



Scotland England Green Link 2 - English Onshore Scheme

Environmental Statement:
Volume 2

Chapter 3: Description of the English
Onshore Scheme

May 2022

For: National Grid Electricity Transmission

Table of Contents

3.	Description of the English Onshore Scheme.....	3-1
3.1	Introduction	3-1
3.2	Scotland England Green Link 2: Peterhead to Drax	3-1
3.2.1	Scottish Onshore Scheme	3-1
3.2.2	Marine Scheme	3-2
3.2.3	English Onshore Scheme	3-2
3.3	Description of the English Onshore Scheme	3-4
3.3.1	Overview	3-4
3.3.2	The Landfall	3-10
3.3.3	The Underground DC Cable Route	3-11
3.3.4	The Converter Station and Underground AC Cable Route.....	3-40
3.4	References.....	3-50

Figures

Figure 3-1	Overview of the SEGL2 HVDC Transmission Link.....	3-3
Figure 3-2:	English Onshore Scheme Planning Application Boundary	3-6
Figure 3-3:	Proposed Landfall Location.....	3-9
Figure 3-4:	Indicative Landfall HDD Cross Section.....	3-10
Figure 3-5:	Underground DC Cable Route Details.....	3-16
Figure 3-6:	Indicative Working Width.....	3-25
Figure 3-7:	Indicative Converter Station at the Proposed Converter Station Site.....	3-40
Figure 3-8:	Proposed Converter Station Site.....	3-44
Figure 3-9:	Converter Station Permanent Footprint, Landscape Design and Biodiversity Offsetting Areas	3-45

Tables

Table 3-1:	Key Parameters of Scotland England Green Link 2.....	3-1
Table 3-2:	English Onshore Scheme within Local Planning Authority Boundaries	3-4
Table 3-3:	Landfall – Summary of Key Characteristics.....	3-11
Table 3-4:	Underground DC Cable Route – Summary of Key Characteristics	3-12
Table 3-5:	Schedule of Underground DC Cable HDD Crossings.....	3-29
Table 3-6:	Duration of Likely Installation Methods – Cabling Works	3-38
Table 3-7:	Converter Station – Summary of Key Characteristics.....	3-41
Table 3-8:	Underground AC Cable Route – Summary of Key Characteristics.....	3-46
Table 3-9:	Indicative Converter Station Construction Programme	3-49

3. Description of the English Onshore Scheme

3.1 Introduction

This chapter of the Environmental Statement (ES) provides an overview of Scotland England Green Link 2 (SEGL2) (the ‘Project’) and in particular presents a description of the English Onshore Scheme. It outlines the main components of the English Onshore Scheme including details of its design, construction and operation.

3.2 Scotland England Green Link 2: Peterhead to Drax

As outlined in **Chapter 1: Introduction**, the Project is a proposed 2 gigawatt (GW) reinforcement of the electricity transmission system, which will provide additional north-south transmission capacity across transmission network boundaries ensuring that green energy is transported from where it is produced to where it is needed.

The Project consists of a subsea High Voltage Direct Current (HVDC) link between Peterhead, Aberdeenshire and Drax, North Yorkshire, as illustrated in **Figure 1-1 (Chapter 1 Introduction)**. It comprises approximately 508 km of subsea and underground HVDC cables between new converter stations at each end of the electricity transmission link. These in turn are connected to the existing National Electricity Transmission Network (NETS) via high voltage alternating current (HVAC) cables between the new converter stations and existing substations. The key components of the Project are outlined in **Table 3-1** and illustrated in **Figure 3-1**.

Table 3-1: Key Parameters of Scotland England Green Link 2

Factor	Details
Link capacity	Up to 2 GW
Cable rating	+/-525 kilovolt (kV)
Operational lifespan	40 years
Total Project length (end to end)	508 km
Scottish Onshore Scheme	<ul style="list-style-type: none"> Location: Peterhead, Aberdeenshire Length of AC cables: approximately 500 m Length of underground DC cables: approximately 2 km from converter station to MLWS.
Marine Scheme	Length of subsea cables (Scotland and England): approximately 436 km
English Onshore Scheme	<ul style="list-style-type: none"> Location: East and North Yorkshire Length of underground DC cables: approximately 69 km Length of AC Cables: approximately 500 m

Transmission projects such as the Project use Direct Current (DC) technology because it is more efficient at transmitting large volumes of electricity over longer distances with lower losses than an equivalent Alternating Current (AC) system, and also because a DC system provides a greater degree of control over the magnitude and direction of flow. This flexibility brings operational benefits, however, in order to transmit electricity in DC form, specialist electrical equipment contained within converter stations at either end of the Project is required to convert from AC to DC (or vice versa).

For the purposes of seeking the necessary consents the Project has been split as detailed below.

3.2.1 Scottish Onshore Scheme

The Scottish Onshore Scheme comprises a converter station located south of the town of Peterhead, Scotland, with approximately 2 km of buried HVDC cable to a landfall at Sandford Bay. The converter

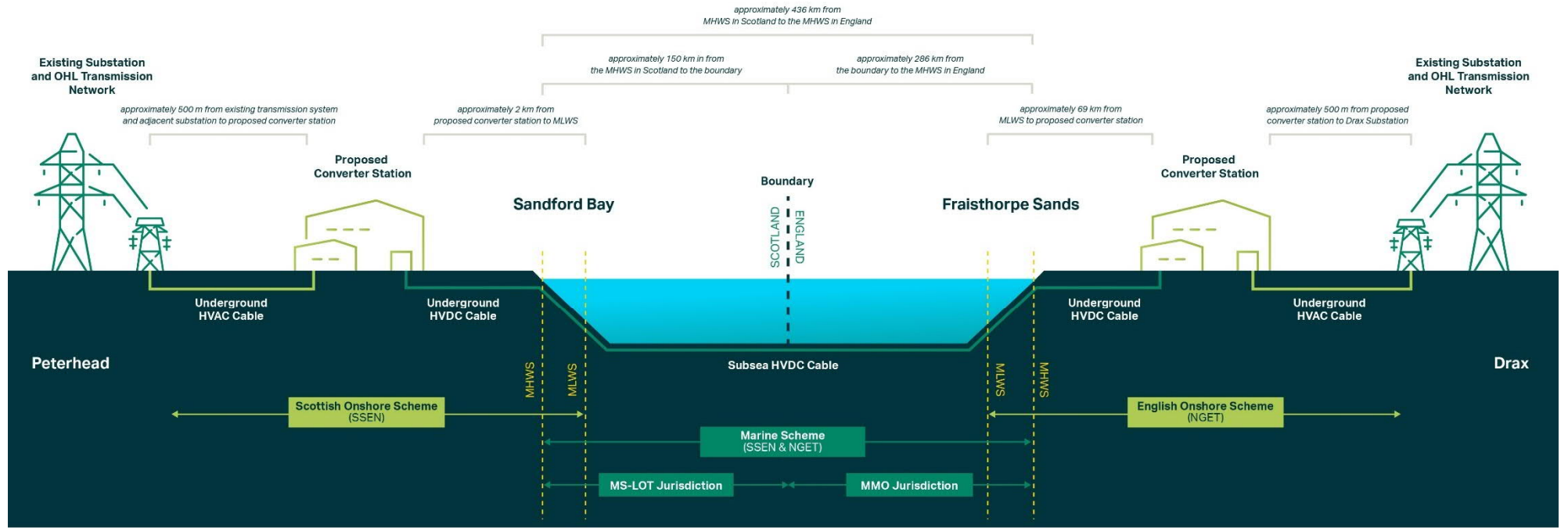
station will be connected to the Peterhead 400 kV substation (currently under construction) by approximately 500 m of HVAC cable. The substation connects the Project to the existing transmission system in Scotland. The Scottish Onshore Scheme has been progressed by Scottish and Southern Electricity Networks (SEN), and an environmental appraisal of the Scottish Onshore Scheme has been undertaken with the results reported in an Environmental Appraisal Report which accompanies the planning application to Aberdeenshire Council (planning reference APP/2021/2681).

3.2.2 Marine Scheme

The Marine Scheme comprises approximately 436 km of subsea HVDC cable from Sandford Bay, Peterhead to Fraisthorpe, East Riding of Yorkshire Council (ERYC). The Marine Scheme is being developed jointly by NGET and SEN who will be submitting marine licence applications to the Marine Scotland Licensing Operations Team (MS-LOT) and the Marine Management Organisation (MMO). Scoping advice confirmed that the Marine Scheme is not considered to be 'EIA Development', however a non-statutory Environmental Appraisal Report will support the licence applications.

3.2.3 English Onshore Scheme

The English Onshore Scheme comprises approximately 69 km of underground HVDC cable from the landfall at Fraisthorpe within ERYC, to the proposed converter station at Drax, within Selby District Council (SDC). The converter station will be connected to the existing 400 kV Drax Substation by approximately 500 m of HVAC cable. A more detailed description of the English Onshore Scheme follows in subsequent sections of this chapter.



Key:
 HVDC - High Voltage Direct Current
 HVAC - High Voltage Alternating Current
 OHL - Overhead Line
 MHWS - Mean High Water Springs
 MLWS - Mean Low Water Springs
 MMO - Marine Management Organisation
 MS-LOT - Marine Scotland Licensing Operations Team
 NGET - National Grid Electricity Transmission
 SSEN - Scottish and Southern Energy Networks

Figure is not to scale.

