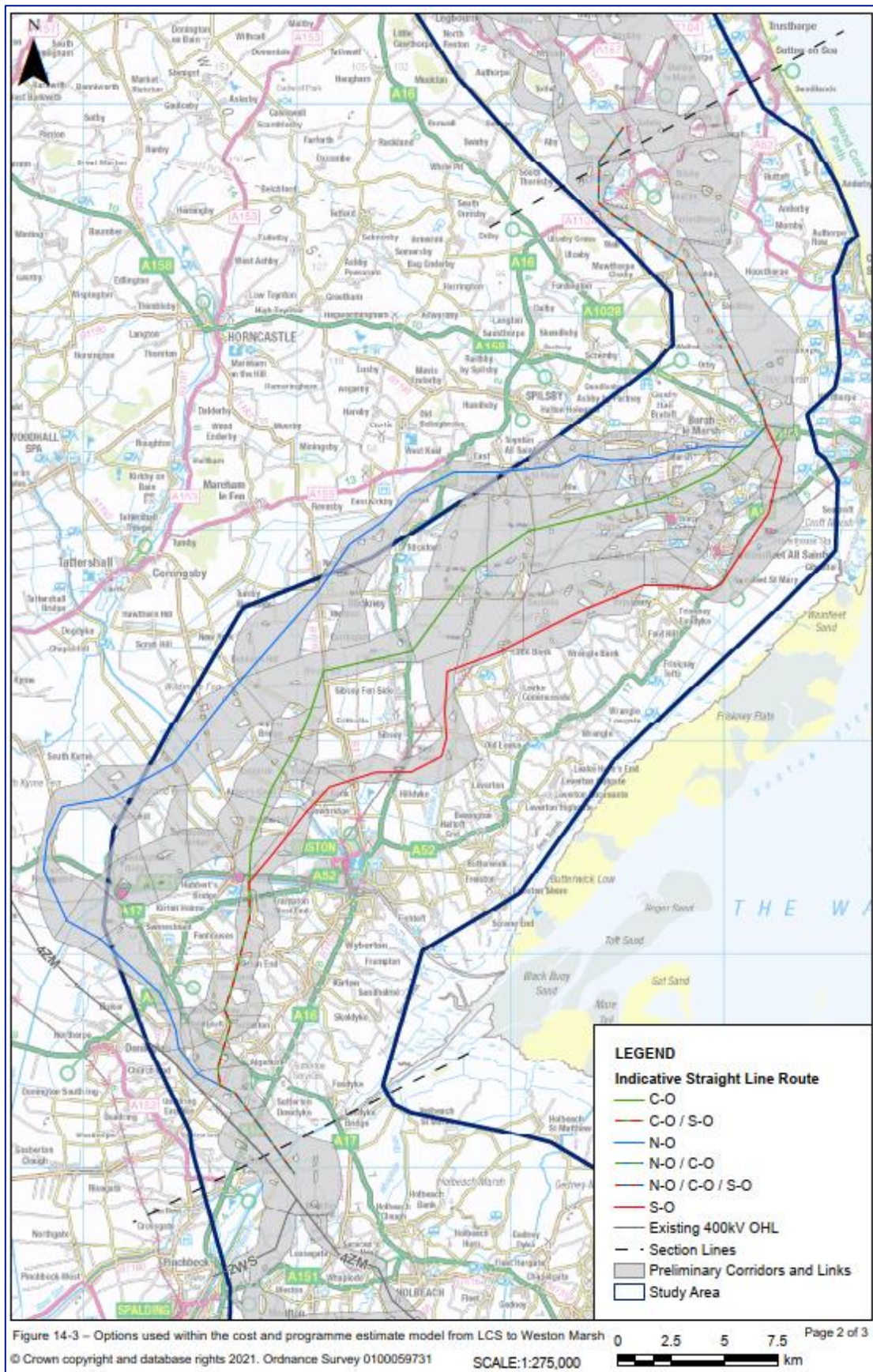
14.2.3 The options used between the connection points, as shown in **Figure 14-1**, are:

- The section between the Grimsby West to LCS (**G-L**):
  - **W-O-U**: This option is a mix of underground cable and overhead line routes. It utilises Sections E1U, C1U, W2U to W5U and W6 to W13 before reaching the LCS;
  - **W-O**: This option is a solely overhead line route. It utilises Sections E1, C1 and W2 to W13 before reaching the LCS;
  - **E-O**: This option is a solely overhead line route. It utilises Sections E1, C1, E2 to E12 before reaching the LCS; and
  - **C-O**: This option is a solely overhead line route. It utilises Sections E1, C1 to C7 and W7 to W13 before reaching the LCS.
- The section between the LCS to Weston Marsh (**L-W**):
  - **N-O**: This option is a solely overhead line route. From the LCS it utilises Sections W14, W15, C7, C8, N1 to N5, N7 to N10, C19, N11 to N14, C20 and C21A before reaching Weston Marsh;
  - **S-O**: This option is a solely overhead line route. From the LCS it utilises Sections E13, E14, C7, C8, S1 to S11, C20 and C21A;
  - **C-O**: This option is a solely overhead line route. From the LCS it utilises Sections E13, E14, C7 to C13, N6, N7, C14 to C16, Link C16-S8, and Sections S8 to S11, C20 and C21A.
- The section between Weston Marsh to new Walpole (**W-W**):
  - **N-O**: This option is a solely overhead line route. It utilises Sections N15, N16, Link N16-C28A and C28A.
  - **C-O**: This option is a solely overhead line route. It utilises Sections C22 to C27, and C28A.
  - **S-O**: This option is a solely overhead line route. It utilises Sections C22, C23, S12 and S13.

14.2.4 Underground cable is only present within the W-O-U option where it routes into the AONB. Outside of the AONB an overhead line was assumed to be the technology used in line with the NPS EN-5 and National Grid's Approach to Consenting.

Figure 14-3 – Options used within the cost and programme estimate model









## 14.3 National Grid's Cost and Programme Estimates

### Cost Estimates

- 14.3.1 Cost estimates have been developed by NGET's cost estimating team using the following assumptions:
- route lengths are based on an indicative route through Sections. They have been determined from a preliminary desktop exercise that is informed by the likely constraints to routing and professional judgement to seek the most direct route possible; and
  - the costs of applying industry 'best practice' mitigation measures during construction and operation are included within the cost base used.
- 14.3.2 This means that cost estimates of different options can be compared on a consistent basis, such that there is no systematic bias in the costing. While there is potential for costs to end up higher or lower from those which have been estimated, this will be the case across all options considered. Therefore, the relative preference for corridor options on the basis of cost should be unchanged by any future fluctuations despite estimates having the potential to shift in absolute terms. This method is adopted at the early stages of a project. It also allows cost estimates to be generated for the different options considered prior to selecting an emerging preference and the later development of a detailed alignment.
- 14.3.3 The cost estimates developed include estimates of the indicative 'capital cost' for the different options. The capital cost estimates consist of the sum of the estimates for the initial capital cost of developing, consenting, installing and commissioning the new transmission assets and the associated procurement of equipment and land.
- 14.3.4 Cost estimates for the different options were estimated based on costs from the financial year 2020/21. It is considered that the cost estimates provide a consistent cost point for comparison of different options at this stage.
- 14.3.5 Pylon types, circuit configurations and underground cable specifications which satisfied the design requirements were assumed based on previous projects, allowing for a unit cost per kilometre of overhead line and underground cable to be defined. This cost was applied to the estimated route lengths of each option to obtain a baseline estimate for the capital cost of each option based on the selected technology.
- 14.3.6 Secondary costs were added to this baseline estimate where significant engineering constraints (which would require a major localised adjustment to the transmission technology selected) were identified. Significant engineering constraints comprised areas which would present likely requirements for localised underground cabling including trenchless crossings, associated transitional equipment, line swap overs, duck-unders or existing overhead transmission line reconfigurations.
- 14.3.7 Underground cabling can take the form of open cut direct buried cable or trenchless solutions (described in more detail in **Chapter 2**). For cost estimates an open cut direct buried cable method has been used. Trenchless solutions may be required where an underground cable route must cross linear constraints (such as major road, rivers, railways and gas pipelines). Where use of a trenchless solution is required, this will result in additional cost to underground cabling and an allowance has been included within the secondary costs.

14.3.8 Undergrounding of DNO overhead lines would also be required as part of the Project and some rationalisation is being assessed in conjunction with the DNOs. Undergrounding of DNO overhead lines will result in additional cost, particularly 132 kV overhead lines. All corridor options cross many lower voltage overhead lines (33 kV and below), and thus low voltage lines are not considered to be a significant cost differentiator. Crossings of 132 kV overhead lines occur less frequently, and each crossing has a higher associated cost for mitigation (via removal, re-routeing, undergrounding or the requirement for a GSP) and therefore are considered in the cost analysis as secondary costs. The mitigation for crossing the 132 kV overhead line is assumed to be undergrounding.

## Programme Estimates

- 14.3.9 To determine programme estimates for the identified options, a logic linked activity schedule was built for each construction discipline e.g. civils engineering based on a generic build process for overhead lines and underground cables using assumptions such as tower type, span length, and tower foundation type for overhead lines, and cable length, open cut direct buried cable method and joint type to standardise any unknown parameters and offer consistency for programme estimates across the identified options. Variables determined by the identified options, such as construction discipline and route length were inputted to the schedule, producing estimates of construction duration and the provision of an earliest operational date for each of the identified options.
- 14.3.10 The schedule was defined at activity level based on how long it takes to construct one kilometre of overhead line or underground cable before the differentiating variables for each option were inputted to calculate a duration of construction and testing. The critical path construction activities were used to define the earliest in-service date (EISD). Programme estimates assume that construction of the overhead line will form the critical path for costed options unless an underground cable is required as part of a costed option. It is assumed that the construction of the substations will be within the EISDs for each costed option.

## 14.4 Results

- 14.4.1 The results are detailed below within **Table 14-1** and **Table 14-2**. Cost estimates are calculated for each individual corridor option and combinations of corridor options for different permutations of end-to-end connections, across the three major sections of the overall route. Programme estimates are also presented for the different permutations of end-to-end connections across the three major sections of the overall route.

Table 14-1 – Discrete options in each section (Grimsby West to LCS (G-L), LCS to Weston Marsh (L-W), and Weston Marsh to Walpole (W-W))

Section	Cost Option	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)
G-L	W-O-U	28.49	15.01	729.7	8.0	737.7
G-L	W-O	43.50	0.00	173.1	7.0	180.1
G-L	C-O	44.80	0.00	178.3	7.0	185.3
G-L	E-O	44.90	0.00	178.7	7.0	185.7
L-W	N-O	80.00	0.00	318.4	7.0	325.4
L-W	C-O	68.30	0.00	271.8	7.0	278.8
L-W	S-O	72.20	0.00	287.4	28.0	315.4
W-W	N-O	26.74	0.00	94.3	39.0	133.3
W-W	C-O	31.00	0.00	123.4	14.0	137.4
W-W	S-O	37.50	0.00	149.3	21.0	170.3

\*Note that this cost option follows the emerging preferences for the Sections identified in Chapter 13

Table 14-2 – Combinations – End-to-End Solutions

Section (Option)	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)	EISD*
G-L(W-O-U) L-W(N-O) W-W(N-O)	135.23	15.01	1142.4	54.0	1196.40	Q4 2036
G-L(W-O-U) L-W(N-O)	139.49	15.01	1171.5	29	1200.5	Q4 2036

Section (Option)	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)	EISD*
W-W(C-O)						
G-L(W-O-U) L-W(N-O) W-W(S-O)	145.99	15.01	1197.4	36.0	1233.4	Q4 2036
G-L(W-O-U) L-W(C-O) W-W(N-O)	123.53	15.01	1095.8	54.0	1149.80	Q4 2036
G-L(W-O-U) L-W(C-O) W-W(C-O)	127.79	15.01	1124.9	29	1153.9	Q4 2036
G-L(W-O-U) L-W(C-O) W-W(S-O)	134.29	15.01	1150.8	36.0	1186.8	Q4 2036
G-L(W-O-U) L-W(S-O) W-W(N-O)	127.43	15.01	1111.4	75.0	1186.40	Q4 2036
G-L(W-O-U) L-W(S-O) W-W(C-O)	131.69	15.01	1140.5	50	1190.5	Q4 2036
G-L(W-O-U) L-W(S-O) W-W(S-O)	138.19	15.01	1166.4	57.0	1223.4	Q4 2036

<b>Section (Option)</b>	<b>overhead line Length (km)</b>	<b>Cable Length (km)</b>	<b>Asset Capital Cost (£m)</b>	<b>Secondary Costs (£m)</b>	<b>Total Capital Cost (£m)</b>	<b>EISD*</b>
G-L(W-O) L-W(N-O) W-W(N-O)	150.24	0.00	585.8	53.0	638.80	Q2 2033
G-L(W-O) L-W(N-O) W-W(C-O)	154.5	0.00	614.9	28	642.9	Q2 2033
G-L(W-O) L-W(N-O) W-W(S-O)	161	0.00	640.8	35.0	675.8	Q3 2033
G-L(W-O) L-W(C-O) W-W(N-O)	138.54	0.00	539.2	53.0	592.20	Q1 2033
G-L(W-O) L-W(C-O) W-W(C-O)	142.8	0.00	568.3	28	596.3	Q1 2033
G-L(W-O) L-W(C-O) W-W(S-O)	149.3	0.00	594.2	35.0	629.2	Q2 2033
G-L(W-O) L-W(S-O) W-W(N-O)	142.44	0.00	554.8	74.0	628.80	Q1 2033
G-L(W-O) L-W(S-O)	146.7	0.00	583.9	49	632.9	Q2 2033

Section (Option)	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)	EISD*
W-W(C-O)						
G-L(W-O) L-W(S-O) W-W(S-O)	153.2	0.00	609.8	56.0	665.8	Q2 2033
G-L(C-O) L-W(N-O) W-W(N-O)	151.54	0.00	591.0	53.0	644.00	Q2 2033
G-L(C-O) L-W(N-O) W-W(C-O)	155.8	0.00	620.1	28	648.1	Q2 2033
G-L(C-O) L-W(N-O) W-W(S-O)	162.3	0.00	646.0	35.0	681.0	Q3 2033
G-L(C-O) L-W(C-O) W-W(N-O)	139.84	0.00	544.4	53.0	597.40	Q1 2033
G-L(C-O) L-W(C-O) W-W(C-O)	144.1	0.00	573.5	28	601.5	Q1 2033
G-L(C-O) L-W(C-O) W-W(S-O)	150.6	0.00	599.4	35.0	634.4	Q2 2033

Section (Option)	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)	EISD*
G-L(C-O) L-W(S-O) W-W(N-O)	143.74	0.00	560.0	74.0	634.00	Q1 2033
G-L(C-O) L-W(S-O) W-W(C-O)	148	0.00	589.1	49	638.1	Q2 2033
G-L(C-O) L-W(S-O) W-W(S-O)	154.5	0.00	615.0	56.0	671.0	Q2 2033
G-L(E-O) L-W(N-O) W-W(N-O)	151.64	0.00	591.4	53.0	644.40	Q2 2033
G-L(E-O) L-W(N-O) W-W(C-O)	155.9	0.00	620.5	28	648.5	Q2 2033
G-L(E-O) L-W(N-O) W-W(S-O)	162.4	0.00	646.4	35	681.4	Q3 2033
G-L(E-O) L-W(C-O) W-W(N-O)	139.94	0.00	544.8	53.0	597.80	Q1 2033
G-L(E-O) L-W(C-O)	144.2	0.00	573.9	28	601.9	Q1 2033

Section (Option)	overhead line Length (km)	Cable Length (km)	Asset Capital Cost (£m)	Secondary Costs (£m)	Total Capital Cost (£m)	EISD*
W-W(C-O)						
G-L(E-O) L-W(C-O) W-W(S-O)	150.7	0.00	599.8	35	634.8	Q2 2033
G-L(E-O) L-W(S-O) W-W(N-O)	143.84	0.00	560.4	74.0	634.40	Q1 2033
G-L(E-O) L-W(S-O) W-W(C-O)	148.1	0.00	589.5	49	638.5	Q2 2033
G-L(E-O) L-W(S-O) W-W(S-O)	154.6	0.00	615.4	56	671.4	Q2 2033



14.4.2 Differences from the cost model were largely dictated by:

- route length (with longer routes naturally resulting in a higher cost and longer programme estimates);
- the technology method used for routing i.e., overhead line or underground cable (with underground cable route costs being multiples higher than the equivalent length of overhead line route and generally requiring longer construction programmes); and
- the number of crossings that would likely be required of 132 kV and 400 kV overhead lines.

14.4.3 As shown in **Table 14-1**, for options for Grimsby West and the LCS ('G-L'), the W-O-U option resulted in the highest cost (£737.7 m) due to the increased construction costs associated with an underground cable when compared to solely overhead line options. Comparatively, the G-L W-O option was calculated as having the lowest overall cost (£180.1 m) as it is solely an overhead line and is comparatively shorter than the G-L C-O (totalling £185.3 m) and E-O (£185.7 m) options. All options between Grimsby West and the LCS are assumed to cross one NPG 132 kV overhead line which are included as secondary costs (approximately £7 m).

