The Great Grid Upgrade

Chesterfield to Willington

Chesterfield to Willington

Corridor Preliminary Routeing and Siting Study

March 2024

nationalgrid

Contents

Tables

Figures

Appendices

Table 1.1 – Abbreviations

Abbreviations	Definition
AC	Alternating Current
AIL	Abnormal Indivisible Load
ALC	Agricultural Land Classification
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
BMV	Best Most Versatile
CPRSS	Corridor Preliminary Routeing and Siting Study
CRoW	Countryside and Rights of Way
DC	Direct Current
DNO	Distribution Network Operator
EIA	Environmental Impact Assessment
ESO	Electricity System Operator
FEED	Front-End Engineering Design
FES	Future Energy Scenarios
FRA	Flood Risk Assessment
GIS	Geographical Information Systems
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
IBA	Important Bird Area
LCA	Landscape Character Assessment
LNR	Local Nature Reserve
NCA	National Character Area
NCN	National Cycle Network
NETS	National Electricity Transmission System
NGED	National Grid Electricity Distribution Plc
NGET	National Grid Electricity Transmission Plc
NNR	National Nature Reserve
NPPF	National Planning Policy Framework

Abbreviations	Definition
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
Ofgem	Office of Gas and Electricity Markets
OHL	Overhead Line
OS	Ordnance Survey
PRoW	Public Right of Way
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEC	Sealing End Compound
SOUV	Statement of Outstanding Universal Value
SLA	Special Landscape Area
SPA	Special Protection Area
SQSS	Security and Quality of Supply Standards
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SUSTRANS	Charity and Custodian of the National Cycle Network
WFD	Water Framework Directive
WHS	World Heritage Site

Table 1.2 – Glossary of Terms

Term	Definition
Alternating Current (AC)	A type of electrical current in which the direction of the flow 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.
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 the analysis of power transfers between separate 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.
Brinsworth to High Marnham Uprating	A proposed uprating of the existing 275kV overhead lines to facilitate a transmission load of 400kV and the development of three new substations to help carry more green power from the North of England to homes and businesses in the Midlands.
Chesterfield to Willington (the Project)	Located in the East Midlands region of England, the Project comprises major reinforcement of the electricity transmission system. This would transport clean energy from the North of England to homes and businesses in the Midlands and play an important role in building a more secure and resilient future energy system. These proposals form part of The Great Grid Upgrade, which is the largest overhaul of the grid in generations. The Project will support the UK's Net Zero target by adding capacity to accommodate increasing power flows from offshore wind and interconnections from Scotland and North East England, which is expected to double within the next ten years, to areas of demand south to the Midlands and beyond.
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 (CPRSS)	The 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 (where relevant) 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.
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

Term	Definition
	DNO in proximity to the Project is National Grid Electricity Distribution Plc (NGED).
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 400kV and 275kV 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 so that the system can be operated in an economic and efficient way by the ESO, ensuring that 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).
Future Energy Scenarios (FES)	Published annually by the ESO to indicate possible future power requirements and where future connections may occur across the network.
Graduated Swathe	Shaded areas within the emerging preferred corridor, siting zone and siting areas (where relevant) 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 zones and siting areas (where relevant).
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[1].

[1] National Policy Statement for Electricity Networks Infrastructure (EN-5).

Term	Definition
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 licensed Transmission Owners and do not develop the national transmission system.
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 recently rebranded as National Grid Electricity Distribution (NGED). NGED is a DNO operating in proximity to the Project.
National Grid Electricity Transmission Plc (NGET)	National Grid operates the national electricity transmission network across Great Britain and owns and maintains 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[2]; Overarching NPS for Energy and EN-5; Electricity Networks Infrastructure.
National Site Network (NSN)	Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK no longer form part of the EU'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: • Existing SACs and SPAs; and • New SACs and SPAs designated under these Regulations. 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. All Ramsar sites remain protected in the same way as SACs and SPAs.
Non-statutory Consultation	An engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the emerging preferred corridor, siting zones, siting areas (where relevant) and the graduated swathe. The feedback received will inform the onward development of the Project.

[2] Overarching National Policy Statement for Energy (EN-1).

Term	Definition
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 routeing options for the Chesterfield to Willington 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 earth wire (to protect the line from electrical faults and carry control data); and the conductors themselves.
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.
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).

Term	Definition
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.
Underground Cable	An insulated conductor carrying electric current designed for underground installation.
Wirescape	Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.

Chesterfield to Willington
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Executive Summary

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Executive summary

National Grid Electricity Transmission (NGET) owns, builds and maintains the high-voltage electricity transmission system in England and Wales. NGET is responsible for ensuring electricity is transported safely and efficiently from where it is produced to where it is needed and for developing upgrades to the network, as agreed with the industry regulator, Office of Gas and Electricity Markets (Ofgem).

The Chesterfield to Willington Project (the Project) is being developed by NGET. Located in the East Midlands region, the Project is required to reinforce the electricity transmission system to help deliver the UK Government's Net Zero targets. This would transport clean energy from the North of England to homes and businesses in the Midlands and play an important role in building a more secure and resilient future energy system. These proposals form part of The Great Grid Upgrade, which is the largest overhaul of the grid in generations[3].