Figure 3-1 Overview of the SEGL2 HVDC Transmission Link

3.3 Description of the English Onshore Scheme

3.3.1 Overview

As outlined in Chapter 1: Introduction and section 3.2.3, the English Onshore Scheme comprises the Project components from Mean Low Water Springs (MLWS) where the Marine Scheme makes landfall at Fraisthorpe to the proposed converter station at Drax. **Figure 3-2** provides an overview of the planning application boundary for the English Onshore Scheme. It is noted that the boundaries for the English Onshore Scheme and the Marine Scheme overlap in the intertidal zone between MLWS and Mean High Water Springs (MHWS).

At the proposed landfall site, the English Onshore Scheme extends from MLWS across the intertidal zone with two submarine HVDC cables and one fibre optic cable, which will terminate at a buried transition joint pit (TJP). From the TJP, the proposed underground HVDC cable route extends for approximately 69 km inland in a broadly south western direction until it reaches the proposed converter station site at Drax. The proposed underground cable crosses through both ERYC (approximately 67 km) and SDC (approximately 2 km) authority areas. The proposed converter station will convert the electricity from DC to AC and will be connected to the existing NETS at the existing 400 kV Drax Substation by approximately 500 m of underground HVAC cable directly across New Road. Access to the converter station will be provided by a new permanent access road off the existing New Road immediately west of the proposed converter station site.

An overview of the extent of the English Onshore Scheme within each Local Planning Authority (LPA) boundary is set out in **Table 3-2**.

Table 3-2: English Onshore Scheme within Local Planning Authority Boundaries

LPA	English Onshore Scheme Details
East Riding of Yorkshire Council	<ul style="list-style-type: none"> Length of underground DC cable route: approximately 67 km Area of Planning Application Boundary: 594 hectares (ha)
Selby District Council	<ul style="list-style-type: none"> Length of underground DC Cable Route: approximately 2 km Converter station platform: maximum 5 ha (excluding earthworks batter and the permanent access road) Length of underground AC Cable Route: approximately 500 m Also includes: <ul style="list-style-type: none"> permanent access, drainage attenuation and compensation, and landscaping. Area of Planning Application Boundary: 35 ha
Total planning application boundary	629 ha

As noted in **Chapter 1: Introduction**, section 1.5 and **Table 1-1**, a hybrid planning permission will be sought from the LPAs for the English Onshore Scheme, with full planning permission sought in ERYC (underground DC cable route) and full (underground DC and AC cable routes) and outline planning permission (proposed converter station) sought in SDC. The level of detail within the design is commensurate to this approach, setting out maximum parameters within which the English Onshore Scheme will be designed and installed/constructed. The finalised design of the English Onshore Scheme is contractor-dependent and subject to a competitive tender process.

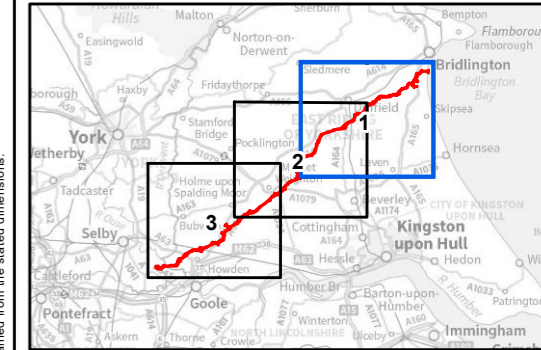
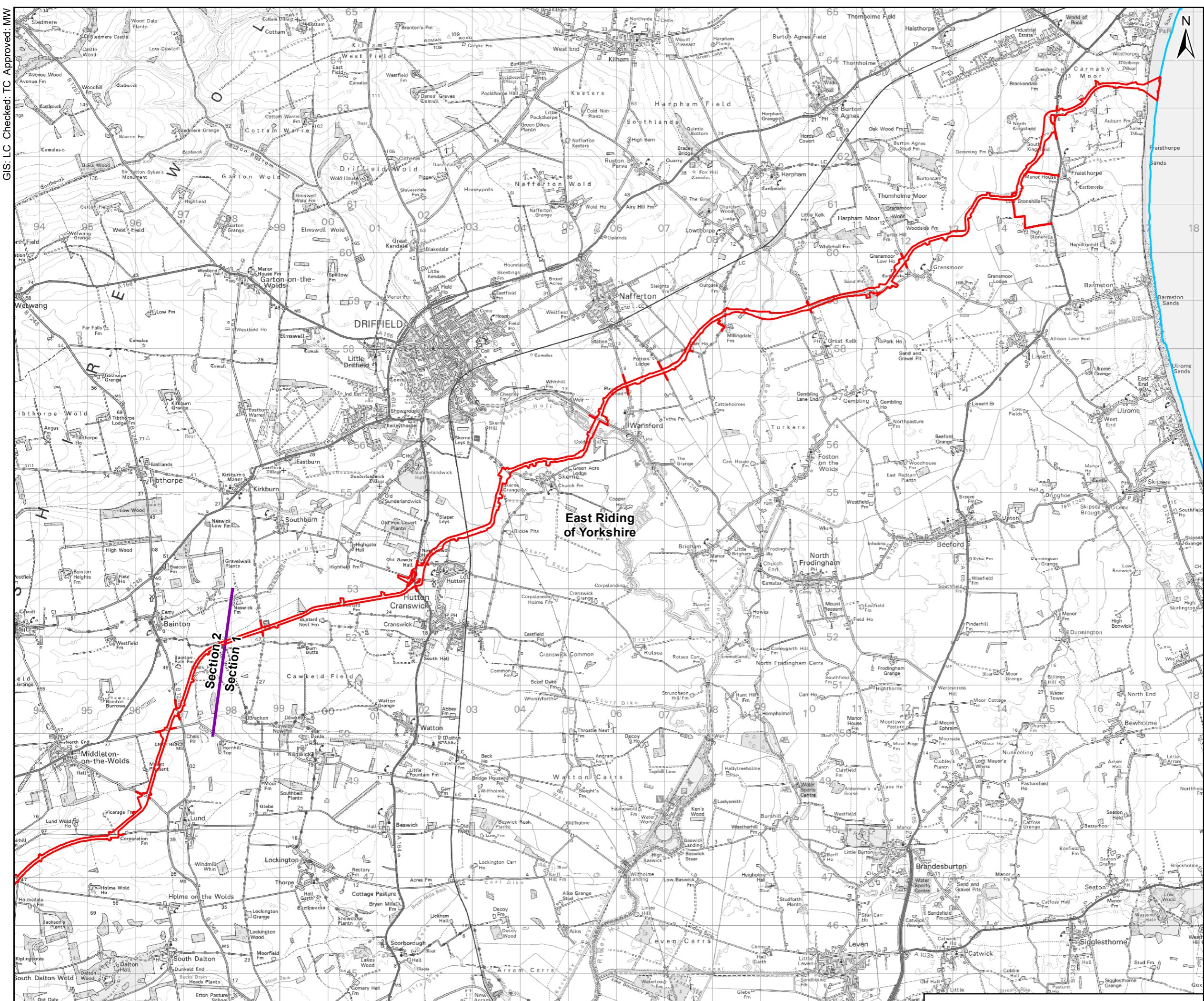
The Rochdale Envelope approach will be used for the converter station for which the Applicant is seeking outline planning permission. This allows specific maximum parameters to be assessed for which the likely significant effects are established and assessed on a realistic 'worst case' basis. This allows sufficient flexibility for the appointed Contractor's final design to be undertaken within these parameters. Such an approach is common for major infrastructure projects and is typically referred to as a 'Rochdale Envelope' after the legal cases which established its precedent (Ref 3-1).

The planning application for the underground DC and AC cable routes includes a Limit of Deviation (LoD). This provides for reasonable flexibility in the planning permission for the cable route to avoid areas of sensitivity or risk (such as unsuitable ground or previously unknown archaeological sites)

identified during construction. Through most of the proposed route the LoD are approximately 20 m (i.e. 10 m either side) beyond the working width. As a result, the planning application boundary is typically 60 m wide through for most of the proposed route. It should be noted that, the LoD are wider in areas of greater risk, such as at sensitive crossing locations.

PROJECT
Scotland England Green Link 2

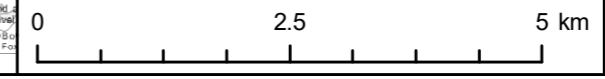
- KEY
- Planning Application Boundary
 - Route Section Break
 - Mean Low Water Springs