14.4.4 Between the LCS and Weston Marsh (L-W), all options are overhead line only and therefore overall route length was the major factor in the cost differences. Generally, the longer the overhead line route the greater the costs for construction and maintenance. The L-W option N-O requires the longest length of overhead line and therefore has the highest cost (£325.4 m). The L-W option C-O has the lowest cost as it requires the shortest length of overhead line (£278.8 m). The options that utilise the Northern Corridor and Central Corridor require a single 132 kV overhead line crossing, adding an additional £7 m in secondary costs to the relevant options. In comparison, those that utilise the Southern Corridor would require a total of four 132 kV crossings adding £28 m to the overall cost of relevant options. However, even when these additional crossings are considered, the Northern Corridor remains the most expensive option.

14.4.5 Between Weston Marsh and Walpole ('W-W'), all options are solely overhead line, so route length is the primary factor for cost differences. Each W-W option also involves multiple crossings of 132 kV overhead lines. The W-W N-O and C-O options would both require two 132 kV overhead line crossings, adding a total of £14 m (assuming undergrounding of the 132 kV overhead lines) to each option. The W-W S-O option would require three 132 kV overhead line crossings, costing £21 m (assuming undergrounding of the 132 kV overhead lines).

14.4.6 Between Weston Marsh and Walpole ('W-W'), the W-W Northern Corridor (N-O) routes in proximity to the existing 4ZM 400 kV overhead line, and where possible a new overhead line would run in parallel to this existing overhead line to reduce potential visual impact (in line with Holford Rule 6). However, construction of a close parallel new overhead line to the 4ZM 400 kV overhead line interacts with features (including residential properties) which must be navigated. Preliminary analysis (described in **Chapter 8**) indicates that at least eight areas where such features (10 in total) are present within a close parallel route are present and would either require duck-unders, line swap overs or compulsory acquisition to overcome. Each duck under or line swap over would cost approximately £2.5 m. Therefore, overcoming the features of a close parallel route within the Northern Corridor is estimated to add £25 m in secondary costs.

- 14.4.7 Between Weston Marsh and Walpole ('W-W'), even with the additional costs of overcoming features to closely parallel the existing 4ZM overhead line, the shorter length of the Northern Corridor gives it the lowest cost (£133.3 m) whilst the Southern Corridor, with the longest route, is the most expensive (£170.3 m) The cost of the Central Corridor is close to that of the Northern Corridor at £137.4 m.
- 14.4.8 Costs and programme estimates calculated for combined end-to-end connections presented in **Table 14-2** show that the combination of G-L(W-O), L-W(C-O), and W-W(N-O) resulted in the lowest cost (£592.2 m). The combination of G-L(W-O-U), L-W(N-O) and W-W(S-O) resulted in the highest cost (£1,233.4 m). Programme estimates calculated that combined end-to-end connections including section W-O-U resulted in the longest programme, with an estimated EISD of Q4 2036. As highlighted in **Table 14-2**, the shortest programme presented an EISD of Q1 2033. There were several combined end-to-end connections which achieved this.
- 14.4.9 The selection of an emerging preference for a transmission connection considers other factors alongside costs and programme including environmental, socio-economic and technical. The analysis shows that the emerging preference for the Project (as detailed in **Chapter 13**) that follows the G-L option C-O, L-W option C-O and W-W option C-O would be approximately £9 m (total cost of £601.5 m) more than the lowest cost end-to-end solution. This option would result in a EISD of Q1 2033, this is among the options delivered in the shortest time. On balance, the increased cost associated with the emerging preferred corridor is not sufficient to change the emerging preference. There are strong environmental, socio-economic and technical drivers for the selection of the emerging preference which are not outweighed by the outcome of the cost and programme analysis.

## 14.5 Conclusion

- 14.5.1 End-to-end connection options were analysed on cost and programme following, and to be considered alongside, the technical and environmental appraisals as part of the decision-making process.
- 14.5.2 From end-to-end the cost variance across all options was £592.2 m to £1,233.4 m. The cost variance was primarily driven by the use of underground cables for end-to-end options that utilise W-O-U between Grimsby West and the LCS and by the overall route length of each end-to-end connection. The variance in EISD was also primarily driven by the construction of underground cables for several options between Grimsby West and the LCS. The activity duration (per km) of underground cable installation is far greater than that of an overhead line.
- 14.5.3 The emerging preference for the Project (as described in **Chapter 13**), is only approximately £9 m more expensive than the lowest cost end-to-end solution as it follows a largely direct route whilst avoiding major engineering constraints and the use of underground cables. This cost difference is not sufficient to outweigh the environmental, socio-economic and technical factors which have also been appraised. Therefore, the emerging preferred option for the Project detailed in **Chapter 13** remains.
- 14.5.4 The emerging preference also results in only offering limited requirements for line swap overs and underground crossings. This means that the carbon impact during the construction phase is also reduced, although the size of carbon reduction is likely to be

insignificant when compared to the carbon impacts caused by constraining renewable generation (i.e. later in-service dates).

# 15. Development of the Graduated Swathe

# 15. Development of the Graduated Swathe

## 15.1 Introduction

- 15.1.1 Following the selection of the emerging preferred corridor, preferred siting zones and siting areas, a preliminary routeing exercise was undertaken to identify where it might be more appropriate to locate the required infrastructure within the corridor, siting zone and siting areas. This exercise considered the Holford Rules and Horlock Rules, having regard to local sites and features. These include features such as known residential properties, larger areas of woodland and existing infrastructure. The outcome of the preliminary routeing exercise is a 'graduated swathe' - coloured shading of varying intensity to indicate areas more likely (darker colour) and less likely (lighter colour) to be the location of the proposed infrastructure. Detailed plans showing the location of the proposed graduated swathe are included in **Appendix B**.
- 15.1.2 A graduated swathe is both preliminary and indicative. It is intended as a tool for non-statutory consultation and engagement with communities and other stakeholders, including landowners. The feedback from non-statutory consultation will inform the further development of the Project. However, it should be noted that feedback will be sought for the emerging preferred corridor, emerging preferred siting zones and emerging preferred siting areas and that the graduated swathe indicates where infrastructure is more or less likely to be located.
- 15.1.3 Within the area covered by the graduated swathe there are areas where there is greater flexibility for routeing and areas where there is less flexibility. This is reflected in the way the width of the darker parts of the graduated swathe varies: in some areas the darker shading covers a broader area (greater flexibility) and in other areas the darker shading is more focused (less flexibility).
- 15.1.4 The outcomes of the analysis, as depicted in the graduated swathe (an example graduated swathe is depicted in **Figure 1-7**), may be subject to change as the design and consenting process continues, more information becomes available, and the views of stakeholders and communities are considered. It does not rule out development within other parts of the emerging preferred corridor, siting zone or siting areas, or indeed outside of these emerging preferences, based on consultation feedback received, the findings of detailed surveys and subsequent design development.
- 15.1.5 As discussed in **Chapter 3**, future detailed localised routeing of the new overhead line will have due regard to the guidelines set out in the 'Holford Rules' and other principles of good design. To limit the number of bulkier angle pylons and develop a more coherent design solution, opportunities will be sought to develop straight sections of route wherever practicable. Accordingly, any detailed design proposal will be a response to local environmental, technical and socio-economic considerations.
- 15.1.6 Additionally, as discussed in **Chapter 4** the siting of substations has taken into consideration the sequential and exception tests is met regarding siting infrastructure within flood zones at high and medium risk of flooding (including rivers or the sea, surface water and reservoirs). This has been done through use of the Environment Agency datasets for flood risk from rivers, the sea, surface water and reservoirs. As the

proposed design of the Project progresses, the sequential approach will also be applied, as part of design process and as part of a FRA, to seek infrastructure being developed within areas of lowest flood risk (where possible) whilst also taking into consideration other factors.

## 15.2 Developing the Graduated Swathe

- 15.2.1 The development of the graduated swathe was informed by the location of sites and features within and beyond the corridor, siting zones and siting areas, which were identified from mapping and site visits to the emerging preferred corridor, siting zones and siting areas, like those that informed the earlier options appraisal work, as described in **Chapter 5**. The emerging preferred corridor, siting zones and siting areas were appraised to identify areas that may be more, or less, sensitive to the introduction of the Project's infrastructure, then outline engineering preliminary designs were developed to identify where new infrastructure might most appropriately be routed or sited, designing in accordance with the Holford and Horlock Rules, whilst considering environmental features and technical requirements. This was informed by opportunities, such as identifying where it was possible to run consistently close parallel to existing overhead lines, as well as detailed consideration of features and the locations of residential properties within the emerging preferences. Where the options appraisal identified potential opportunities to develop close parallel routes, this opportunity has been considered in the development of the graduated swathe.
- 15.2.2 To effectively portray the graduated swathe between the new Grimsby West, the LCS, Weston Marsh and new Walpole substations, avoidance of properties has been included in the analysis.
- 15.2.3 Known (primarily residential) properties and their curtilages, and larger settlements have been excluded from the graduated swathe. However, there are locations where there are several grouped exclusions which limit routeing flexibility and as a result, darker shading is presented adjacent to properties within these areas. Where these occur, there is the potential that a route could be considered that would oversail the possible curtilage of a residential property. This would only be considered where such a route would result in a significantly better overall design outcome against other receptors or constraints and in discussion with the potentially affected resident and landowner.

## 15.3 Description of the Graduated Swathe

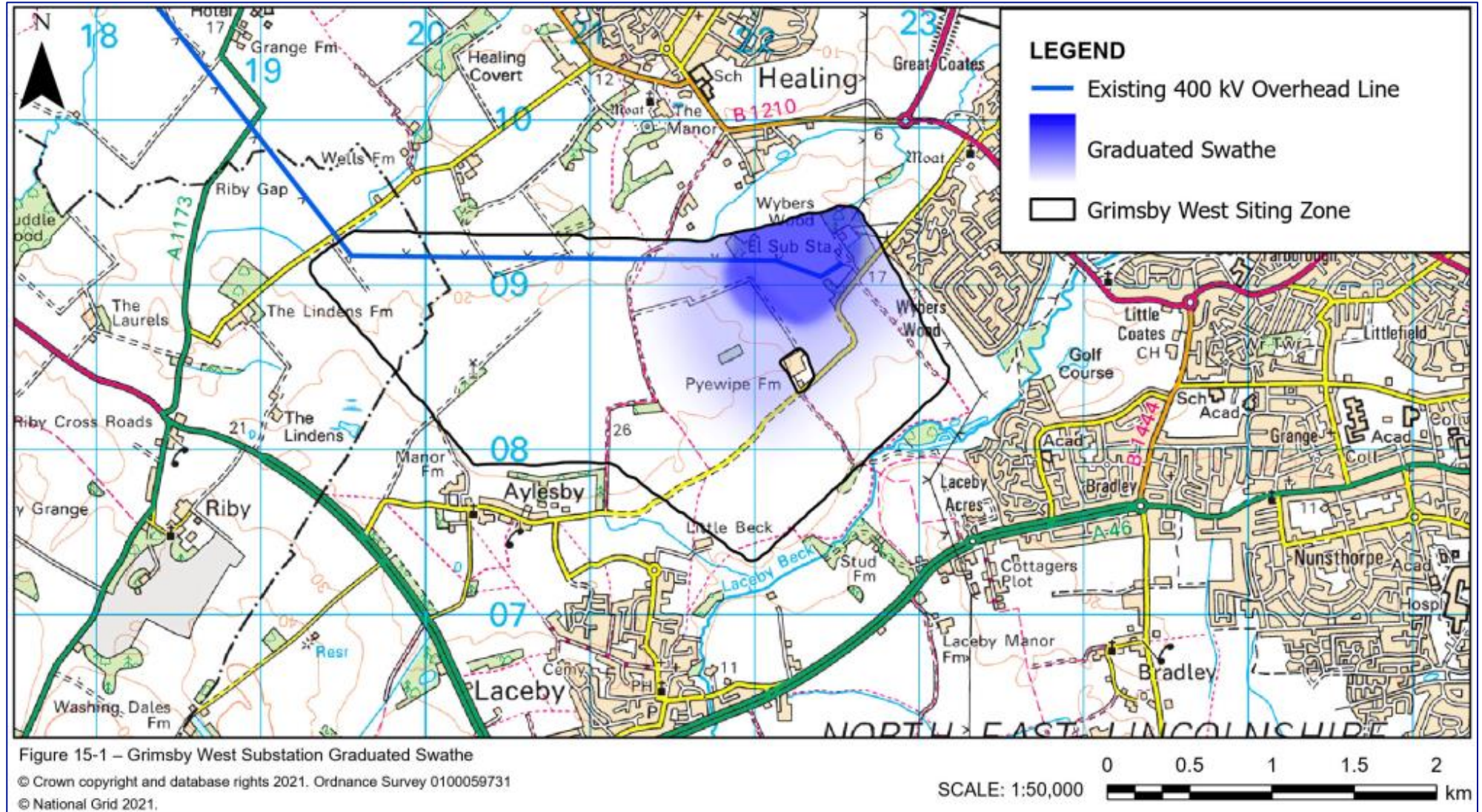
- 15.3.1 For the purposes of consultation, the graduated swathe has been split into its different infrastructure components (substations and overhead line). The graduated swathes for the substation and the overhead line need to overlap to provide an end-to-end solution for the Project. The graduated swathe for the overhead line has also been split into 12 separate sections. These have been largely defined by geographical features and are intended to provide clarity during reporting and to aid public consultation feedback. A summary of the graduated swathe for each infrastructure component of the Project is provided below and more detailed plans are included in **Appendix B**.

## Substations

### Grimsby West substation

- 15.3.2 Within the Grimsby West substation siting area emerging as preferred, outline potential substation layouts were developed by engineering specialists and reviewed by environment specialists and the project team. The outcome identified that the area most likely for infrastructure to be located was within and/or adjacent to the NGET landholding to reduce impacts upon the surrounding environment and in seeking to avoid larger areas at high and medium risk of surface water flooding to the north and south. The graduated swathe for the Grimsby West substation is shown in **Figure 15-1**.

Figure 15-1 - Grimsby West Substation Graduated Swathe





## Lincolnshire Connection substations

15.3.3 Within the siting zones emerging as preferred for the LCS (LCS5 and a hybrid of LCS6 and LCS8), potential siting areas (see **Figure 15-2**) were defined. The definition of the siting areas within each of the siting zones emerging as preferred has taken into consideration the Horlock Rules and Holford Rules applicable at this early stage of option development. The siting areas identified each have sufficient space to accommodate one of the two LCS 400 kV substations, whilst seeking to avoid the features of technical constraint and environmental and socio-economic significance within each siting zone. Following identification of these siting areas, comparative appraisal of options was undertaken, considering the siting area options within each emerging preferred siting zone, to identify an area where infrastructure is most likely at this stage and subject to consultation, to be located within each siting zone. The outcome of this comparative appraisal is set out below.

## LCS Siting Area Comparative Appraisal

### Amended Siting Zone LCS5

- 15.3.4 Within the amended LCS5 siting zone, three siting areas were identified (from west to east):
- LCS5-1: this siting area is located between Woodthorpe (located east) and Claythorpe (located south-west). The siting area is approximately 1.2 km by 0.7 km.
  - LCS5-2: this siting area is located between Claythorpe (located west) and Woodthorpe (located north-east). This siting area is approximately 0.8 km by 0.8 km.
  - LCS5-3: this siting area is located between Woodthorpe (located north) and Ailby (located south). This siting area is approximately 1.2 km by 0.9 km.

### Environmental Appraisal

15.3.5 The topics of socio-economic, air quality and noise are not considered to be a differentiating factor between siting areas LCS5-1 to LCS5-3. Except for Woodthorpe Hall Golf Course (near all siting areas) and Strubby Glider and Airfield (approximately 1.5 km east of all siting areas) there are no socio-economic receptors near the siting areas which would be material to decision making. There are few residential properties within or adjacent to the siting areas and sufficient space is available to allow noise-generating development to be located at a reasonable distance from sensitive receptors. Therefore, the comparative appraisal has focused on the topics of ecology, landscape, visual, heritage and water.