TITLE
**Figure 3-2
English Onshore Scheme Planning
Application Boundary**

REFERENCE
SEGL2_T_ES_3-2_v2_20220526

SHEET NUMBER 1 of 3 DATE 26/05/2022

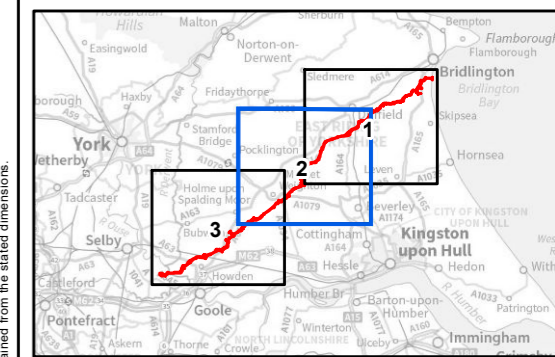
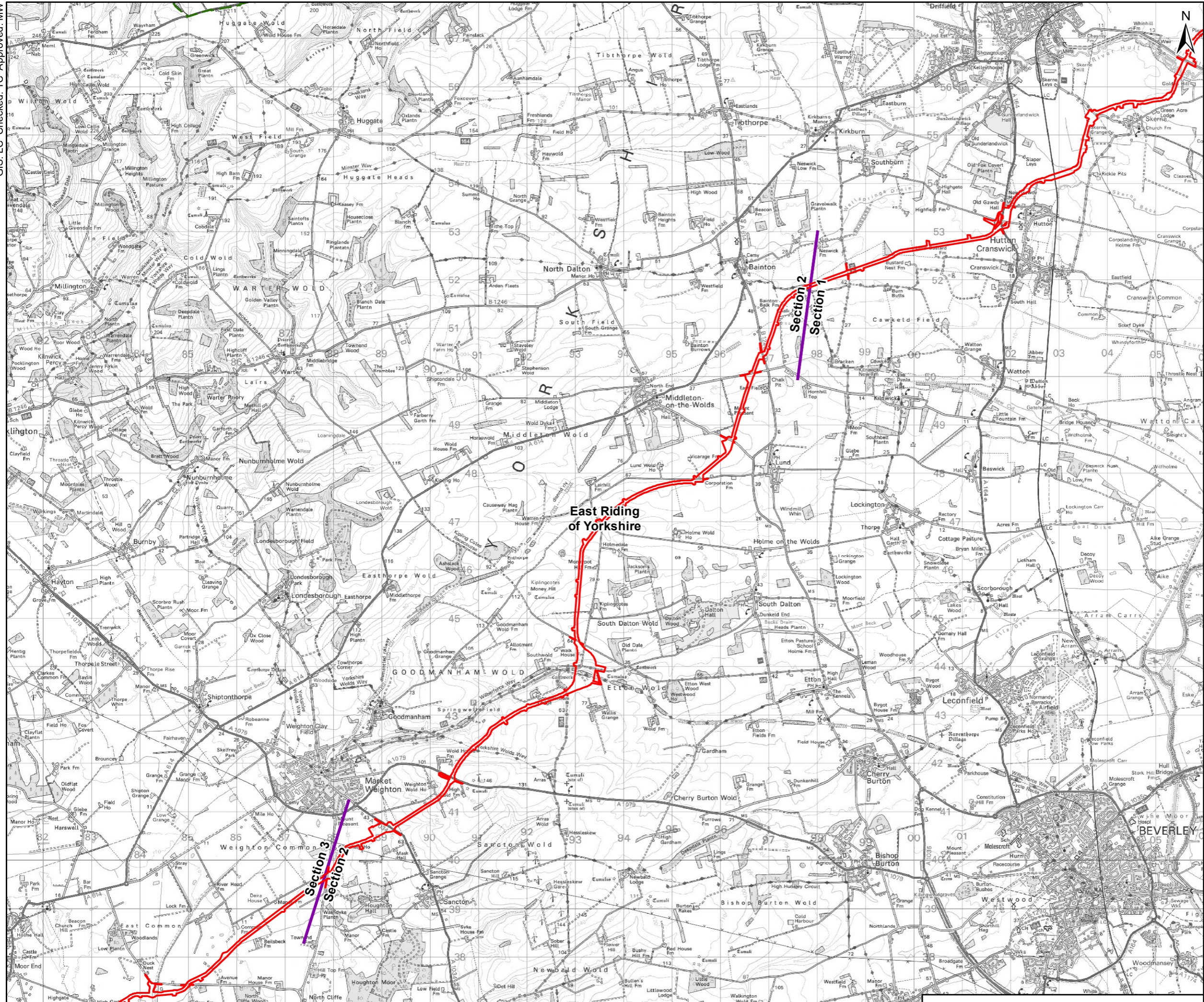


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PROJECT
Scotland England Green Link 2

- KEY
- Planning Application Boundary
 - Route Section Break
 - District Borough Unitary Boundary

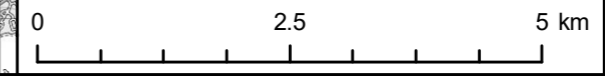


TITLE
**Figure 3-2
English Onshore Scheme Planning
Application Boundary**

REFERENCE
SEGL2_T_ES_3-2_v2_20220526

SHEET NUMBER DATE
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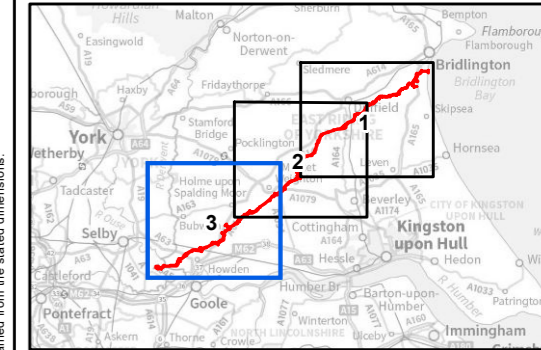
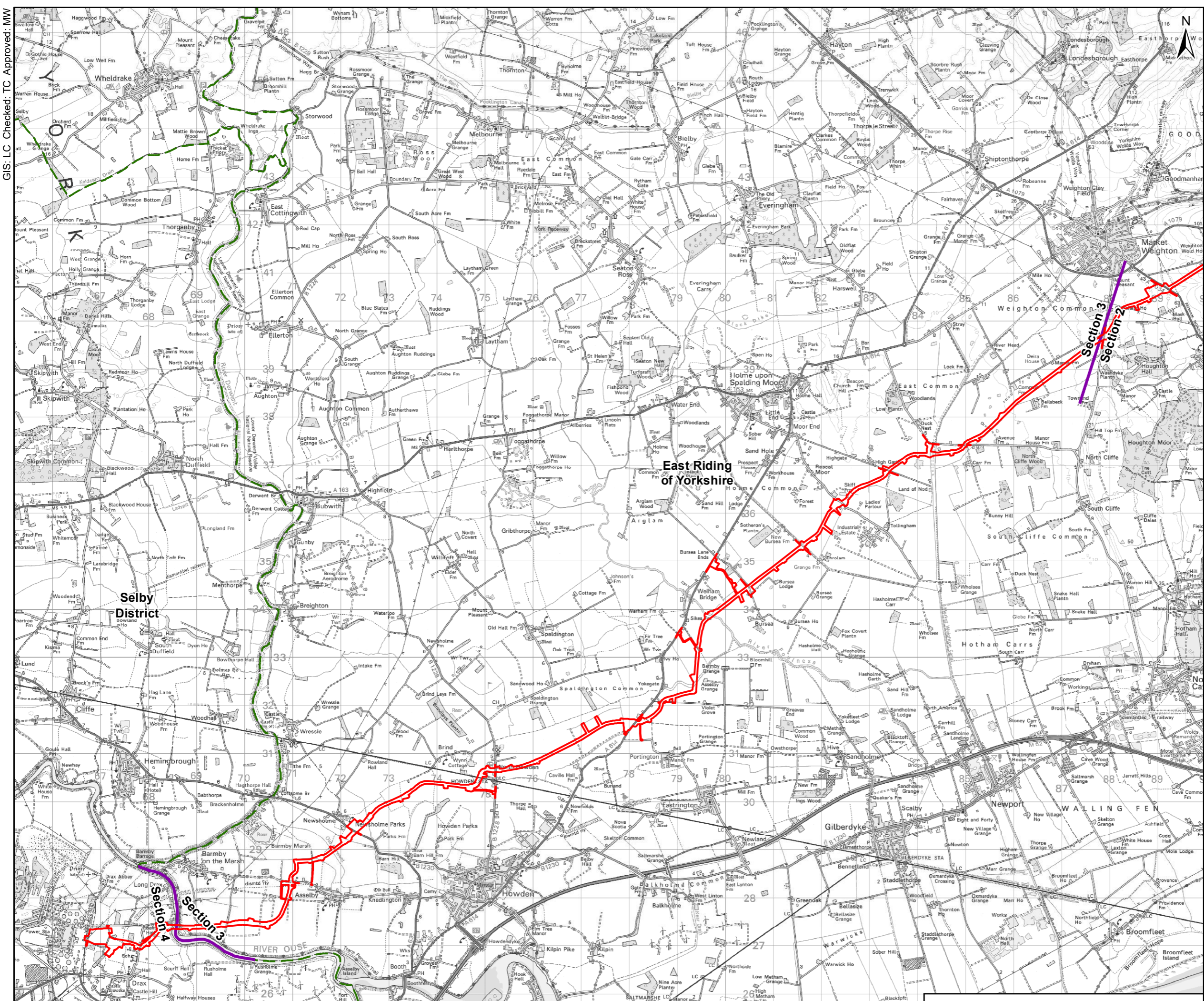
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Coordinate System: British National Grid

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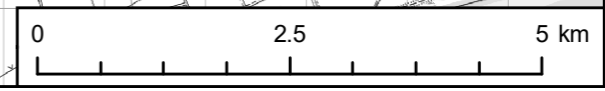
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- KEY
- Planning Application Boundary
 - Route Section Break
 - District Borough Unitary Boundary



TITLE
**Figure 3-2
English Onshore Scheme Planning
Application Boundary**

REFERENCE
SEGL2_T_ES_3-2_v2_20220526

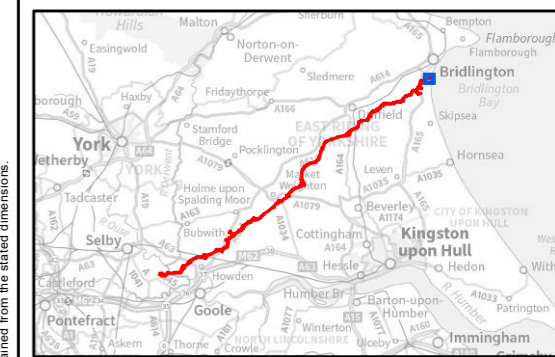
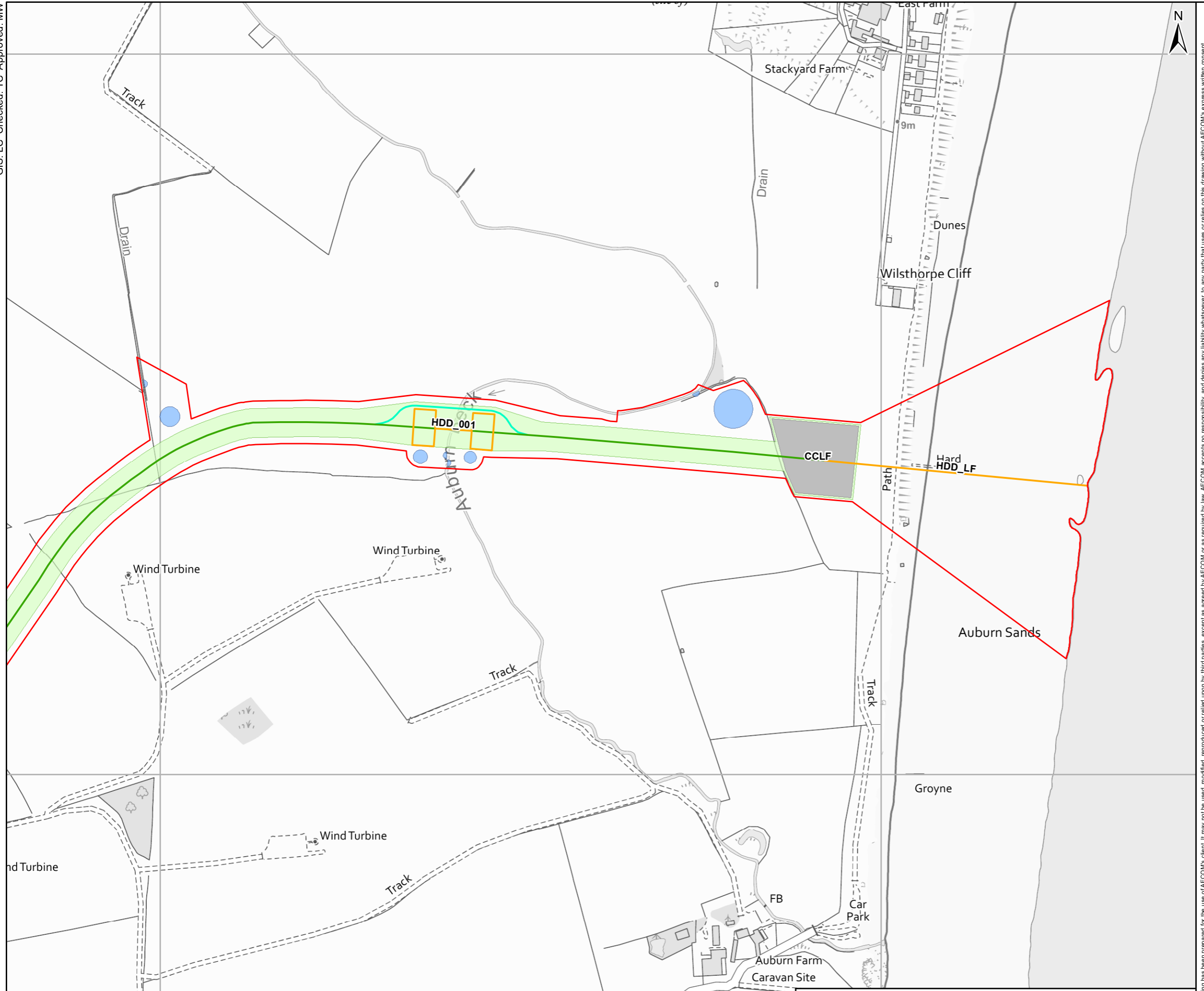


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PROJECT
Scotland England Green Link 2

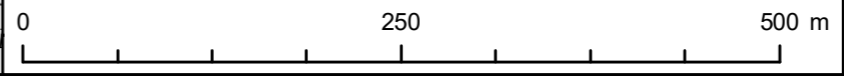
- KEY**
- Planning Application Boundary
 - HDD - Proposed
 - DC Cable Alignment – Open Cut
 - Haul Road where Alignment Differs from HVDC Cables
 - DC Cable Route Working Width (40m)
 - Temporary Attenuation Pond and Outfall
 - Temporary Construction Compound



TITLE
Figure 3-3
The Proposed Landfall Area

REFERENCE
SEGL2_T_ES_3-3_v3_20220527

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3.3.2 The Landfall

The landfall is the interface between the English Onshore Scheme and Marine Scheme, shown on **Figure 3-3**.

The landfall is located at Fraisthorpe, East Yorkshire. This is the location where subsea cables (which are larger due to increased protection), will connect to the underground cables at a buried TJP. The TJP will be set back from the coastline, beyond the coastal erosion risk area to avoid future cable exposure and to reduce risk of exacerbating any existing erosion. The TJP is located approximately 150 m inland from the MHWS.

3.3.2.1 Construction and Installation at the Landfall

The TJP is an underground chamber constructed of reinforced concrete that houses the cable joints between the subsea and underground DC cables. The permanent buried TJP will occupy an area of up to 60 m² (based on an indicative footprint of 12 m by 5 m), however, a larger area will be required during cable installation to accommodate temporary construction equipment and storage areas. This temporary compound area (up to approximately 100 m x 100 m) will contain all necessary plant and equipment plus parking and welfare facilities required for the installation activities at the landfall location. Once installation has been completed, the only infrastructure visible on the surface (on otherwise fully reinstated land) will be the cover of the link box pit.

Installation of the cables at the landfall between terrestrial and marine environments will be achieved utilising trenchless methods in order to minimise disruption and avoid direct impacts to the intertidal zone. The trenchless technique is likely to be Horizontal Directional Drilling (HDD). HDD is a construction technique typically utilised in utilities construction whereby a tunnel is drilled under a constraint (such as a watercourse, environmentally sensitive area or other infrastructure) and a pipeline or cable is pulled through the drilled underground tunnel. At the landfall HDD would be utilised to install a duct for each subsea cable between the TJP and the breakout point in the marine environment beyond the MLWS. The breakout point from the HDD is subject to the appointed Contractor's final design and dependent on the ground conditions and depth of the cable needed to be achieved to ensure suitable protection, however HDD's can typically be up to 800-1,200 m in length. The subsea cables will be pulled through the installed ducts and joined to the underground DC cables at the TJP. An indicative cross section of the HDD at the landfall is provided in **Figure 3-4**.

Access to the landfall will be via a temporary access track from the existing road network, from the A165. Construction activities within the landfall area will include compound construction, site mobilisation, site operations, materials deliveries, cable pull-in, site demobilisation and site reinstatement and anticipated construction vehicles will include heavy goods vehicles (HGVs), light goods vehicles (LGVs), vans and cars. Abnormal Indivisible Load (AIL) movements will be required to allow cable delivery to the landfall area.

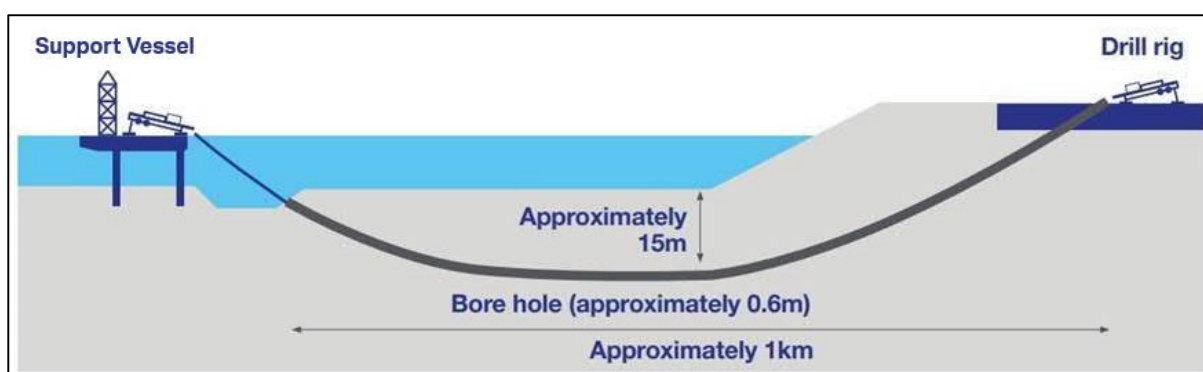


Figure 3-4: Indicative Landfall HDD Cross Section

It is anticipated that site preparation works would take place within normal working hours, Mon-Fri 7am – 7pm and Sat 8 am – 5 pm. Individual drill operations (i.e. the entire sequence of activities pertaining to a single bore) are carried out continuously until completion and therefore may need to be completed beyond these periods. The expected duration of works to set up the drilling location, complete drilling activities and pull the ducts back through for cable pulling at the landfall is likely to be up to 2 months.

A summary of the key characteristics of the landfall are outlined in Table 3-3 and illustrated in **Figure 3-3**.