Figure 15-2 – LCS Siting Areas and Key Features

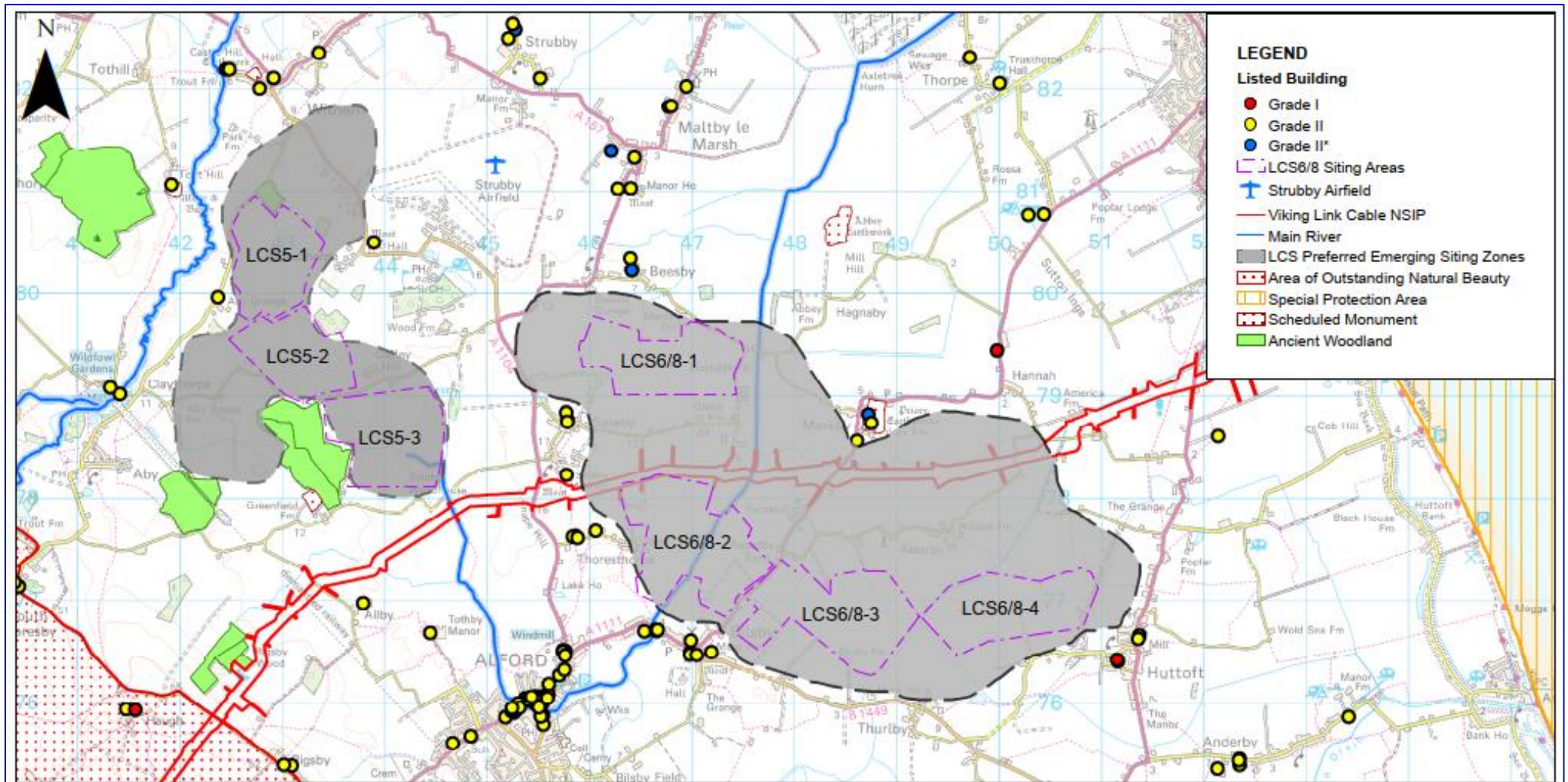


Figure 15-2 – LCS Siting Areas and Key Features

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- 15.3.6 Siting area LCS5-1 is in an open and slightly undulating area with views contained by woodland blocks to the north, east and south-west limiting views from key visual receptors and residential areas at Aby, Claythorpe, Withern and Woodthorpe. Due to the openness of the siting area, the potential for landscape and visual impacts is likely more widespread than siting area LCS5-3 and of a similar scale to siting area LCS5-2. No designated ecological features are located within the siting zone and the closest NSN and Ramsar site is located approximately 9.1 km east (Greater Wash SPA). No designated heritage assets are located within LCS5-1, however there are four within 1 km including a scheduled monument (*Toot Hill motte and bailey castle*) and three Grade II listed buildings. Mitigation planting and siting as far east as possible within the siting area may reduce potential impacts on the setting of these assets but would bring infrastructure in proximity to Woodthorpe (increasing potential for adverse landscape and visual impacts). The siting area is situated on a principal bedrock aquifer and a surface water drinking water safeguard zone. Surface water flooding risk within the siting area is overall very low, with a small area of medium risk located within the centre of the siting area associated with a minor watercourse. Therefore, locating infrastructure within this siting area has a comparatively (compared to LCS5-2) greater risk of impacting the water environment (from pollution or flow disruption to surface water and ground water).
- 15.3.7 Siting area LCS5-2 is in an open, slightly undulating but generally shallow bowl contained by woodland blocks to the north-east, east, south and north-west potentially limiting views from nearby villages (Woodthorpe and Saleby). A shallow rise between the siting area and the villages of Aby and Claythorpe may partially restrict views. Key visual receptors include residential areas at Aby, Claythorpe, Withern and Woodthorpe. Due to the openness of the siting area, there is the potential for landscape and visual impacts to be comparatively widespread (to siting area LCS5-3) unless siting within the south-east of the siting area. There are no designated ecological features located within the siting zone and the closest NSN and Ramsar site is located approximately 9 km east (Greater Wash SPA). The siting area is bordered (within approximately 50 m) to the south by Mother Wood, which is an area of ancient woodland. However, it is not envisaged there would be any impacts on the ancient woodland. No designated heritage assets are located within LCS5-2, however there are three within 1 km including a scheduled monument (*Site of St Mary's Priory, Greenfield*) and two Grade II listed buildings. As with LCS5-1, mitigation planting and siting infrastructure as far east as possible within the siting area may reduce potential impacts on the setting of these assets. The siting area is also situated on a principal bedrock aquifer. Surface water flooding risk within the siting area is overall very low, with a moderately sized medium-high risk area located within to north of the of the siting area associated with a minor drain.
- 15.3.8 Siting area LCS5-3 is in a slightly undulating area contained by woodland blocks to the west, south-west and north. A shallow rise between the siting area and the villages of Claythorpe and Aby to the west (in combination with existing woodland screening) considerably limits views to these villages. A shallow rise between the siting area and the villages of Saleby and Beesby (peaking near the A1104) will, in-combination with existing planting along the A1104, considerably limit views to these villages. Key visual receptors include residential areas at Woodthorpe, Saleby, Beesby and Alford. There are no designated ecological features located within the siting zone and the closest NSN site is located 8.9 km east of the siting area (Greater Wash SPA). The siting area is bordered (within approximately 50 m) to the west by Mother Wood, which is an area

of ancient woodland. Although it is considered there would be no impacts to the ancient woodland. No designated heritage assets are located within LCS5-3, however there is one scheduled monument within 1 km (*Site of St Mary's Priory, Greenfield*). The scheduled monument and other heritage assets present within the villages of Saleby and Alford are either screened by woodland (like the *Site of St Mary's Priory, Greenfield*) or are located within villages such that settings are unlikely to be affected, assuming careful siting. The siting area is situated on principal bedrock aquifer and the Wold Grift Drain (main river and WFD watercourse) is present in the south-east corner. Surface water flooding risk within the siting area is overall very low, however smaller areas of medium-high risk follow the minor watercourses that intersect the centre of the siting zone. Therefore, siting infrastructure within this siting area has a comparatively greater risk of impacting the water environment than LCS5-2.

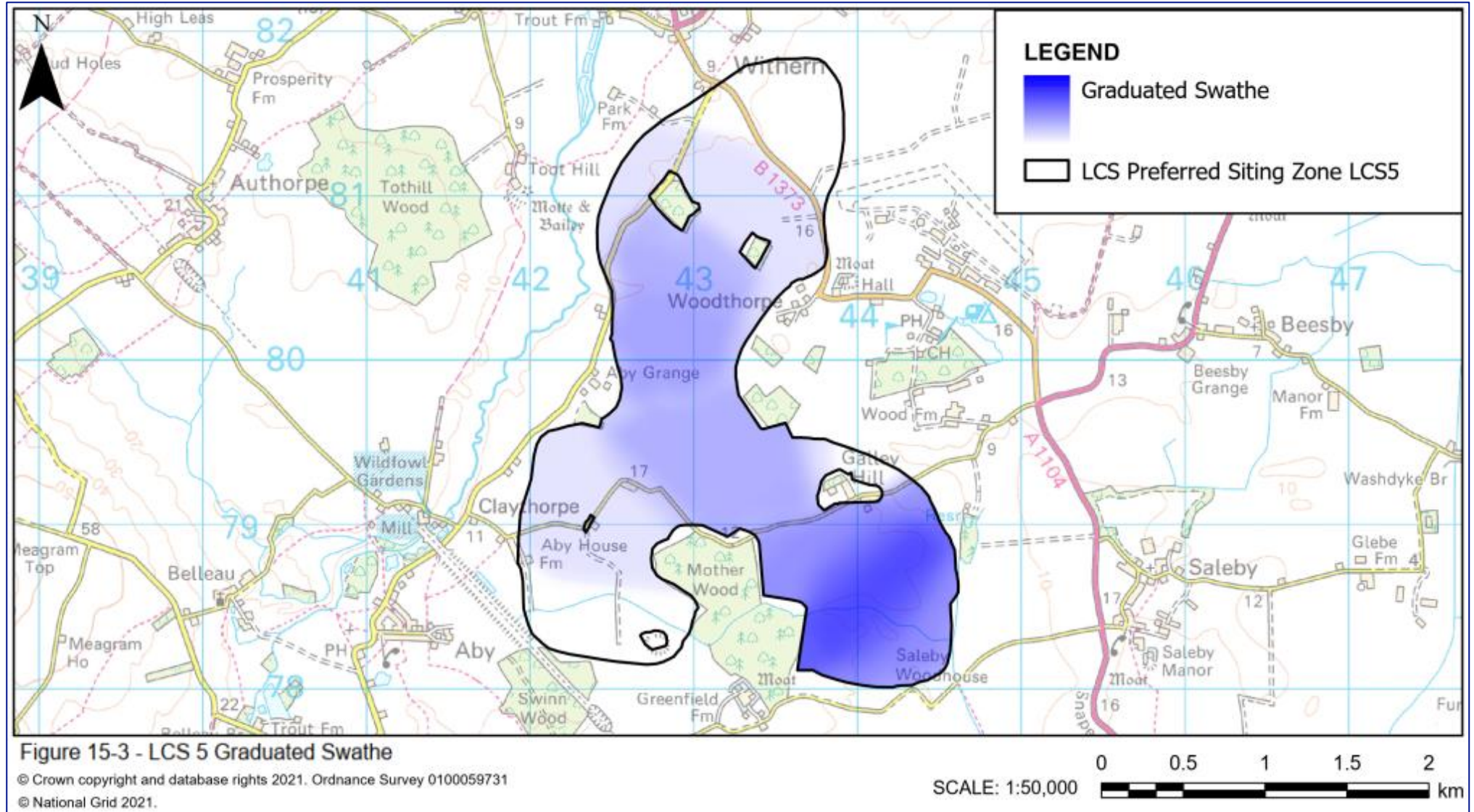
#### Technical Appraisal

- 15.3.9 There are no material constraints to siting within LCS5-1. Siting a substation here should be considerate of scattered properties near the boundary (west and east), Strubby Airfield located 1.5 km east and Woodthorpe Hall Golf Course located south-east which may constrain both connections for the Project to the site. An area of Flood Zones 2 and 3 is present approximately 200 m from the siting area (associated with Great Eau) which may constrain connections for the Project to the site.
- 15.3.10 Like LCS5-1, there are no material constraints to siting within LCS5-2. Here, siting should also be considerate of scattered properties near the boundary (north-west and west) and Woodthorpe Hall Golf Course (located east). Siting should also be considerate of Mother Wood which may constrain connections to the site.
- 15.3.11 Like LCS5-1 and LCS5-2, there are no material constraints to siting within LCS5-3. Siting should be considerate of scattered properties near the north-east boundary, Woodthorpe Hall Golf Course (located north-east) and Mother Wood (located west). LCS5-3 also contains a small watercourse (Wold Grift Drain) in the south-east corner which would slightly constrain siting.
- 15.3.12 When considering the potential connections by customers and other transmissions connections to the new 400 kV substation, approaches to each siting area are limited from the following directions:
- LCS5-1 – limited to the north-east by Strubby Airfield, settlement at Woodthorpe in the east, and by Woodthorpe Hall Golf Course and Leisure / Caravan Park to the south-east. Pockets of priority habitat (deciduous woodland), and settlement at Withern may also pose accessibility constraints from the north.
  - LCS5-2 – limited to the north-east by Woodthorpe Hall Golf Course and Leisure / Caravan Park, and to the south by Mother Wood ancient woodland. Scattered properties, such as Galley Hill Farm (which includes a campsite) may also pose accessibility constraints from the east.
  - LCS5-3 – limited to the west by Mother Wood ancient woodland and partially to the north by woodland and individual properties at Galley Hill.

## Comparative Appraisal

- 15.3.13 Siting Areas LCS5-1 and LCS5-2 are both located in comparatively more open landscape areas and despite being free from technical constraints, they are more likely to lead to comparatively greater visual impacts and impacts to the setting of designated heritage assets. In addition, LCS5-1 is also underlain by drinking water safeguard zones and LCS5-2 has larger areas at risk of surface water flooding located within. Furthermore, Siting Areas LCS5-1 and LCS5-2 offer limited flexibility for customer and other transmission connections from the Lincolnshire Coast. Most notably, the presence of Woodthorpe Golf Course and Leisure / Caravan Park, Strubby Glider / Airfield and settlement at Woodthorpe all constrain accessibility from the east. Therefore, these siting areas are less preferred.
- 15.3.14 Siting Area LCS5-3 is in a comparatively less open area (leading to comparatively fewer visual impacts) and although it contains a small watercourse (Wold Grift Drain, noted as a statutory main river and WFD river waterbody) to the south-east, this would not materially limit siting or increase technical complexity. Siting Area LCS5-3 is also located outside of Flood Zones 2 and 3 and is of comparatively lower risk of surface water flooding despite the presence of minor watercourses. In addition, LCS5-3 is considered to provide comparatively better opportunities for connections by other projects into the proposed 400 kV substation. As such this siting area is considered preferred, which is reflected in the graduated swathe shown in **Figure 15-3**.

Figure 15-3 – LCS5 Graduated Swathe



## Hybrid Siting Zone – LCS6 and LCS8

15.3.15 Within the hybrid siting zone of LCS6 and LCS8, four siting areas were identified as shown in **Figure 14-6** (from west to east):

- LCS68-1 – this siting area is located between Saleby (located south-west) and Beesby (located north). The siting area is approximately 1.9 km by 0.8 km.
- LCS68-2 – this siting area is located between Saleby (located north-west) and Bilsby (located south-east). The siting area is approximately 1.0 km by 1.2 km.
- LCS68-3 – this siting area is located between Bilsby (located south-west) and Asserby (located north-east). The siting area is approximately 1.1 km by 0.9 km.
- LCS68-4 – this siting area is located between Asserby (located north-west) and Huttoft (located south-east). The siting area is approximately 1.9 km by 0.8 km.

### Environmental Appraisal

15.3.16 The topics of ecology, socio-economics, air quality and noise are not considered to be differentiating factors between siting areas LCS68-1 to LCS68-4. All siting areas are free from designated ecological features and are located between 3.6 km and 5.6 km from The Wash designated sites at the coastline (the nearest NSN and Ramsar sites). There are no socio-economic features identified within 1 km of the siting areas considered material to decision making. There are few residential properties within or adjacent to the siting areas and sufficient space is available to allow noise-generating equipment to be located at a reasonable distance from sensitive receptors. Therefore, the comparative appraisal has focused on the topics of landscape, visual, heritage and water.

15.3.17 Siting area LCS68-1 is located at a local high point within the siting zone, although woodland blocks to the south and west may limit views from Saleby. Key visual receptors include residential areas at Beesby, Saleby, Thoresthorpe and Markby. Given the siting area is located at a local high point it has the potential for widespread landscape and visual impacts. In addition, due to its proximity to Beesby, views may result in significant adverse visual impacts for properties with views south. Although unlikely, should woodland to the west of the siting area be removed, there may be a significant adverse effect on views from Saleby. No designated heritage assets are located within LCS68-1, however there are seven within 1 km including a scheduled monument (*Churchyard Cross St Margarets churchyard*) and six Grade II listed buildings at Beesby. Mitigation planting (and where applicable landscaping) may reduce potential impacts on the setting of these heritage assets, however given the siting area is at a local high point, and the proximity of designated heritage assets at Beesby, there is the potential for significant adverse effects on setting to still occur. No relevant water related receptors material to decision making are located within the siting area. Minor areas of medium-high risk of surface water flooding are located within the centre of the siting area, associated with minor watercourses, however these can be avoided.

15.3.18 Siting area LCS68-2 comprises an open undulating area between the village of Saleby, the Viking Link Interconnector and the A1111, with lower lying ground closer to the Wold Grift Drain. Key visual receptors include those at Asserby Turn, Bilsby, Saleby and Thoresthorpe, and some scattered individual properties. Siting within the lower lying land to the south of the siting area would limit potential impacts on views from Saleby.

Use of mitigation planting (and where applicable landscaping) would assist in reducing the severity of potential adverse impacts from other directions. No designated heritage assets are located within LCS68-2, however there are ten within 1 km (primarily at Bilsby) including two scheduled monuments (*Churchyard cross, St Margaret's churchyard and Churchyard cross, Holy Trinity churchyard*), a Grade II\* listed building and seven Grade II listed buildings. Views from Beesby are partially screened by existing vegetation and while the use of mitigation planting may not avoid impacts, it would help to reduce the potential for significant impacts upon the setting of designated assets. Wold Grift Drain crosses the siting area and approximately 30% of the siting area is covered by Flood Zone 2 and 3 and minor areas of medium-high risk of surface water flooding are located within the centre of the siting area, associated with minor watercourses, however these can be avoided. In addition, a SPZ2 covers the south-east corner of the siting area. These limit flexibility for substation siting, including the orientation of substations (to be determined at a later stage), and may require additional flood mitigation measures.

15.3.19 Siting area LCS68-3 is an open undulating low-lying area close to watercourses located between the A1111, Asserby and Thurlby. Key visual receptors include properties along A1111 to the north-west and the villages of Asserby, Markby, Hannah, Huttoft, Thurlby, and Bilsby. Although already at relatively low ground compared with the rest of the siting zones, siting further south and east is the lowest and more remote part of the siting area, further limiting the potential for adverse landscape and visual impacts. No designated heritage assets are located within LCS68-3, however there are four within 1 km (primarily at Bilsby) including one scheduled monument (*Churchyard cross, Holy Trinity churchyard*), one Grade II\* listed building (*Church of Holy Trinity*) and two Grade II listed buildings. Siting south-and east combined with the use of mitigation planting (and where applicable landscaping) will considerably limit the potential for effects on the setting of assets. Area of Flood Zone 2 and 3, associated with the Boy Grift Drain, cover approximately 15% of the siting area at its eastern boundary. Minor areas of medium-high risk of surface water flooding are located within the centre, northwest and south-east of the siting area associated with minor watercourses, however these can be avoided. In addition, the siting area is located within a SPZ2 and adjacent to an area of SPZ1.

15.3.20 Siting Area LCS68-4 comprises an open undulating low-lying area close to watercourses located between Asserby and Huttoft. Key visual receptors include Asserby, Huttoft, Thurlby, and some scattered individual properties to the north and south. Siting in the area has the potential for adverse visual impacts although locating to the north, further from the majority of receptors, would limit these. No designated heritage assets are located within LCS68-4, however there are five within 1 km (primarily at Huttoft) including a Grade I listed building (*Church of St. Margaret*) and four Grade II listed buildings. Potential impacts upon the setting of these designated heritage assets would be limited with use of mitigation planting. Boy Grift Drain routes through the north-west of the siting area and areas of Flood Zone 2 and 3 (primarily associated with this drain and its tributaries) cover approximately 40% of the siting area. In addition, a SPZ2 area covers the south of the siting area. This limits the flexibility for siting, and it may not be possible to avoid areas of Flood Zones 2 and 3. Additionally, minor areas of medium-high risk of surface water flooding are located at the northern, western and eastern edges of the siting area, associated with minor watercourses. Therefore infrastructure would need to be designed accordingly and additional flood mitigation (and potentially compensation) measures would be required.



## Technical Appraisal

- 15.3.21 There were few material constraints to siting within LCS68-1. Siting a substation here should be considerate of scattered properties near the boundary and a 33 kV overhead line to the east. Flood Zones 2 and 3 may pose a constraint to overhead line entries and may be unavoidable, depending on final substation positioning (to be determined at a later stage).
- 15.3.22 The Viking Link Interconnector (located adjacent to the north), the presence of Wold Grift Drain and its associated flood zones, and the presence of an existing 33 kV overhead line (crossing the siting area), limit the flexibility for siting a substation within siting area LCS68-2. In addition, overhead line entries will have to be considerate of these features which may cause potential access limitations and restrict pylon positioning. Areas of Flood Zones 2 and 3 could be avoided depending on the final orientation of the substation (to be determined at a later stage of design) and routeing of overhead line entries. Infrastructure will need to be designed accordingly due to the presence of a SPZ2 and areas of Flood Zone 2 and 3.
- 15.3.23 Siting of a substation and overhead line entries into siting area LCS68-3 should be considerate of scattered properties near the boundary. As noted above, Flood Zones 2 and 3 are present at the east of the siting area, and a SPZ1 is located to the south. Flood Zones 2 and 3 could be avoided by the substation but may not be avoidable for overhead line entries. Infrastructure will need to be designed accordingly due to the SPZ1, SPZ2 and Flood Zone 2 and 3 areas.
- 15.3.24 The main constraint to siting the substation and overhead line entries within LCS68-4 is the presence of Flood Zones 2 and 3 and areas at risk of surface water flooding (as described above) which is present within and surrounding the siting area. Avoiding these features will considerably limit the flexibility for siting a substation, increase the technical complexity of the design and introduce a likely requirement for additional mitigation. The flood zones may result in access and construction limitations due to flood events. Boy Grift Drain in the north-west will limit siting flexibility. Depending on the orientation of the substation (to be determined at a later stage) use of additional angle pylons and a longer overhead line may be required.

## Comparative Appraisal

- 15.3.25 Siting area LCS68-1 is at a local high point and although generally free from relevant water related features and generally free from technical constraints, is likely to result in widespread landscape and visual impacts and comparatively worse impacts upon the setting of designated heritage assets. It is therefore least preferred.
- 15.3.26 Although siting area LCS68-4 is in an open undulating low-lying area, it contains a larger area of Flood Zones 2 and 3 alongside areas at risk of surface water flooding, which will increase the technical complexity of design, construction and operation of the substation and overhead line entries into and out of the siting area. In addition, the presence of Boy Grift Drain limits siting and routeing flexibility, and routeing to and into the siting area may require additional length of overhead line and the use of angle pylons. It is therefore less preferred.
- 15.3.27 When comparing siting area LCS68-2 and LCS68-3, both are comparatively similar and are in open undulating low-lying areas within the siting zone. Both also contain small areas of Flood Zones 2 and 3, and are within a SPZ2, and contain areas at risk of

surface water flooding. Environmentally, use of siting zone LCS68-3 would be preferred as it would be better from a landscape, visual and heritage perspective but less so from a water perspective as it contains more areas of flood zone. Both siting areas are also similar from a technical perspective with additional design complexity likely to be involved in siting within LCS68-3 due to more extensive areas of Flood Zones 2 and 3 and the SPZ coverage, but additional design complexity with LCS68-2 due to the proximity of the Viking Link Interconnector and due to Wold Grift Drain. When considering the sequential test, it is considered that LCS68-1 is not a reasonable alternative considering its potential landscape and visual impact. The result of the comparative appraisal is a slight preference for siting area LCS68-3 combined with LCS68-2 to allow for flexibility in siting infrastructure outside of flood zones. The graduated swathe for the hybrid LCS6 and LCS8 zone is shown in **Figure 15-4**.

Figure 15-4 – LCS Hybrid Zone (LCS6 and LCS8) Graduated Swathe

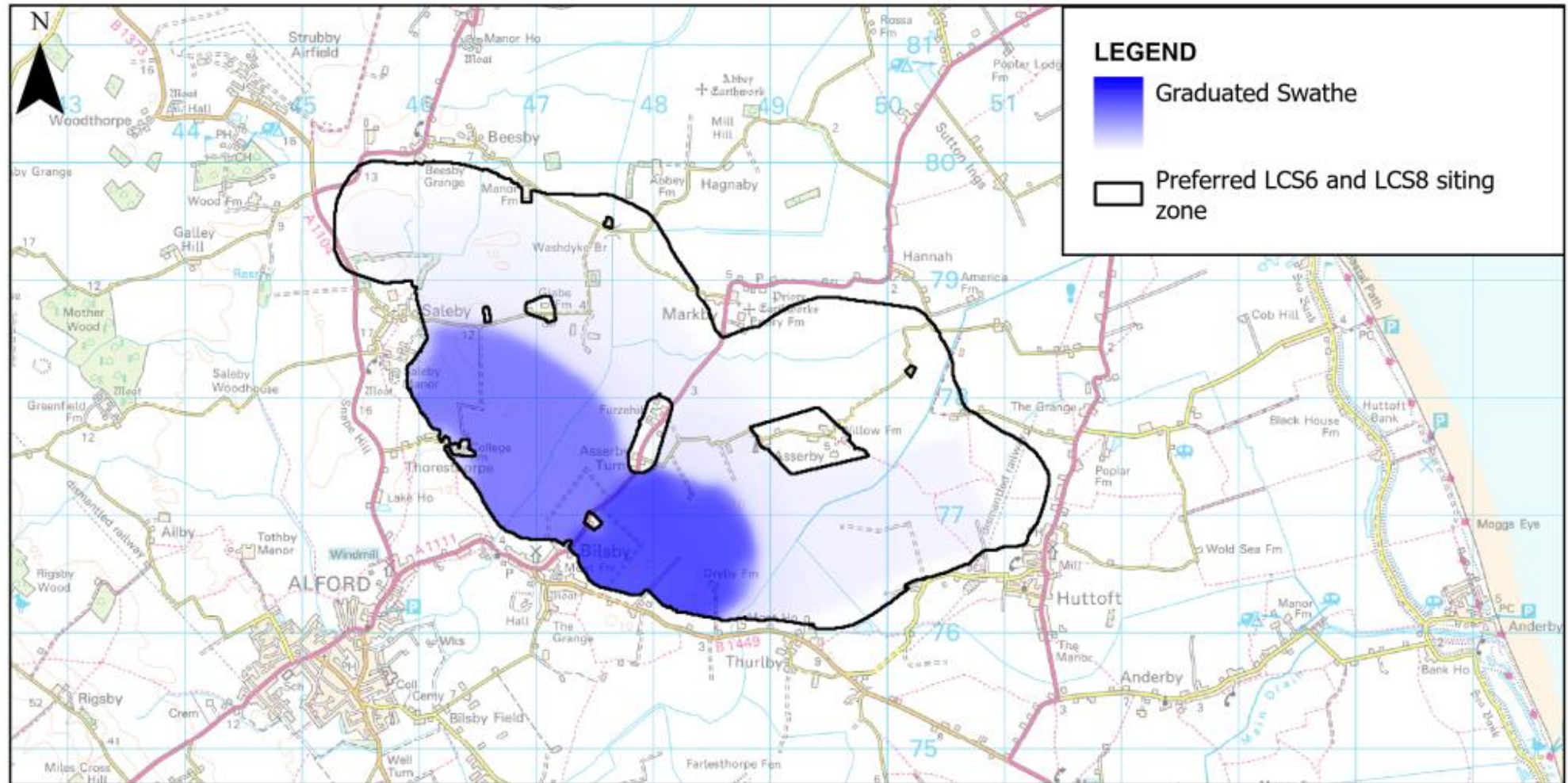


Figure 15-4 - LCS Hybrid Zone (LCS6 and LCS8) Graduated Swathe

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## Weston Marsh substation

- 15.3.28 Within the Weston Marsh siting zone four siting areas were identified (WM1, WM2, WM3 and WM4), all of which were in a similar area north of Wykeham and west of Moulton Seas End. The area is characterised by flat, open arable fields bound by drains with limited woodland and roadside vegetation. The topics of ecology, water, socio-economics, air quality and noise are not considered to be differentiating factors between siting areas WM1, WM2, WM3 and WM4. All siting areas are free from designated ecological features, are located at least 5.2 km from The Wash designated sites at the coastline (the nearest NSN and Ramsar sites) and are within areas of Flood Zones 2 and 3 (although it is noted that those nearer the River Welland may have comparably greater potential impacts). There are no socio-economic features identified within 1 km of the siting areas which are material to decision making. There are few residential properties within or adjacent to the siting areas and sufficient space is available to allow noise-generating equipment to be located at a reasonable distance from sensitive receptors.
- 15.3.29 For landscape, visual and heritage and technical aspects a comparative appraisal was undertaken. The analysis identified that from a landscape and visual perspective there is little to choose between the siting areas as they are within such proximity, however due to their proximity to the 4ZM and 2WS 400 kV overhead lines siting areas WM2 and WM3 would have comparatively lesser landscape and visual impacts (but reducing the spread of infrastructure into the wider surrounding areas). From a heritage perspective siting areas WM2 and WM3 are preferred as they are more distant from designated heritage assets to the south and north of the Weston Marsh siting zone and limit the spread (and therefore impacts upon setting) of infrastructure to the surrounding areas. From a technical perspective there was little to differentiate between the siting areas, however use of siting areas WM2 and WM3 offered the opportunity for more simple line entries (from the 4ZM, 2WS and proposed 400 kV overhead lines) and are therefore more preferred.
- 15.3.30 Overall, an area primarily encompassing WM2 and WM3 is identified as the emerging preference and the most likely area for infrastructure to be located, to limit the spread of infrastructure from the Spalding Tee-Point. The graduated swathe for Weston Marsh substation is shown in **Figure 15-6**.

Figure 15-5 – Weston Marsh Graduated Swathe

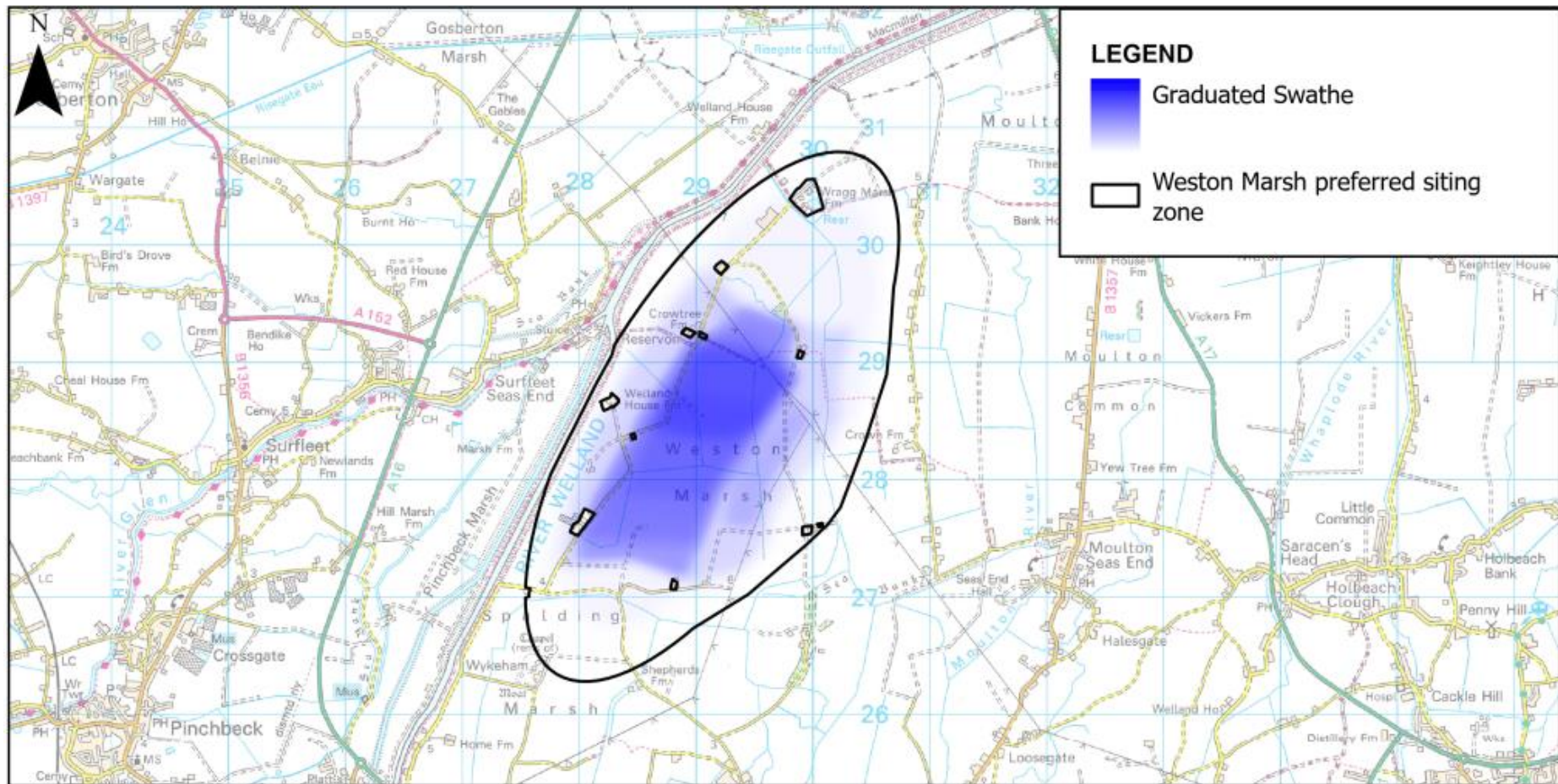


Figure 15-5 – Weston Marsh Graduated Swathe

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## Walpole substation

- 15.3.31 Within the Walpole siting zone five siting areas were identified (WLPS1, WLPS2, WLPS3, WLPS4 and WLPS5 shown in **Figure 15-7**), all of which were in a similar area north of West Walton and Walton Highway. The area is characterised by irregular arable fields bound by scattered properties and woodland. The topics of ecology, water, socio-economics, air quality and noise are not considered to be differentiating factors between siting areas WLPS1, WLPS2, WLPS3, WLPS4 and WLPS5. As all siting areas are free from designated ecological features and are located at least 11.6 km from The Wash designated sites at the coastline (the nearest NSN and Ramsar sites) and all are within areas of Flood Zone 2 and 3 (although it is noted that those nearer the River Nene may have comparably greater potential for flooding impacts and require comparatively more complex design solutions) these were not considered a determining factor. There are socio-economic features identified within 1 km of the siting areas except for the Rose and Crown Solar Farm (which is avoided but may be temporarily affected by all siting areas) that would be material to decision making. There are few residential properties within or adjacent to the siting areas and sufficient space is available to allow noise-generating equipment to be located at a reasonable distance from sensitive receptors.
- 15.3.32 For landscape, visual, heritage and technical aspects a comparative appraisal was undertaken. The analysis identified a landscape and visual preference for the WLPS5 because of an assessed strong sense of enclosure across the siting area, specifically from the west where views are well screened by vegetation, as well as to take advantage of siting directly beneath the 4ZM overhead line minimising potential wirescapes in the area. From a heritage perspective WLPS4 was preferred as only one heritage asset was identified within 1 km with a view to the siting area which could be mitigated through measures such as screen planting during construction. From a technical perspective WLPS5 is preferred because of its size allowing for flexibility of siting within the siting area and is located directly under the 4ZM 400 kV overhead line, allowing for a less technically complex design to be adopted.
- 15.3.33 Taking this into consideration an area primarily encompassing WLPS5 as the emerging preference and most likely location for infrastructure to be located due to its position on/adjacent to the 4ZM 400 kV overhead line, reducing the required deviations of this overhead line and limiting the spread of impacts into the surrounding environment. The graduated swathe for Walpole substation is shown in **Figure 15-8**.