Table 3-3: Landfall – Summary of Key Characteristics

Factor	Details
Location	<ul style="list-style-type: none"> Fraisthorpe, East Riding of Yorkshire
Working Area	<ul style="list-style-type: none"> Approximately 100 m x 100 m (1 ha)
Installation Approach	<ul style="list-style-type: none"> Horizontal Directional Drilling (HDD)
HDD Length	<ul style="list-style-type: none"> Approximately 650 m
Operational Footprint (i.e. Transition Joint Pit)	<ul style="list-style-type: none"> TJP operational footprint: 12 m x 5 m. Entirely buried – no above ground infrastructure.

3.3.3 The Underground DC Cable Route

3.3.3.1 Route overview

The English Onshore Scheme comprises two underground DC cables (and fibre optic cable(s) for performance monitoring) laid within a single trench (or where constraints dictate pulled through pre-installed ducts). The underground DC cables will form part of a bipole system which transmits power through two high voltage conductors of opposite polarity, operating at up to + 525 kV and – 525 kV.

The term proposed route is used throughout this report and refers to the DC cables, trench (or installation area) and associated temporary working areas required for cable installation as covered below (see section 3.3.3.6). The proposed route for the English Onshore Scheme is illustrated on **Figure 3-2**. For ease of describing the proposed route, and for the identification and assessment of potentially significant impacts, the English Onshore Scheme is split in to four Route Sections. Route Sections 1, 2 and 3 fall within ERYC, and Route Section 4 is within SDC these are illustrated on **Figure 3-2**. The four Route Sections are:

- Route Section 1 – Landfall to Bainton;
- Route Section 2 – Bainton to Market Weighton;
- Route Section 3 – Market Weighton to River Ouse; and
- Route Section 4 – River Ouse to Drax Substation.

The following sections provide a high-level description of the proposed route including its design, construction and operation.

3.3.3.2 Route Description: Route Section 1 – Landfall to Bainton

The proposed route extends in a general south-westerly direction from the landfall location at Fraisthorpe. From the TJP the proposed route extends across Carnaby Moor in a westerly direction north of Fraisthorpe Wind Farm, before crossing the A165 and extending southwards across open agricultural land. This section of the route avoids the proposed working area and export cable route of the Hornsea Project Four Offshore Wind Farm which is located approximately 2 km south. The route crosses the Earl’s Dyke and the Burton Agnes to Paull gas pipeline west of the A165 before continuing in a south-westerly direction.

The proposed route continues in this direction for approximately 6 km, passing the settlement of Gransmoor to the north and between the villages of Great Kelk (south of the route) and Little Kelk (north of the route). The proposed route crosses minor roads, PRoWs, smaller watercourses and unnamed drains until reaching Kelk Beck, a main river and tributary of the River Hull that is designated as a Site of Special Scientific Interest (SSSI) (River Hull Headwaters). After crossing Kelk Beck via HDD, the proposed route continues for approximately 4 km to the village of Wansford. The proposed route runs approximately 750 m north of the village of Wansford to avoid residences and providing separation to the community.

At Wansford the proposed route crosses the B1249, Driffield Canal and the River Hull between Whinhill Lock and Wansford Lock. South of this crossing the proposed route extends further westwards towards the village of Bainton crossing the Driffield to Hull railway line and the A164 whilst bypassing the villages of Skerne and Hutton Cranswick.

3.3.3.3 Route Description: Route Section 2 – Bainton to Market Weighton

From Bainton, as the proposed route extends south to Middleton-on-the-Wolds the English Onshore Scheme enters into the Yorkshire Wolds – an Important Landscape Area (ILA). Between Middleton-on-the-Wolds and Lund the proposed route continues south through areas of open agricultural land. Dalton Hall and the associated Registered Park and Garden is passed to the west. The proposed route continues south to the crossing of the Wilberforce Way Long Distance Walking Route and Local Nature Reserve (LNR) (Etton-Gardham Disused Railway/Kiplingcotes Road Earthworks).

From the crossing of the Wilberforce Way, the proposed route continues for approximately 6 km in a south-westerly direction towards the town of Market Weighton. There are crossings of the Yorkshire Wolds Way and two trunk roads, the A1079 and A1034, as the route passes Market Weighton to the south and extends into Route Section 3. At the boundary between Route Sections 2 and 3 the proposed route exits the Yorkshire Wolds ILA.

3.3.3.4 Route Description: Route Section 3 – Market Weighton to River Ouse

Route Section 3 starts to the south of Market Weighton, adjacent to Houghton Hall and the associated Registered Park and Garden, and the proposed route continues south-westerly for approximately 15 km passing through agricultural land, between Holme upon Spalding Moor (north of the route) and the Tollingham industrial estate (south of the route) towards Howden. Crossings are also required of the Market Weighton Canal, River Foulness and the A614 before reaching Howden.

The proposed route extends north of Howden before extending immediately south across the Selby railway line (ensuring a right-angle crossing) to the west of the settlement. The alignment again continues to the southwest towards Asselby, extending through agricultural and plantation (willow and fir/spruce) land and crossing the A63. The proposed route crosses Main Street to the west of Asselby village in a largely north-south direction before heading in an easterly direction to the proposed crossing point of the River Ouse and in to Route Section 4.

3.3.3.5 Route Description: Route Section 4 – River Ouse to Drax Substation

The crossing of the River Ouse is to the south of Redhouse Lane, with the proposed route extending to the southwest to cross Main Road (through Drax) to the north of Read School. The proposed route continues west, to the south of Wren Hall, and into the proposed converter station site immediately to the east of the Drax Power Station and existing Drax 400 kV Substation.

3.3.3.6 Physical Description of the Underground DC Cable Route

Table 3-4 provides a summary of the key characteristics of the proposed route. The exact configuration of the proposed route is subject to the appointed Contractor’s final design; however, the general characteristics below set the parameters within which the final design will comply with. The components of the proposed route that form the basis of the planning application are shown across the route in **Figure 3-2**.

Table 3-4: Underground DC Cable Route – Summary of Key Characteristics

Factor	Details
Length of Route	<ul style="list-style-type: none"> Approximately 69 km
Cable Rating	<ul style="list-style-type: none"> +/- 525 kV
Cable number and dimensions	<ul style="list-style-type: none"> Two HVDC cables will be installed. An optional fibre optic cable may be installed with the HVDC cables for monitoring. Each HVDC cable is approx. 15 cm in diameter
Trench width/depth	<ul style="list-style-type: none"> Two HVDC cables in a single trench. Width: up to 1.5 m. Depth:

Factor	Details
	<ul style="list-style-type: none"> - Whether HDD or open cut installation is utilised the minimum depth of coverage will be 900 mm to the cable warning tape. - The depth of installation will be deeper at locations where HDD is used.
Backfill material	<ul style="list-style-type: none"> • A thermally suitable material (such as cement bound sand (CBS), or alternative), protective tile, warning tape, subsoil and topsoil (from stockpiled excavated material).
Working width	<ul style="list-style-type: none"> • 40 m wide. • Working width includes provision for: <ul style="list-style-type: none"> - the cable trench, - cable joint bays, - soil storage, - materials and equipment laydown, and - temporary haul road. <p>The working width extends at HDD locations or at complex crossings where additional space is needed.</p>
Cable joint bays	<ul style="list-style-type: none"> • Permanent buried footprint of approximately 60 m² (within the working width). • Required approximately every 800 m to 1.5 km. • Estimated to require 72 joint bays along the proposed route (this is subject to the Contractor's design).
Drainage	<ul style="list-style-type: none"> • Header drains will be installed throughout the underground cable route to intercept the clean surface water runoff to the header drains. • Filter drains will be installed throughout the underground cable route to collect runoff from the haul road and discharge into various dirty ponds along the route. • Attenuation storage is proposed primarily through ponds, the scaling of which has accounted for a 1 in 100 year return period plus 40% increase in peak rainfall to account for climate change. • Outfalls are proposed to the nearest watercourse or drain. Where there is no watercourse within the vicinity of the works (namely through the Yorkshire Wolds) it is proposed that infiltration is used to dispose of surface water.
Permanent easement	<ul style="list-style-type: none"> • Typically 15 m (wider at crossing locations)
Permanent Infrastructure	<ul style="list-style-type: none"> • Cable markers may be installed at crossing points with roads to identify the presence of the cable. However there is no other necessary permanent above ground infrastructure associated with the proposed route.

The installation of the underground DC cables requires a working width up to 40 m wide (greater at HDDs and areas of crossing risk) to be established along the length of the cable route. The planning application provides for a LoD around the proposed route which provides for reasonable flexibility in the planning permission for the cable installation to avoid areas of sensitivity or risk (such as unsuitable ground or previously unknown archaeological sites) during construction. Though most of the route the LoD are approximately 20 m (i.e. 10 m either side) beyond the working width. As a result the planning application boundary is typically 60 m wide for most of the proposed route. It should be noted that, the LoD are wider in areas of greater risk, such as at sensitive crossing locations.

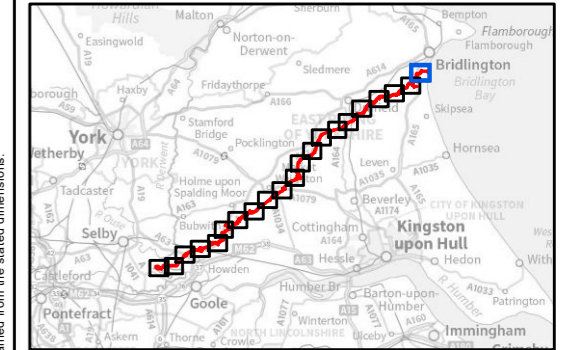
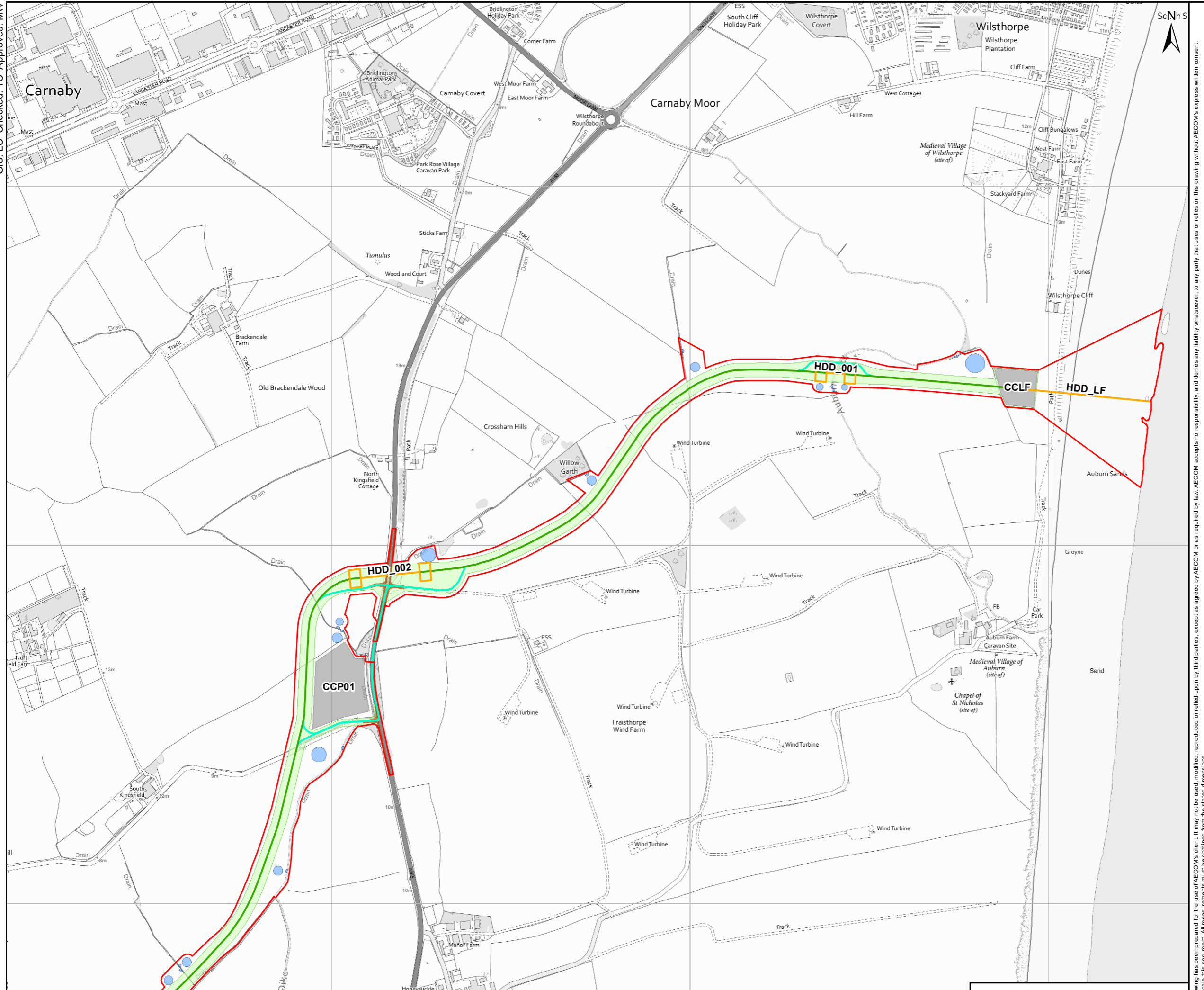
The working width is demarcated by a post and rail fence and will typically comprise:

- Storage areas for topsoil and subsoil stripped from the working width which will be re-used in reinstating the working width;
- Drainage measures and provision for water management required during cable installation;
- Temporary haul road for the movement of installation traffic approximately 5 m wide, with passing places;
- Agreed haul road/landowner crossing points, where existing access routes are separated by the works
- Cable installation trench of a minimum depth of 900 mm (to the cable warning tape);

- Storage areas for excavated material; and
- Other mitigation measures as necessary.

An indicative cross section of the working width is shown in **Figure 3-6**.

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 - Temporary Bellmouth and Visibility Splay

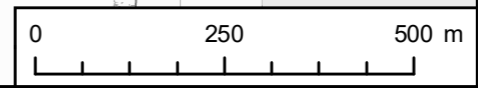


TITLE
Figure 3-5
Underground DC Cable Route Details

REFERENCE
SEGL2_T_ES_3-5_v4_20220530

SHEET NUMBER 1 of 21
DATE 30/05/2022

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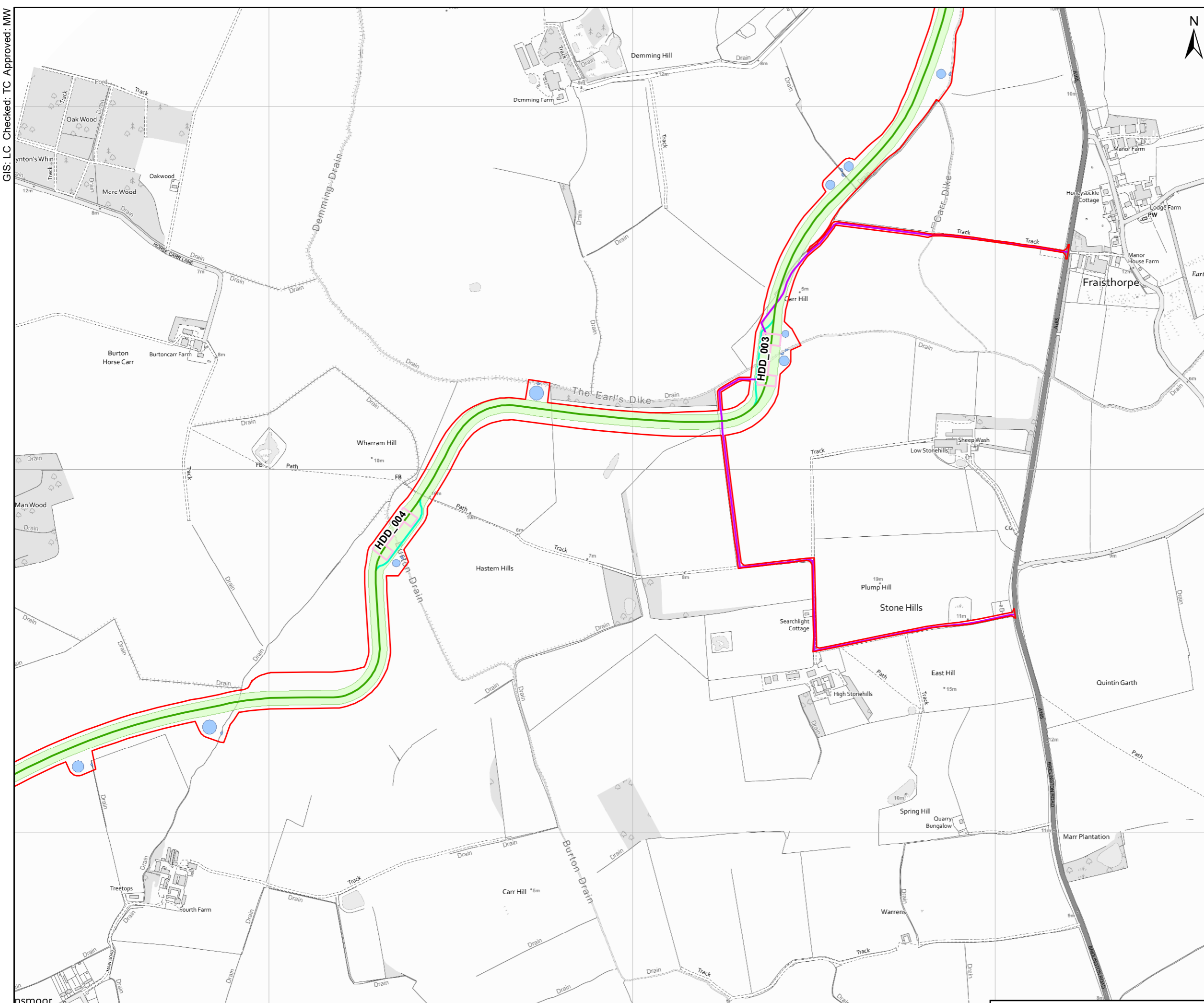
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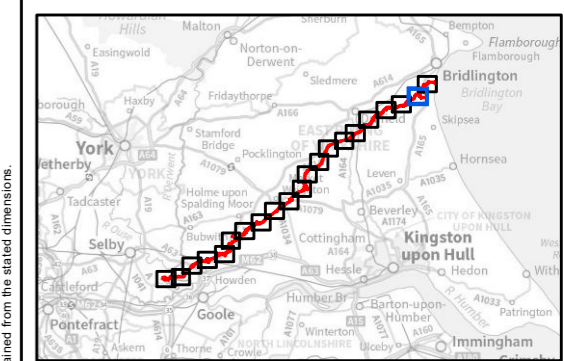
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PROJECT
Scotland England Green Link 2

- KEY**
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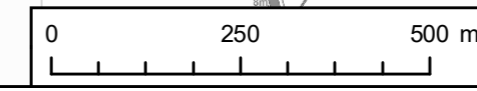