Figure 15-6 – Walpole Siting Areas and Key Features

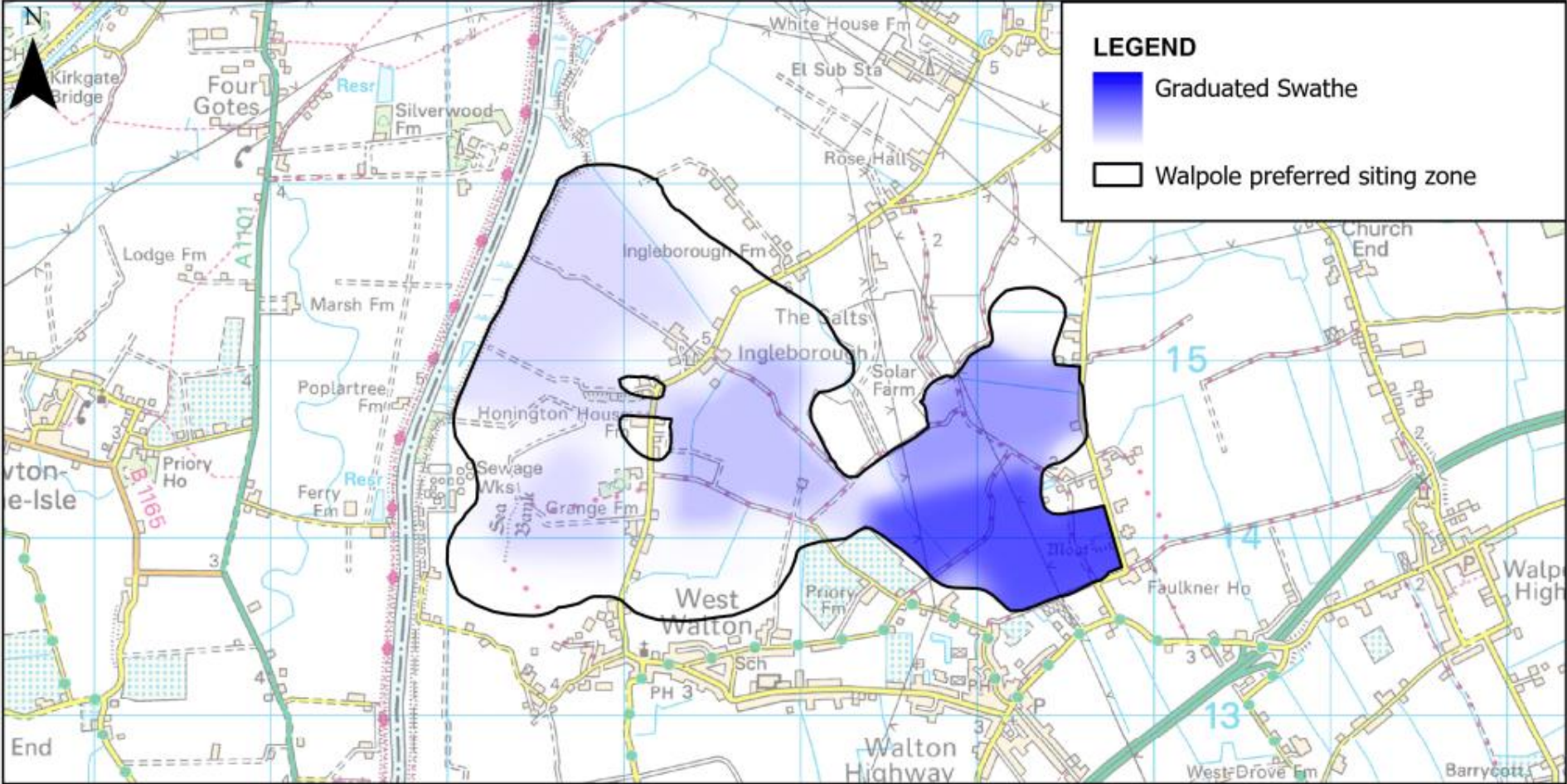


Figure 15-6 – Walpole Graduated Swathe

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SCALE: 1:50,000 0 0.5 1 1.5 2 km

## Overhead Line Corridor

15.3.34 The 11 sections are listed below and shown on **Figure 15-7 to 15-17**.

- Section 1: Grimsby West – Barnoldby le Beck;
- Section 2: Barnoldby le Beck – North Thoresby;
- Section 3: North Thoresby – Alvingham and Keddington;
- Section 4: Alvingham and Keddington – Tothill;
- Section 5: Tothill – Cumberworth;
- Section 6: Cumberworth – Burgh le Marsh;
- Section 7: Burgh le Marsh – Midville;
- Section 8: Midville – River Witham;
- Section 9: River Witham – River Welland;
- Section 10: River Welland – the B1165; and
- Section 11: the B1165 – Walpole.

15.3.35 A summary of the graduated swathe by sections is provided below and more detailed plans are included in **Appendix B**.

### **Section 1 – Grimsby West to Barnoldby le Beck**

15.3.36 This section of the emerging preferred corridor runs from the connection point at the new Grimsby West substation to a point immediately east of the village of Barnoldby le Beck (south of Waltham Road). This is shown in **Figure 15-7 9** below and on Sheet 1 of **Appendix B**.



Figure 15-7 – Section 1 (Grimsby West to Barnoldby le Beck)

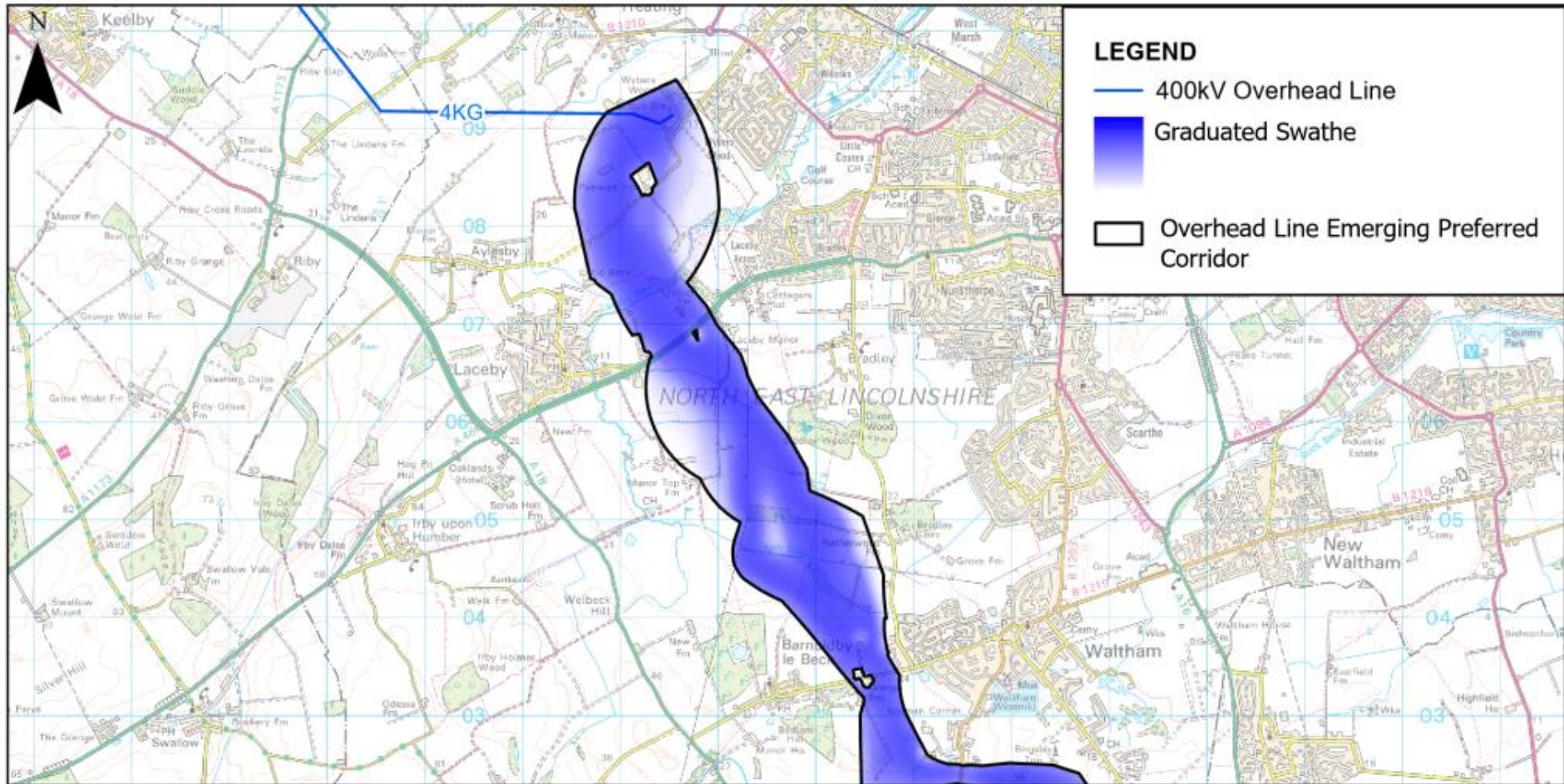
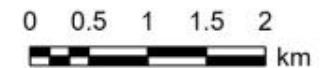


Figure 15-7 – Section 1 (Grimsby West to Barnoldby le Beck)

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SCALE: 1:90,000



- 15.3.37 The new overhead line would route west out of the siting area for the new Grimsby West substation towards Laceby and then south towards the A46. This seeks to route away from a large number of receptors at Wybers Wood and minimise interaction with the GWUE allocation, both to the east. It also seeks to minimise interactions with the Aura Power Solar Farm and existing wind turbines to the west.
- 15.3.38 From Laceby Beck, the overhead line would route directly south-east across the A46 towards the existing 132 kV overhead lines and the existing and proposed solar farms. The overhead line route is retained towards the centre and east of the emerging preferred corridor where possible, to retain distance from the AONB (and a setting within a more urban fringe environment). Optionality has been introduced at Brigsley as to whether to cross the two NPG 132 kV overhead lines by routeing to the east of the Corridor (over a proposed solar farm), or to route to the west of the Corridor (over part of an existing solar farm) to minimise interactions with the existing overhead lines.
- 15.3.39 As the overhead line route reaches Waltham Road it passes Grange Farm. The emerging preference is to route in the east of the Corridor in this area, due to the presence of the AONB and to limit the potential impact upon its setting and views/to and from the AONB. However, optionality has been retained, with more detailed studies to be carried out following non-statutory consultation.

## **Section 2 –Barnoldby le Beck to North Thoresby**

- 15.3.40 This section of the emerging preferred corridor runs from a point immediately east of the village of Barnoldby le Beck (south of Waltham Road) to a point immediately east of the village of North Thoresby (south of the B1201). This is shown in **Figure 15-108** below and on Sheet 2 of **Appendix B**.

Figure 15-8 – Section 2 (Barnoldby le Beck to North Thoresby)

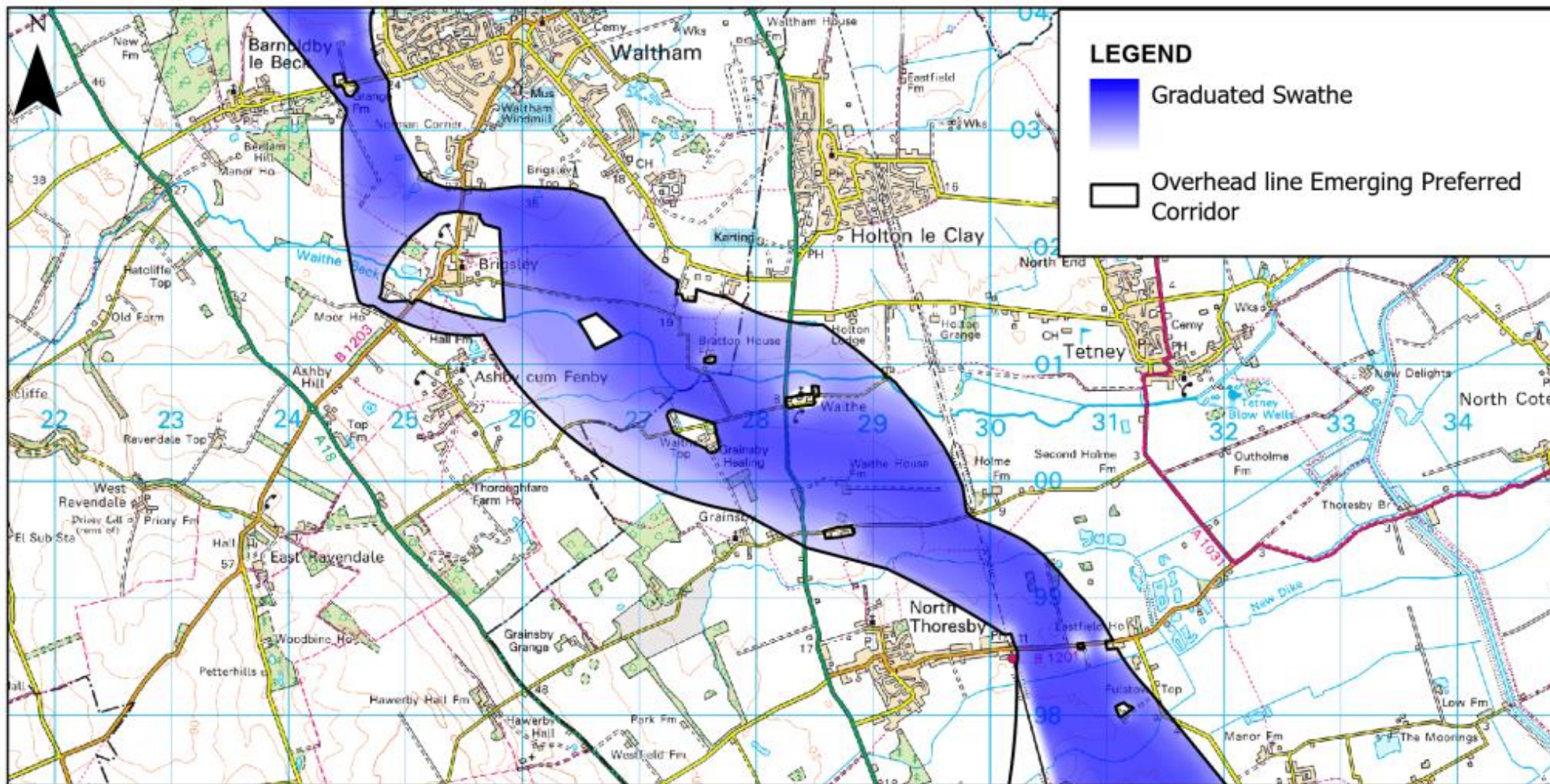


Figure 15-8 - Section 2 (Barnoldby le Beck to North Thoresby)

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SCALE: 1:75,000



- 15.3.41 The overhead line would then route south towards the village of Brigsley, then continues south, then east, crossing the B1203 (also called Waltham Road) at a narrower area between Norman Corner and Brigsley. Due to the narrowness of the area between Norman Corner and Brigsley the optionality of crossing the B1203 south-west of Brigsley has been retained subject to the outcome of non-statutory consultation and more detailed studies.
- 15.3.42 Once through this narrower area, the overhead line routes in a direct line south-east towards the east of North Thoresby. An overhead line route that aims to keep central or east within the corridor here will help to limit potential effects on the setting of the AONB (by the infrastructure being further away) but would also need to be considerate of scattered features present. However, it is considered that the width of the corridor in this area allows for flexibility in routing to avoid scattered features.

### **Section 3 –North Thoresby to Alvingham and Keddington**

- 15.3.43 This section of the emerging preferred corridor runs from a point immediately east of the village of North Thoresby (south of the B1201) to a point north-east of the village of Keddington and south-west of the village of Alvingham (south of Alvingham Road). This is shown in **Figure 15-119** below and on Sheet 3 of **Appendix B**.
- 15.3.44 Once across the B1201, the overhead line would route away to the east to avoid crossing the Lincolnshire Wolds Railway (heritage), retaining a greater distance from the AONB (seeking to reduce potential impacts on its setting) and reducing the potential for impacts on the setting of two scheduled monuments (*Deserted village* and *Louth Park Abbey*). The overhead line route also seeks the most direct line, subject to scattered features, to reduce the amount of infrastructure required.