TITLE
Figure 3-5
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REFERENCE
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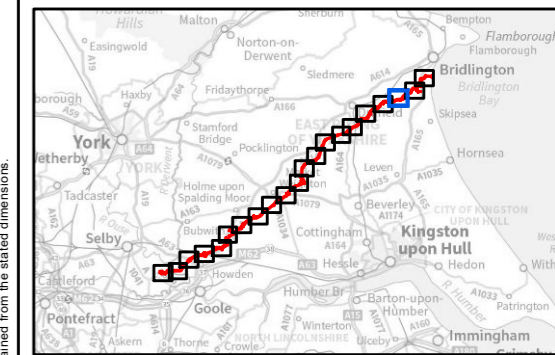
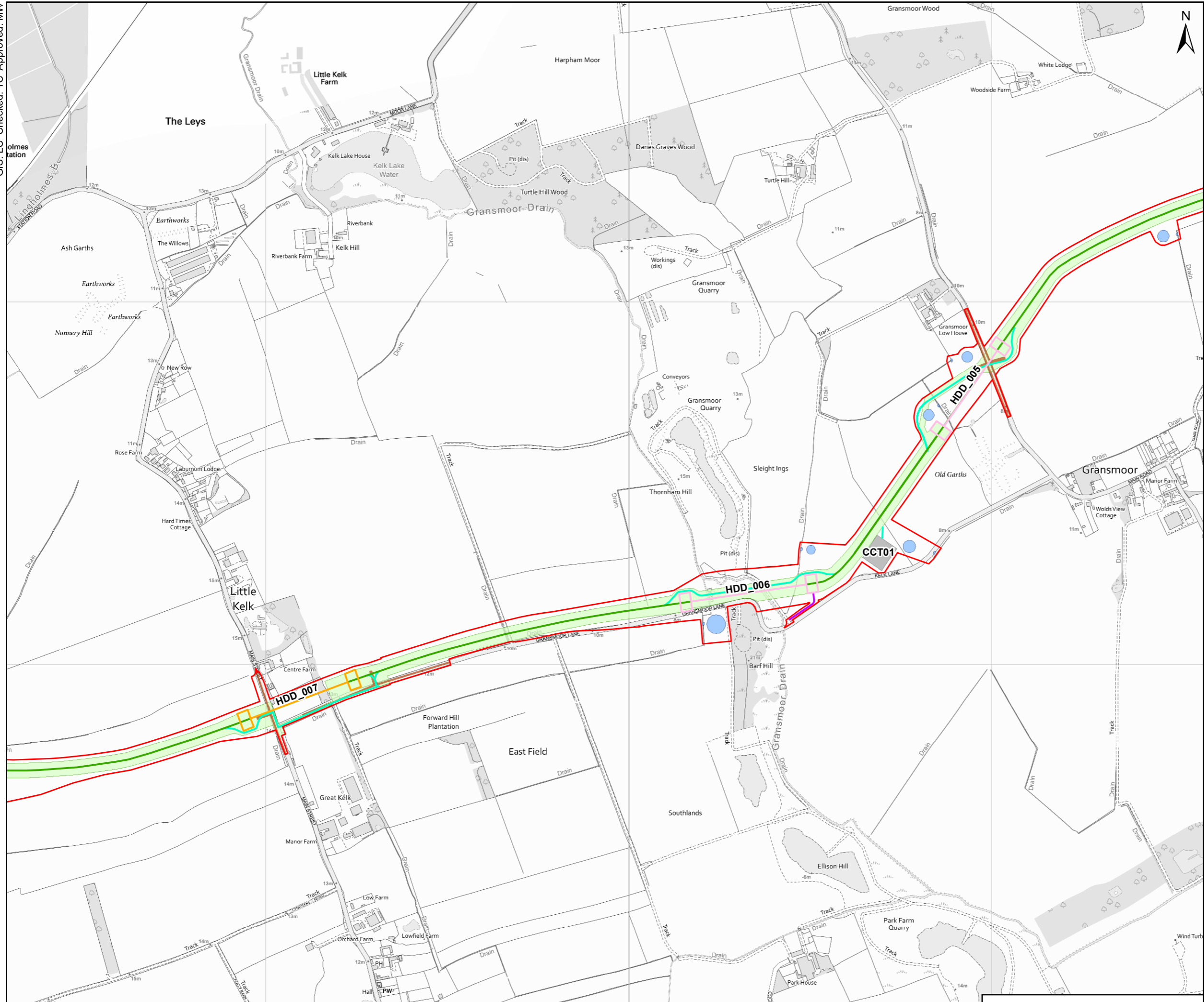
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Coordinate System: British National Grid

GIS: LC Checked: TC Approved: MW

PROJECT
Scotland England Green Link 2

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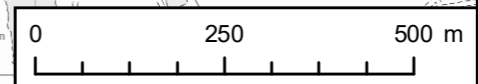


TITLE
Figure 3-5
Underground DC Cable Route Details

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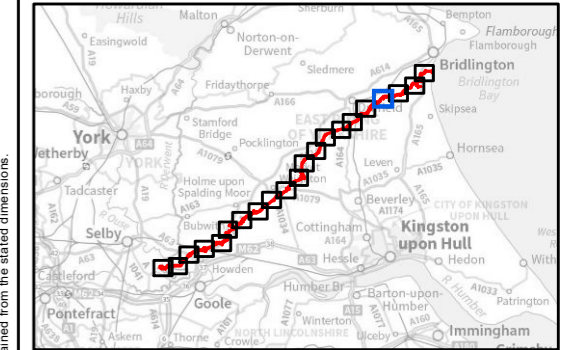
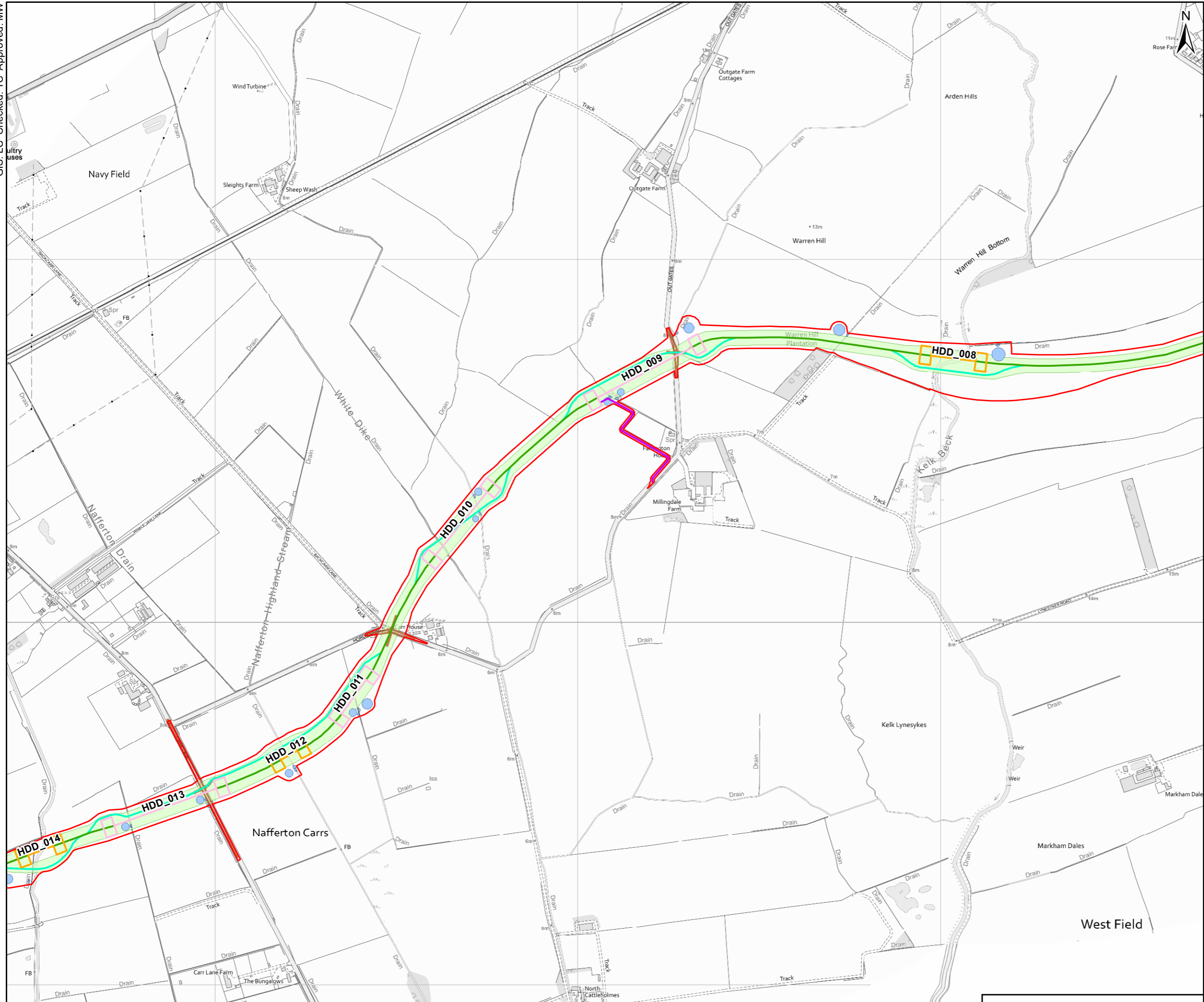
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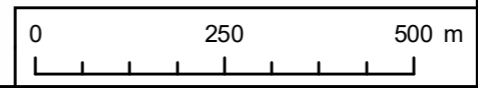


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SHEET NUMBER 4 of 21
DATE 30/05/2022

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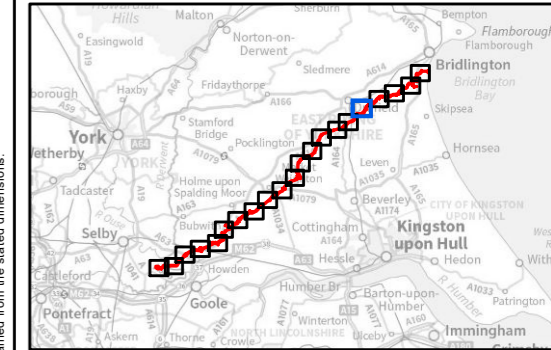
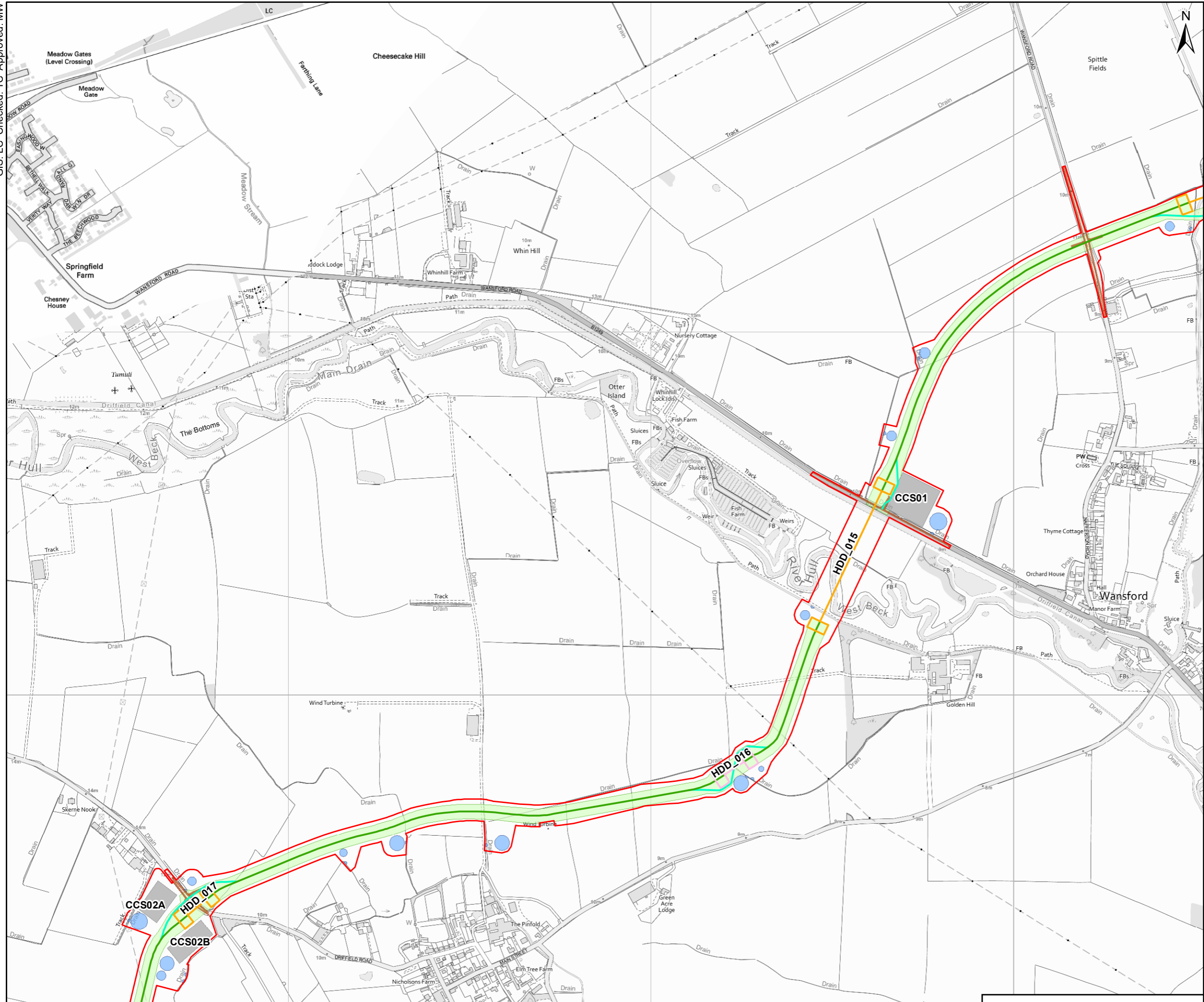
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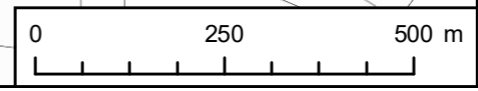


TITLE
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DATE 30/05/2022

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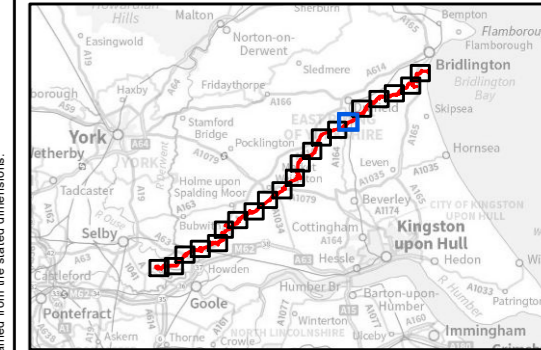
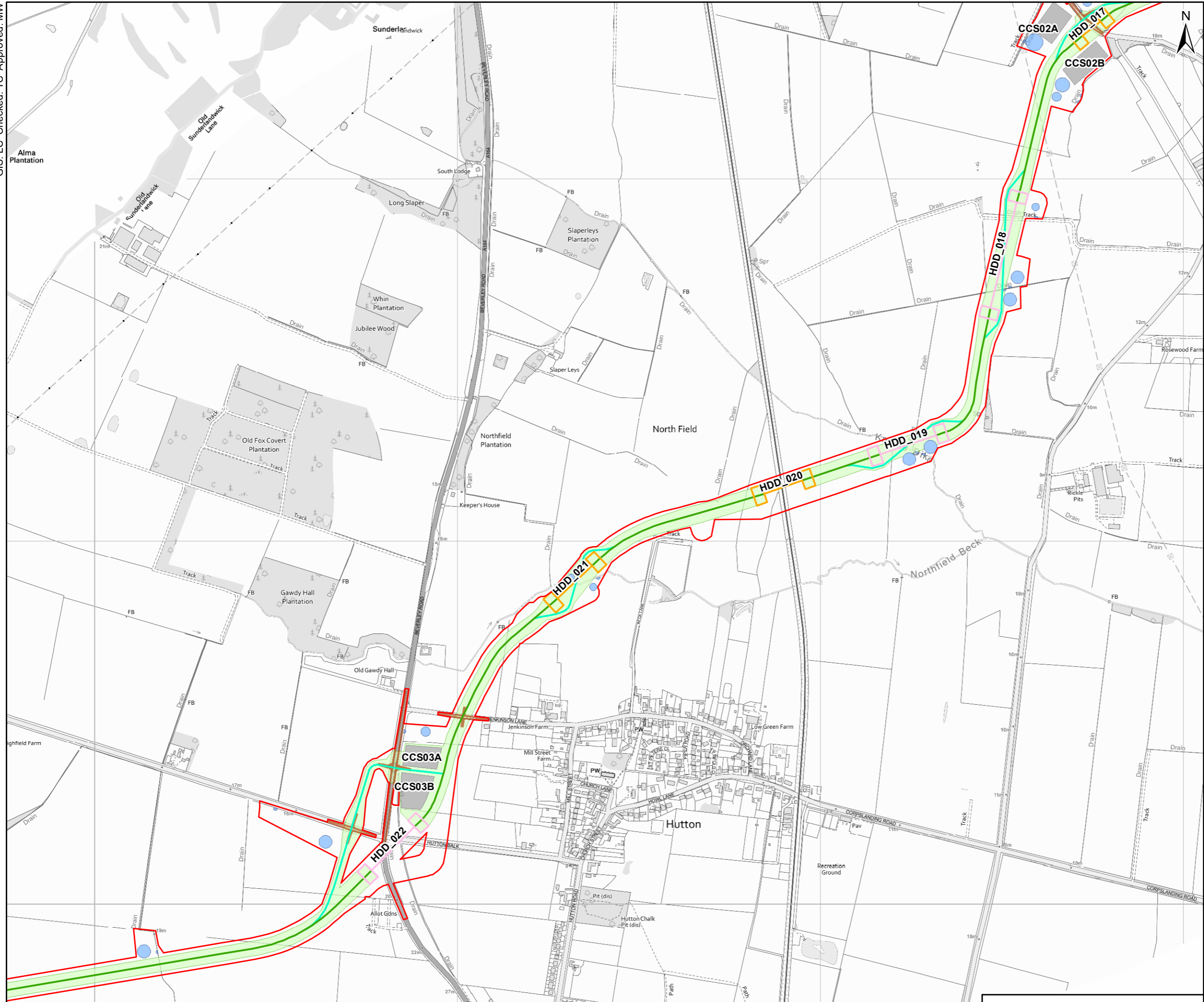
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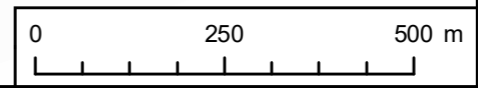


TITLE
Figure 3-5
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