Figure 15-9 – Section 3 (North Thoresby to Alvingham and Keddington)

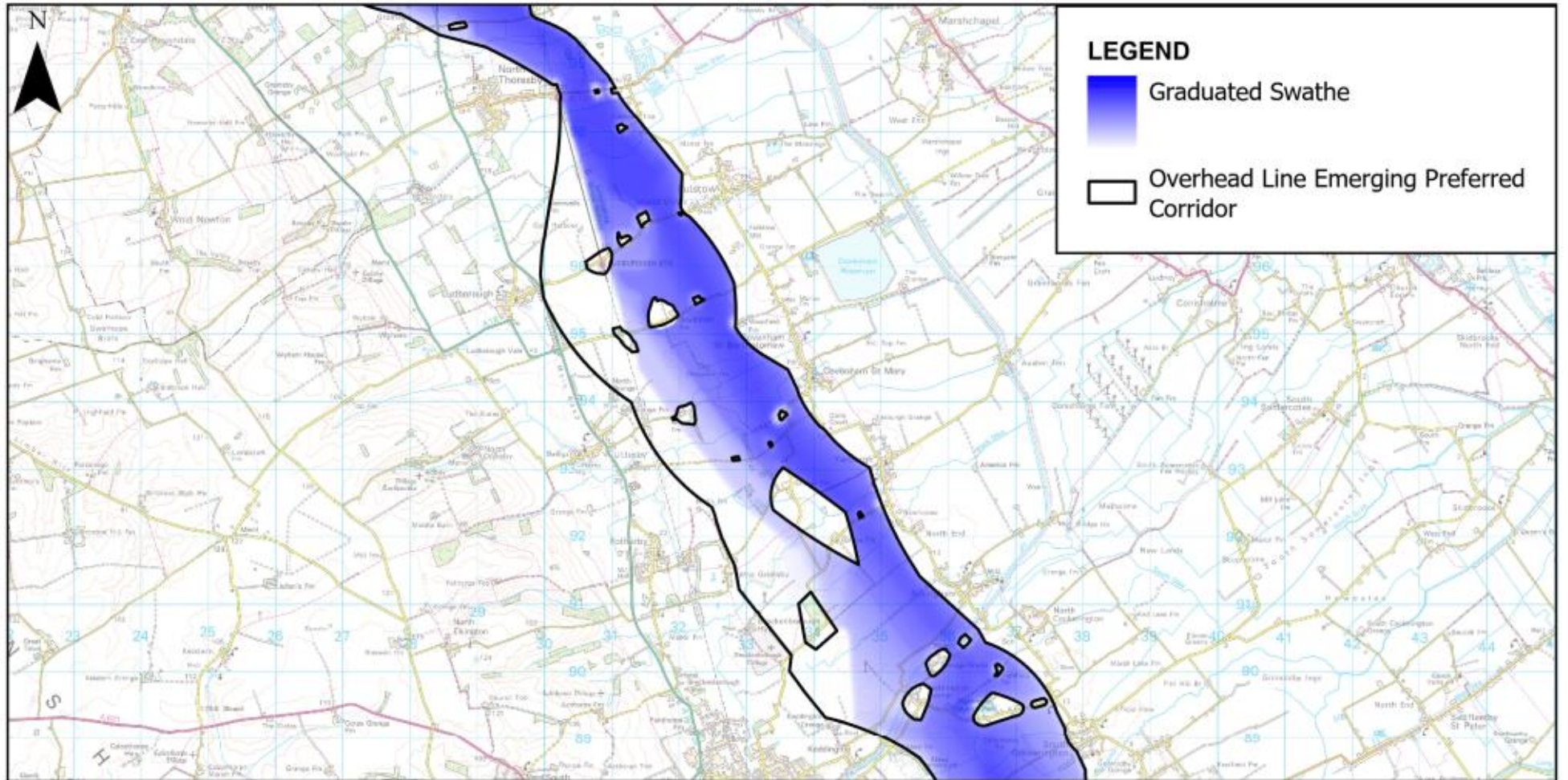
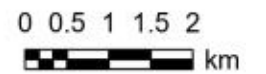


Figure 15-9 - Section 3 (North Thoresby to Alvingham and Keddington)

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SCALE: 1:130,000



#### **Section 4 –Alvingham and Keddington to Tothill**

- 15.3.45 This section of the emerging preferred corridor runs from a point north-east of the village of Keddington and south-west of the village of Alvingham (south of Alvingham Road) to a point immediately east of the village of Tothill. This is shown in **Figure 15-120** below and on Sheet 4 of **Appendix B**.
- 15.3.46 The overhead line would stay west of the properties along Louth Road to avoid a narrow area associated with several properties and farms. From there it would take the shortest, straightest route across the B1200 west of Manby Showground. The overhead line would then route east to retain a greater distance from the AONB (seeking to reduce potential impacts on its setting) and North Reston Farm Airfield.

Figure 15-10 – Section 4 (Alvingham and Keddington to Tothill)

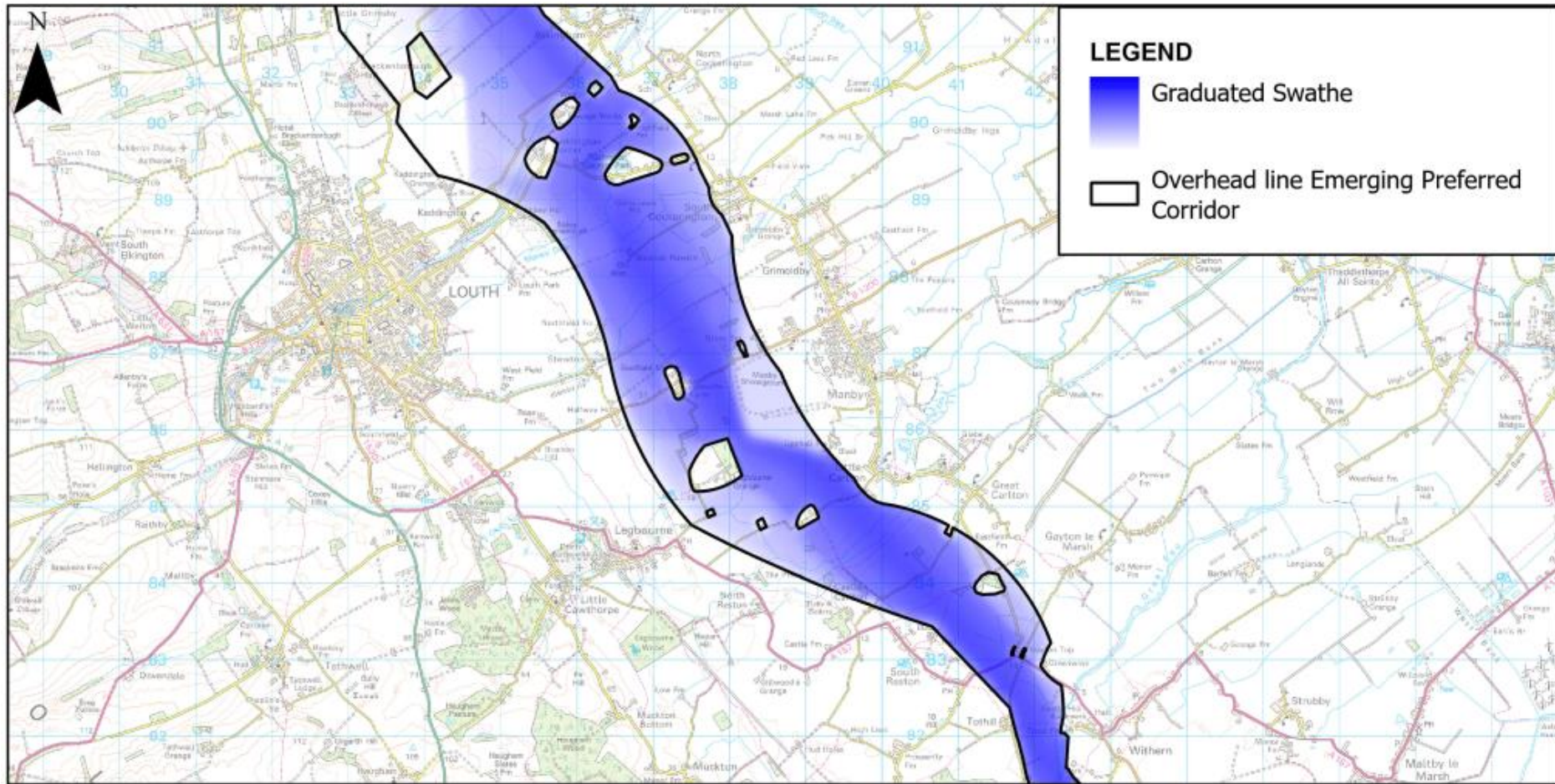
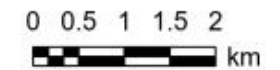


Figure 15-10 - Section 4 (Alvingham and Keddington to Tothill)

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SCALE: 1:115,000



## Section 5 –Tothill to Cumberworth

- 15.3.47 This section of the emerging preferred corridor runs from a point immediately east of the village of Tothill to a point west of the village of Cumberworth. This is shown in **Figure 15-131** below and on Sheet 5 of **Appendix B**.
- 15.3.48 From Tothill the overhead line would continue south routeing east of Mother Wood and west of Woodthorpe Hall Golf Course. Opting for this route would reduce the overall length of the overhead line, avoids the use of multiple angle pylons in this location and maximises the use of Mother Wood as a visual screen between the overhead line and the AONB. This route would also pass through the location of the emerging preference for the siting of LCS infrastructure within siting zone LCS5.
- 15.3.49 The overhead line then routes direct east south of Saleby before routeing south-east, passing Bilsby to the east. This was proposed to maximise the overlap between the overhead line swathe and the location of the emerging preference for the siting of LCS infrastructure within the combined LCS6 and LCS8 siting zone, whilst still avoiding routeing in proximity to residential properties and designated heritage assets in Bilsby and Saleby. From Bilsby the overhead line route would continue southward taking the shortest straightest route through a relatively unconstrained area before routeing through a narrower area between residential and commercial properties west of Cumberworth.



Figure 15-11 – Section 5 (Tothill to Cumberworth)

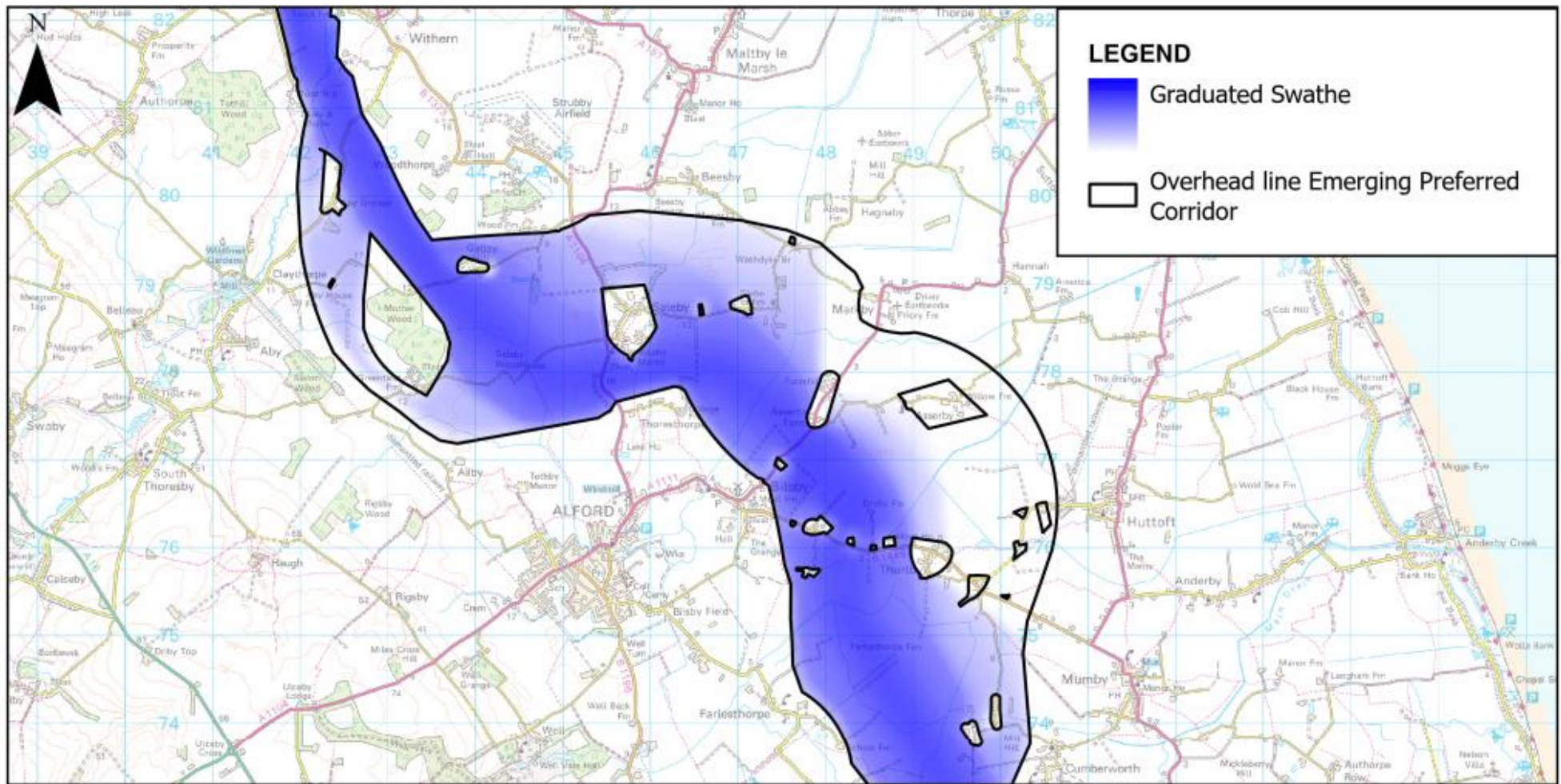
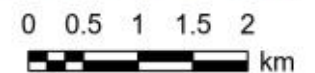


Figure 15-11 - Section 5 (Tothill to Cumberworth)  
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SCALE: 1:100,000



## Section 6 – Cumberworth to Burgh le Marsh

- 15.3.50 This section of the emerging preferred corridor runs from a point west of the village of Cumberworth to a point east of the town of Burgh le Marsh (south of the A158). This is shown in **Figure 15-142** below and on Sheet 6 of **Appendix B**.
- 15.3.51 From Cumberworth the overhead line would continue south, seeking to avoid scattered residential and commercial properties west of Ashington End. The overhead line would then route marginally west within a narrow area east of Burgh Le Marsh to reduce interactions with other NSIP applications with built and proposed NSIP projects already crossing that area within the area including Outer Dowsing OWF and Triton Knoll. However, optionality has been retained to route east of the features at Burgh Le Marsh pending further studies regarding a suitable crossing of the minor road in this section (to be conducted at detailed design).

Figure 15-12 – Section 6 (Cumberworth to Burgh le Marsh)

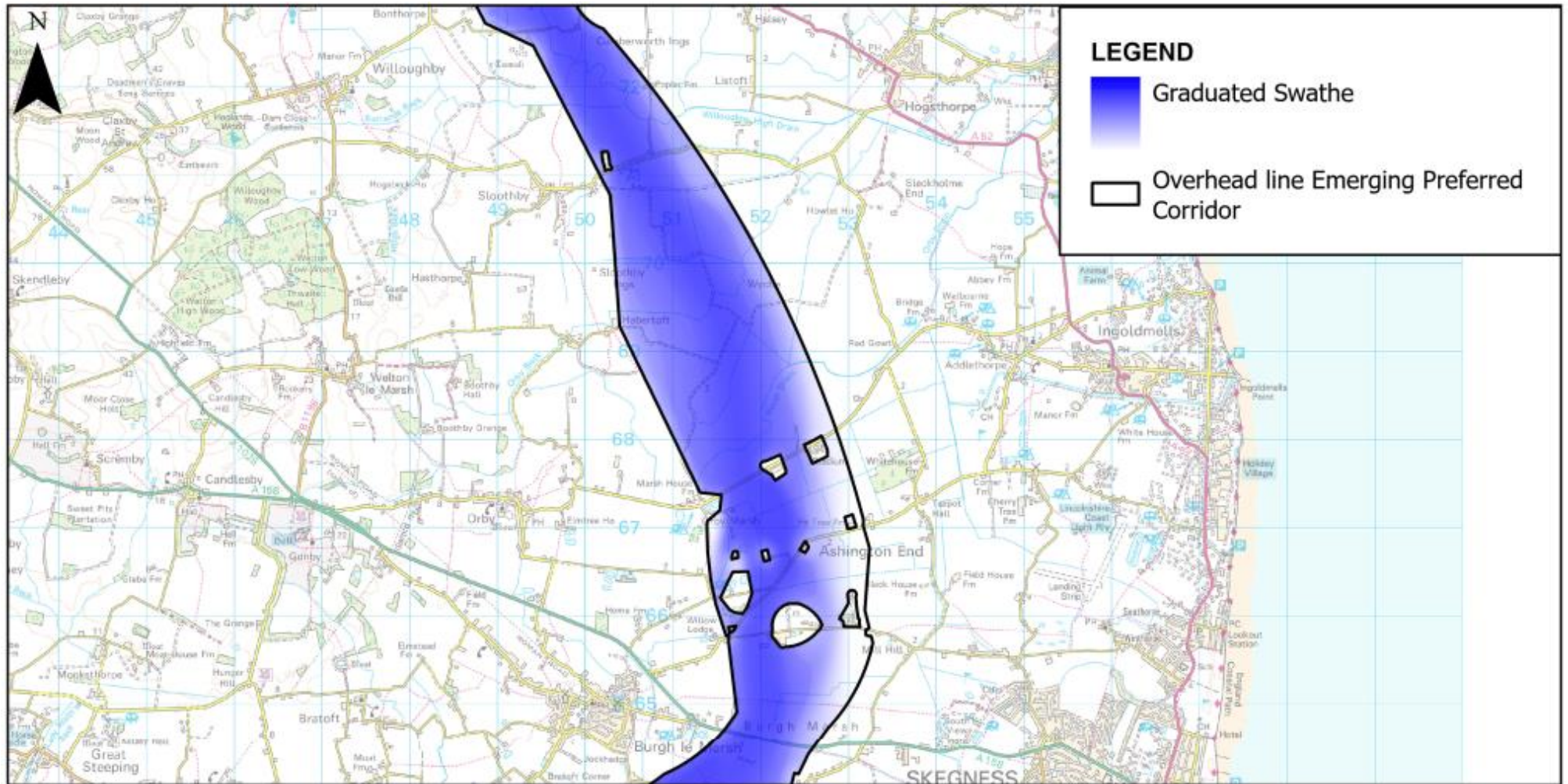


Figure 15-12 - Section 6 (Cumberworth to Burgh le Marsh)

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SCALE: 1:100,000

0 0.5 1 1.5 2  
km

## Section 7 –Burgh le Marsh to Midville

- 15.3.52 This section of the emerging preferred corridor runs from a point east of the town of Burgh le Marsh (south of the A158) to a point west of the village of Midville (south of Fodder Dike). This is shown in **Figure 15-13** below and on Sheet 7 of **Appendix B**.
- 15.3.53 From Burgh Le Marsh the overhead line would route south-west. Given the complexity of routeing through narrower areas along High Lane and Croft Lane, a route through the Hollies Solar Park and Wind Farm is the emerging preference. In line with Holford Rules, this would also increase the separation from the existing 132 kV overhead line (to avoid a wirescape) and seek to reduce visual impacts on residential properties. From this narrow area, the overhead line would continue to route west seeking to maximise separation with the existing 132 kV overhead line to the south as well as existing properties. The route would then run parallel to the Poacher railway line before crossing it north-east of New Leake, aiming to maintain the shortest and most direct route possible through the corridor to reduce both potential landscape impacts and increased costs. The route would then continue south-west following a direct route before turning south at Midville.

Figure 15-13 – Section 7 (Burgh le Marsh to Midville)

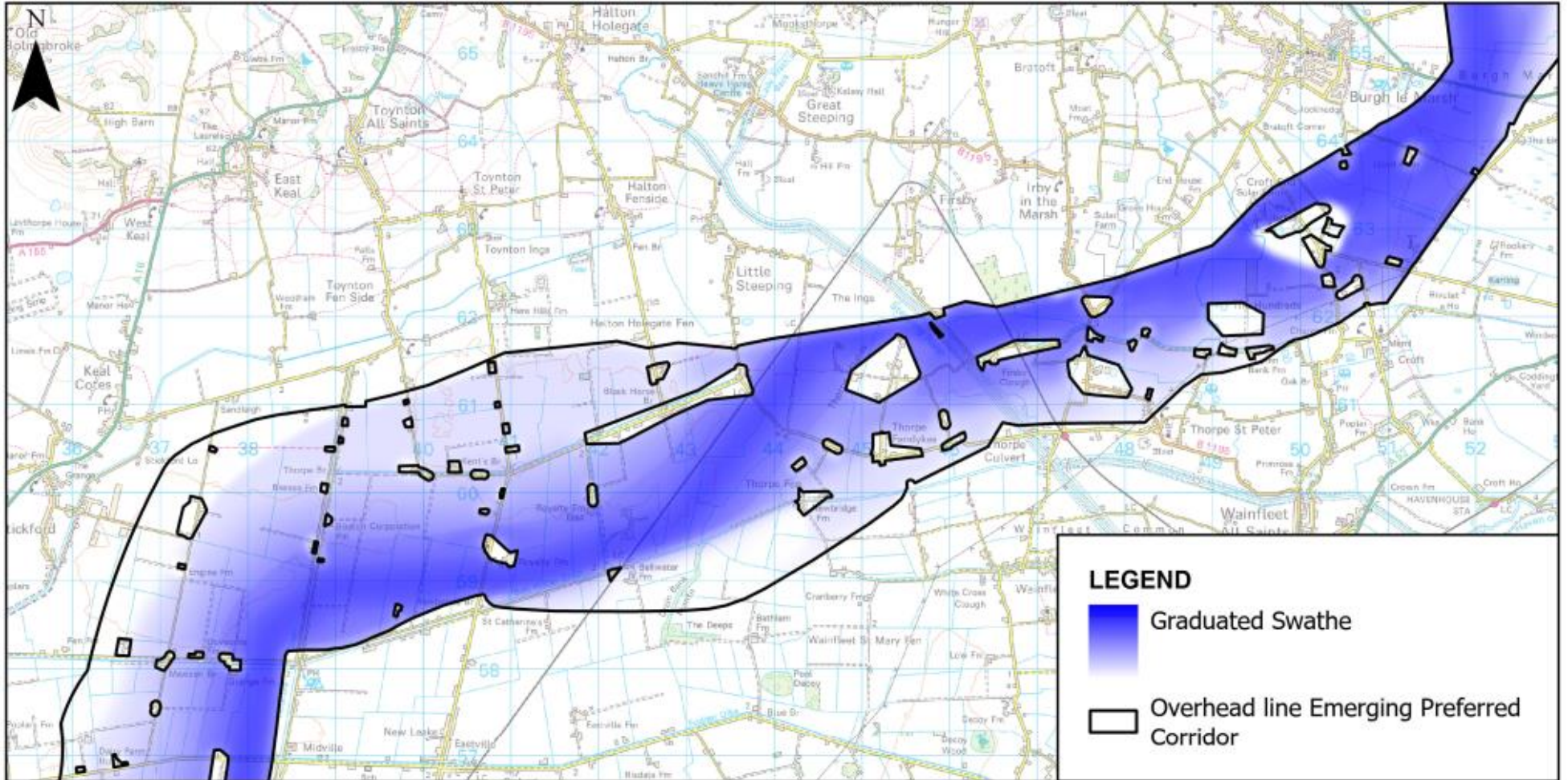


Figure 15-13 - Section 7 (Burgh le Marsh to Midville)

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SCALE: 1:100,000

0 0.5 1 1.5 2  
km

## **Section 8 – Midville to River Witham**

- 15.3.54 This section of the emerging preferred corridor runs from a point west of the village of Midville (south of Fodder Dike) to a crossing of the River Witham between Langrick Bridge and Anton's Gowt. This is shown in **Figure 15-164** below and on Sheet 8 of **Appendix B**.
- 15.3.55 From Midville the overhead line would continue south before turning west at Hobhole Bank. Generally, the constraints are widely spaced between Midville and Sibsey Northlands and as such the route can follow a direct path to reduce the extent of new overhead line in the landscape and also thereby minimising costs.
- 15.3.56 At Sibsey Northlands the overhead line would then turn south with a preference to route west of the areas specifically excluded along West Fen Drain to allow for a straighter route (minimising the number angle pylons required). From West Fen Drain to the River Witham the route is relatively free of constraints allowing for the most direct route to then be taken.

Figure 15-14 – Section 8 (Midville to River Witham)

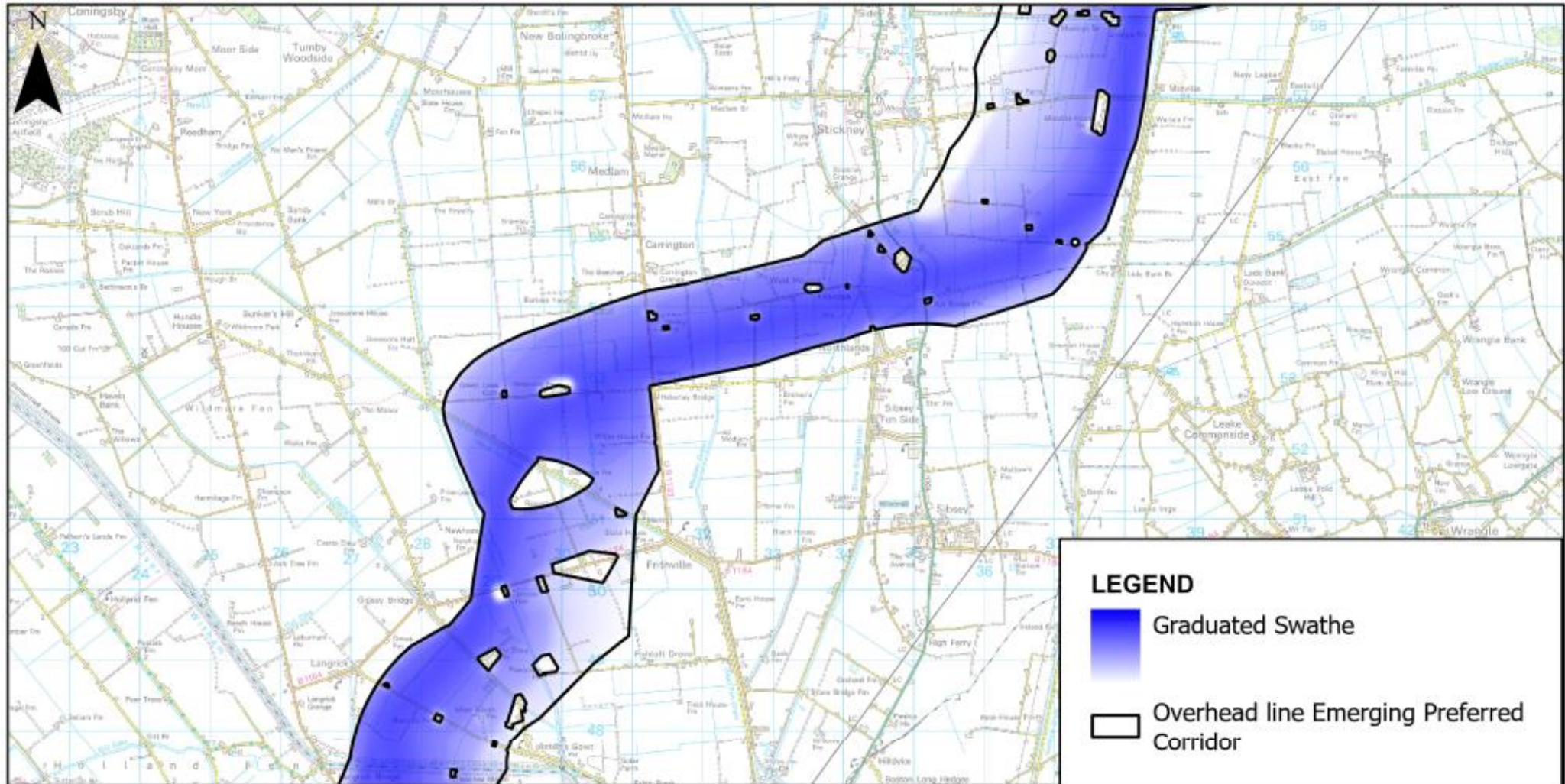


Figure 15-14 - Section 8 (Midville to River Witham)

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SCALE: 1:125,000

0 0.5 1 1.5 2  
km

## Section 9 – River Witham to River Welland

- 15.3.57 This section of the emerging preferred corridor runs from a crossing of the River Witham between Langrick Bridge and Anton's Gowt to a crossing of the River Welland between Spalding and The Wash. This is shown in **Figure 15-175** below and on Sheet 9 of **Appendix B**.
- 15.3.58 From the River Witham, the overhead line would route directly south. South of the River Witham there is a preference to route east of an excluded area of the corridor to maintain a direct route south, thereby minimising costs and reducing the potential for landscape effects in this area. At New Hammond Beck there is a preference for the area to the west due to the presence of fewer properties and curtilages allowing for greater routing flexibility and potentially reducing visual effects compared to a route further east.
- 15.3.59 From New Hammond Beck the route would then continue directly south, taking a route west of Wigtoft to retain distance from the designated sites associated with the Wash. From there, the route would continue south-east towards the River Welland through a relatively unconstrained area. The overhead line would also begin to parallel the existing 4ZM 400 kV overhead line near Risegate Eau, seeking to reduce the level of visual intrusion and creation of a wirescape (in line with the Holford Rules), before then connecting to the emerging preferred area for infrastructure at Weston Marsh.



Figure 15-15 – Section 9 (River Witham to River Welland)

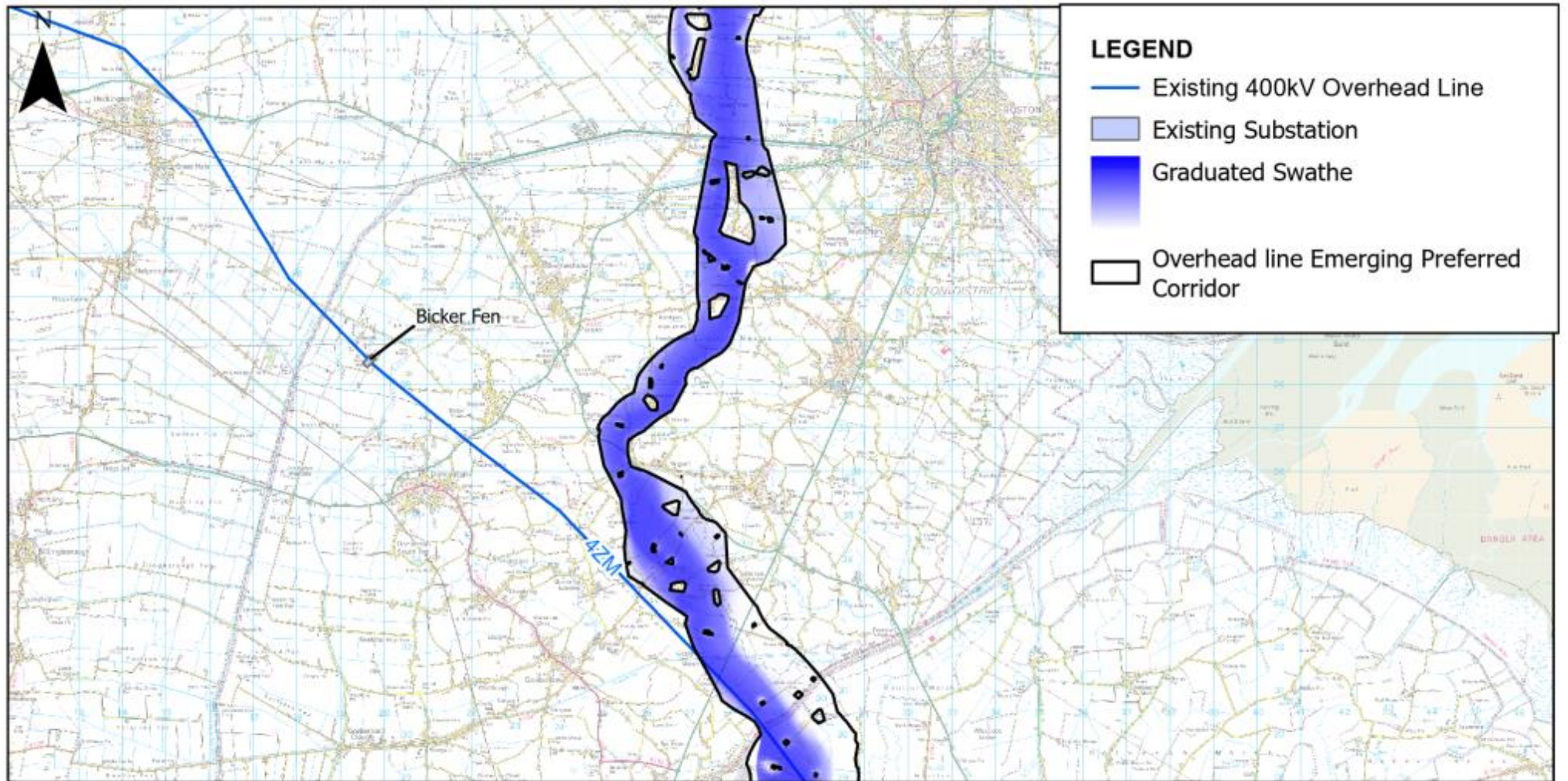


Figure 15-15 - Section 9 (River Witham to River Welland)

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SCALE: 1:200,000



## Section 10 – River Welland to the B1165

- 15.3.60 This section of the emerging preferred corridor runs from a crossing of the River Welland between Spalding and The Wash to a crossing of the B1165 north-west of Whaplode St Catherine. This is shown in **Figure 15-186** below and on Sheet 10 of **Appendix B**.
- 15.3.61 From the River Welland the overhead line would then continue directly south through a relatively unconstrained area before then routing west of Weston, and east of Spalding, crossing the A151. In doing so, the route would seek to maintain separation from potential visual receptors. From here, the overhead line would continue east with optionality to route either side of a small narrow area south of Weston through another relatively unconstrained area before turning south. Heading south the route crosses the B1165 at a narrower area seeking to limit potential impacts upon the setting of a scheduled monument (*King's Hall moated site, 480 m east of Broadwater House Farm*) to the west and upon a settlement to the east.

Figure 15-16 – Section 10 (River Welland to the B1165)

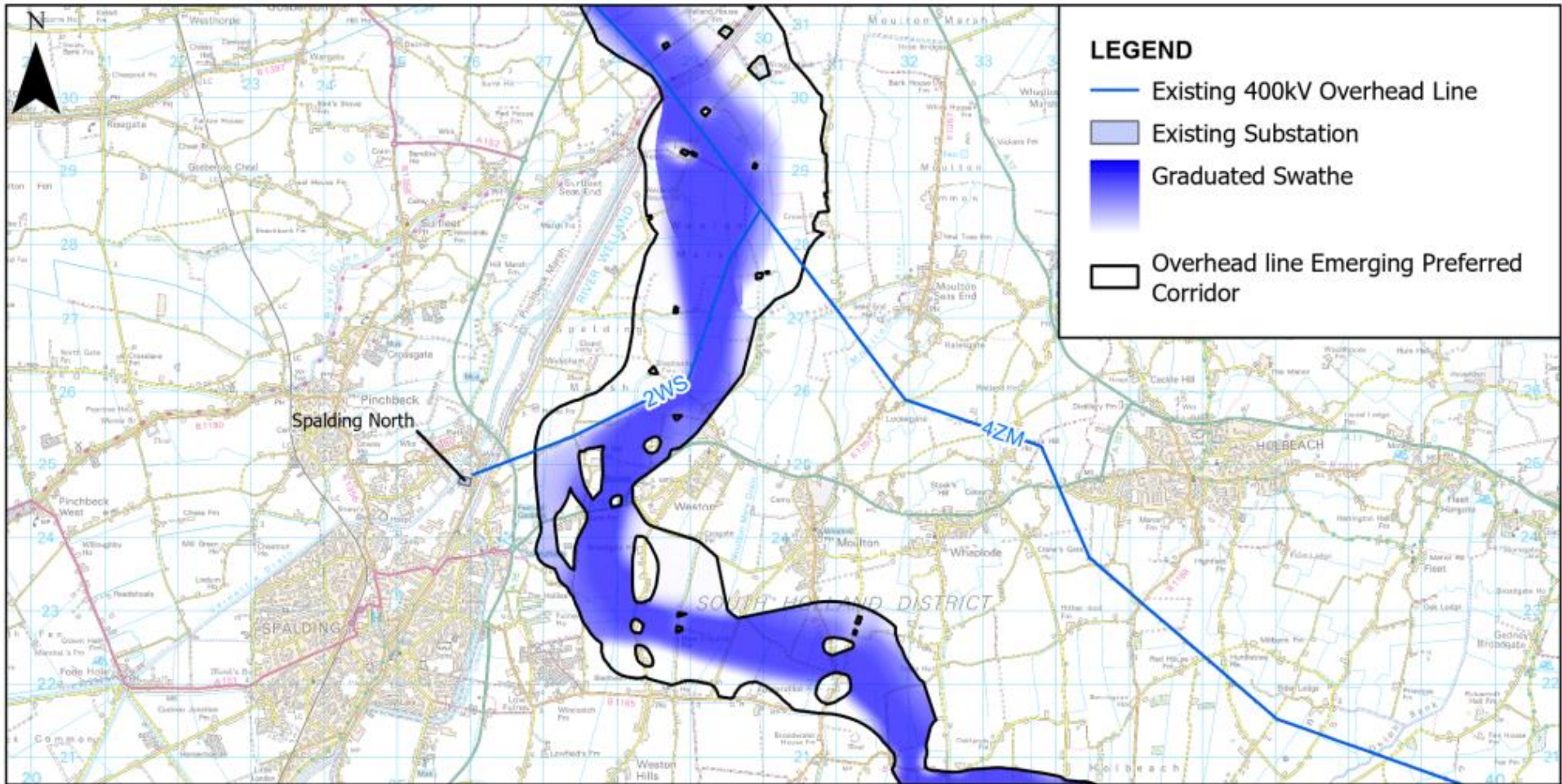


Figure 15-16 - Section 10 (River Welland to the B1165)

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SCALE: 1:120,000



## Section 11 – The B1165 to Walpole

- 15.3.62 This section of the emerging preferred corridor runs from a crossing of the B1165 north-west of Whaplode St Catherine to the new Walpole substation at the existing 4ZM 400 kV overhead line north of Walton Highway. This is shown in **Figure 15-197** below and on Sheet 11 of **Appendix B**.
- 15.3.63 From the B1165 the route would continue south-east, taking the most direct route to limit the amount of infrastructure (and angle pylons) within the landscape. At South Holland Main Drain there is a minor preference to route east to allow for greater routeing flexibility before routeing to the north at Cross Drove to again allow for the most direct line to be taken avoiding a lengthier, less direct and visually intrusive route to the south.
- 15.3.64 The overhead line would then continue east along the most direct route towards the River Nene. Here, a route south of the area excluded along the A1101 is the emerging preference, to allow for greater routeing flexibility and to retain separation from the Wisbech Gas Compressor station. The overhead line would then cross the River Nene taking a direct route into the preferred Walpole siting area at the existing 4ZM 400 kV overhead line.

Figure 15-17 – Section 11 (The B1165 to Walpole)

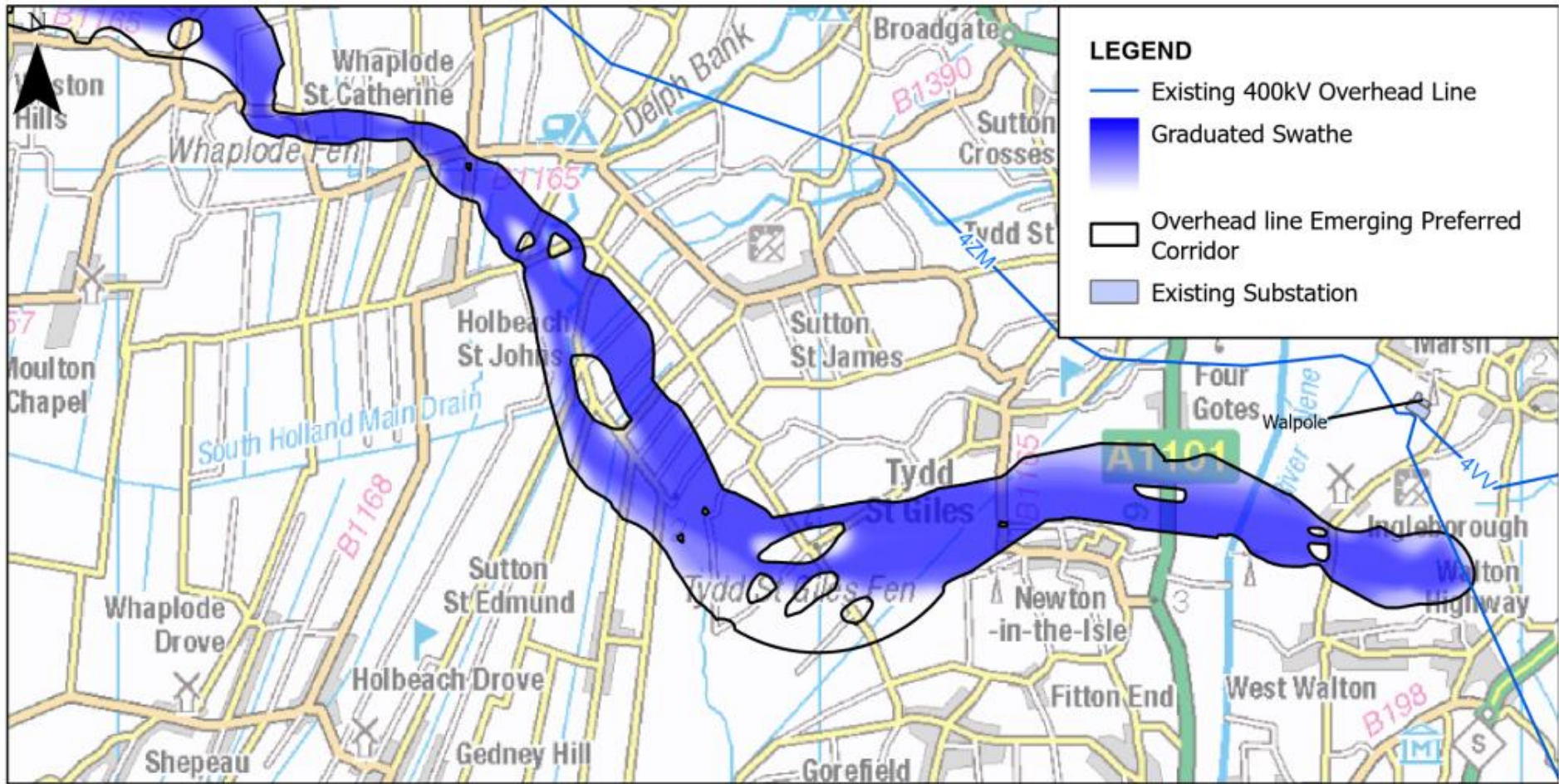


Figure 15-17 - Section 11 (The B1165 to Walpole)

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SCALE: 1:125,000



## 15.4 Summary of the Graduated Swathe

- 15.4.1 The graduated swathe, for non-statutory consultation, as shown in the figures presented in this chapter and in **Appendix B** depicts the graduated swathe itself, existing 400 kV overhead lines and key environmental, socio-economic and technical features that directly inform the overall graduated swathe. On these figures the existing 400 kV overhead lines (from north to south these are the 4KG, 4ZM between Bicker Fen and Walpole, the 2WS and the 4ZM between Burwell and Walpole) is, shown as a dark blue line.

## 15.5 Conclusion

- 15.5.1 The graduated swathe represents the current thinking on where the Project infrastructure is more likely to be located based on the current appraisals of constraints that have been identified. This will be further informed by feedback received during consultation and therefore there is the potential for the current indicated preference to move within the corridor. In some instances, feedback may indicate that the preference should be to route through areas currently being shown as less preferable. This will be addressed at the next stage of the project. We shall also summarise the feedback within a consultation report during the next stage of the project when feedback has been fully reviewed. This will be fully considered through the development of the Project, whilst maintaining the principles used to develop the current graduated swathe such as, for instance, the avoidance where practicable of areas of highest constraint such as settlements.

# 16. Summary and Next Steps

# 16. Summary and Next Steps

## 16.1 Summary of Options Identification and Selection Process (Stage 2)

- 16.1.1 A detailed Options Identification and Selection Process (Stage 2) (see **Chapter 4**) has been undertaken to identify the proposed substation zones and siting areas for new substations at Grimsby West, LCS-A, LCS-B, Weston Marsh and Walpole. It sought to connect these proposed substations by a proposed corridor for a 400 kV electricity transmission connection. The connection is expected to wholly or largely comprise of a new overhead line. NGET will also need to replace short sections of existing 400 kV overhead line and commission local changes to the lower voltage distribution networks and other utilities to facilitate the construction of the new overhead line.
- 16.1.2 For the Project, three preliminary overhead line corridors, a preliminary underground cable corridor, four siting areas at Grimsby West, twelve siting zones for the LCS, four siting zones at Weston Marsh and six siting zones at Walpole were identified and appraised (in **Chapter 6** to **Chapter 14**). The preliminary corridors were divided in Sections and Connection Links for appraisal, and the identification of an emerging preferred corridor. Following appraisal of the Sections, Links, Siting Zones and Siting Areas, an end-to-end review was then undertaken between Grimsby West and Walpole via the LCS and Weston Marsh. This review considered each preferred Section or Link of the preliminary corridor, siting zones or siting areas in the context of the wider end-to-end solution. The reasoning and justification for progressing each individual element was tested to ensure that it remained robust when considered in the context of the whole route. The wider end-to-end solution review also incorporated cost and programme performance, reported in **Chapter 13**. The review did not result in any amendments to the emerging preferred corridor, siting zones or siting areas.
- 16.1.3 In summary, the emerging preferred siting areas, siting zones and corridor for a new overhead line are as follows:
- **Connection between Grimsby West and Walpole** – the connection routes between Grimsby West and Walpole via LCS-A, LCS-B and Weston Marsh
    - As described in **Chapter 6**, between Grimsby West and Burgh le Marsh, three overhead line corridors (Eastern, Western and Central) were defined and reviewed alongside an underground cable adjacent to the Western Corridor along with Links between corridors. The corridor emerging as preferred (see **Chapter 13**) between Grimsby West and Burgh le Marsh comprises the Sections E1, C1 to C6 and W7 to W13, Link E12-W13/W13-E12, Sections E12 to E14 and C7. It is considered that a route following these Sections and Links represents the best opportunity to limit environmental and socio-economic impacts and technical complexity, whilst also representing the most direct, and a lower cost route (except for linking Section W13 and Section E12 where a local deviation of approximately 800 m is proposed to avoid Alford, routing in proximity to the AONB and to connect to the LCS siting zones emerging as preferred).



- As described in **Chapter 7**, between Burgh le Marsh and Weston Marsh, three Corridors (Northern, Southern and Central) were defined and reviewed alongside Links between them. The corridor emerging as preferred (see **Chapter 13**) comprises Sections C8 to C13, N6, N7 and C14 to C16, Link C16-S8, Sections S8 to S10A, S11, C20 and C21A. A route following these Sections and Links represents the best opportunity to limit environmental and socio-economic impacts (in part by limiting the length and therefore amount of infrastructure required) and technical complexity, whilst also representing the most direct and least cost route.
- As described in **Chapter 8**, between Weston Marsh and Walpole, three Corridors (Northern, Southern and Central) were defined and reviewed alongside Links between these corridors. The corridor emerging as preferred (see **Chapter 13**) comprises Sections C22 to C28A. A route following these Sections and Links represents the best opportunity to limit environmental and socio-economic impacts and technical complexity, whilst avoiding potential compulsory acquisitions or oversail of residential properties.
- **New Grimsby West substation** - siting area GW5 was identified as the emerging preference (see **Chapter 13**). This was because the siting area offers greater opportunities to limit the spread of environmental effects and effects upon adjacent land uses. It also offers the opportunity to use existing vegetation screening and, where possible, site within existing NGET land ownership. Use of the siting area reduces the required overhead line lengths for the new (replacement) 132 kV circuits to the 132 kV substation and limits extents of overhead line entry work required. The siting area also best aligns with the Horlock and Holford Rules.
- **Two new LCS substations** – of the 12 siting zones considered (LCS1-LCS12, as set out in **Chapter 8**) those identified as most suitable for either LCS-A or LCS-B were an iteration of LCS5, LCS8 and LCS11. None were considered suitable to accommodate both LCS-A and LCS-B. Following an in-combination comparative appraisal, considering the corridor emerging as preferred (as detailed in **Chapter 11**), siting zones LCS5, LCS6 and LCS8 were identified as the emerging preferences. Siting zones LCS6 and LCS8 were combined (including the area between them) to offer the best opportunity to limit potential effects upon identified constraints as neither was identified as an outright preference in combination with LCS5. The combined LCS6 and LCS8 siting zone, in addition to an amended LCS5, were identified as preferred. These siting zones offer the best opportunity to limit potential landscape and visual effects in-combination and help to reduce the potential for other environmental and socio-economic effects whilst minimising the length of overhead line/underground cable required as well as technical complexity during construction and operation. The siting zones also best align with the Horlock and Holford Rules.
- **New Weston Marsh Substation** - Siting zone WMZ3 was identified as the emerging preference (see **Chapter 13**). This was because the siting zone offered the greatest opportunities to limit the spread of environmental effects, shortest overhead line deviations of two existing overhead lines, and reduced technical complexity during construction and operation by siting closest to the Spalding Tee-Point. The siting zone also best aligns with the Horlock and Holford Rules.
- **New Walpole Substation** - Siting zones WLP4 and WLP5 were identified as the emerging preferences (see **Chapter 13**). This was because the siting zones offer the

greatest opportunity to limit the spread of environmental effects, shortest overhead line deviations to connect the existing 4ZM 400 kV overhead line, reduced technical complexity during construction and operation, and limit the length of connections for the Project and the EGL 3 and EGL 4 Projects. The siting zones also best align with the Horlock and Holford Rules.

- 16.1.4 Following the identification of the preferred route corridor and preferred siting areas, a graduated swathe has been identified within these. The graduated swathe is a way of showing the areas within the emerging preferences where the required Project infrastructure is considered more or less likely to be located. The graduated swathes are shown with a colour shading, with the depth of shading indicating NGET's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, while lighter shading indicates less likely locations.
- 16.1.5 The use of the graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor, siting zones and siting areas. The graduated swathe represents the current thinking on where the Project infrastructure may be located. This will be informed by feedback received during non-statutory consultation and therefore there is the potential for the final design of the Project to extend beyond the graduated swathe. This will be fully considered through the development of the Project, whilst maintaining the principles used to develop the current graduated swathe, for instance, the avoidance of areas of highest constraint such as settlements.

## **16.2 Non-statutory Consultation**

- 16.2.1 This report will be used as part of the non-statutory consultation and engagement with key stakeholders, including landowners and the public. The non-statutory consultation will take place in January 2024.
- 16.2.2 During the non-statutory consultation, feedback will be gathered from consultation events and feedback forms on the preferences identified in this report and the graduated swathe which highlights where infrastructure is more likely to be located.
- 16.2.3 The preferences (siting zones, siting areas and corridors) identified in this report, in conjunction with the other elements of the Options Identification and Selection Process (Stage 2), will be kept under review throughout the development of the Project.

## **16.3 Analysing Non-statutory Consultation Feedback**

- 16.3.1 The feedback from non-statutory consultation will inform the further development of the Project.
- 16.3.2 Information from surveys undertaken to obtain baseline data and ongoing design studies will also inform the development of the Project.

## **16.4 Defined Proposal and Statutory Consultation (Stage 3)**

- 16.4.1 Following the completion of non-statutory consultation, including the analysis of the feedback, NGET will commence the Defined Proposal and Statutory Consultation Stage

(Stage 3). As part of this, the design will be subject to an EIA, further statutory consultation, and iterative design development prior to submission of the application for a DCO.