The Project will support the UK's net zero target by adding capacity to accommodate increasing power flows from offshore wind and interconnections in Scotland and North East England, which is expected to double within the next ten years, to areas of demand south in the Midlands and beyond.

The Project will establish a new 400kV transmission connection between a new 400kV Chesterfield Substation intended to be completed under a separate project (Brinsworth to High Marnham) and the existing Willington Substation. The connection is expected to wholly or largely comprise a new overhead line. NGET will also need to facilitate other local network configurations.

The need for this Project was first identified by the National Grid Electricity System Operator (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. This considered a wide range of options for providing the necessary north-south power flows and concluded that the establishment of a new electricity transmission route between the Chesterfield and Willington Substations represented the most appropriate solution. The Strategic Options Appraisal is reported in the Strategic Options Report (SOR).

This report, the Corridor Preliminary Routeing and Siting Study (CPRSS), has been undertaken to facilitate feedback from all interested parties as part of the Project through non-statutory consultation. The CPRSS reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) to identify an emerging preferred corridor within which the required infrastructure for the Project may be located.

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 summer 2024.

For this Project, eight preliminary corridors were identified for appraisal. The identified preliminary corridors were then appraised by environmental, socio-economic, engineering and system factor specialists. Following the appraisal of the preliminary corridors, further technical feasibility analysis was undertaken by the Front-End Engineering Design (FEED) team. Through

[3] The Great Grid Upgrade

this process, it was determined that certain preliminary corridors were technically unfeasible. These preliminary corridors were therefore removed from further consideration.

Preliminary corridors that were deemed to be technically feasible were then subject to further refinement where possible, based on several factors, including the opportunity to avoid or minimise potential impacts to areas of higher amenity, settlements and other technical and engineering constraints.

Once refined, the corridors were then divided into sections and links to provide options to connect from one corridor to another so that constrained sections of an otherwise suitable corridor could be bypassed.

The refined corridors, comprising their sections and links, were then further reviewed by NGET and the FEED Contractor to confirm their technical feasibility and ensure that key issues, and the interaction of constraints, had been fully considered. Feasible solutions comprising the identified sections and links were then taken forward for further appraisal.

The refined corridors were not considered as whole end-to-end corridors for the purposes of the comparative evaluation of options, but rather their sections and links were evaluated, which presented the opportunity to utilise sections and links from multiple corridors to find the optimal path from Chesterfield Substation to Willington Substation, if this emerged as the best approach to avoid major constraints present in specific sections and links within certain corridors.

Some of the refined corridors have constraints that are unavoidable, such as the Peak District National Park present in Corridor 1, and the Derwent Valley Mills World Heritage Site present in Corridors 2 and 3, whilst some of the refined corridors have localised constraints that may be avoided through alternative routeing opportunities (i.e. linking sections of different refined corridors). The presence of certain localised constraints within specific sections of some of the refined corridors also resulted in a need to perform a comparative analysis of areas within those sections, in order to determine which onward sections remained feasible options after avoiding key constraints. Therefore, a combination of sections of refined corridors, rather than a single refined corridor, was used to identify the emerging preferred corridor to route between Chesterfield Substation and Willington Substation. The sections and their key constraints were broadly appraised from north to south within the Study Area and considered in a logical stepwise manner at key decision points.

To summarise, the emerging preferred corridor for a new overhead line:

- Extends in a southeasterly direction out of Chesterfield Substation to avoid the more constrained and built-up area to the southwest between Chesterfield and Clay Cross;
- Turns southwest in the vicinity of Heath between the M1 motorway and the edges of several settlements, including Holmewood, North Wingfield and Clay Cross, allowing for potential options to the north or south of Lower Pilsley;
- Continues to the south of Clay Cross, allowing for potential options to the north or south of Stretton;
- Broadly follows the Amber River Valley south to Ripley between South Wingfield and Alfreton, allowing for potential options to the west or east of Oakerthorpe, Pentrich and Lower Hartshay;
- Continues to extend south between Belper and Ripley, allowing for potential options around the west or east of a cluster of settlements including Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse. The

western option traverses between Holbrook and Lower Kilburn, whilst the eastern option traverses between Horsley Woodhouse and Smalley;

- Allows for potential options to the west or east of Morley before extending south between Morley Smithy and Stanley Common and around the eastern edge of Derby between Borrowash and Draycott; and
- Broadly follows the corridor containing the A50 and River Trent Valley from north of Aston-on-Trent through to Willington Substation, allowing for potential options around the north and south of Barrow-upon-Trent and Stenson.

The emerging preferred corridor was ultimately selected to avoid, where possible, potential impacts to areas with the highest amenity value in alignment with Holford Rules 1 and 2, as well as finding a direct path in alignment with Holford Rule 3. After assessing viable alternative paths, this was achieved by ruling out potential options that crossed the Peak District National Park (i.e., Corridor 1, except for its most northerly and southerly sections, including each substation) and the Derwent Valley Mills World Heritage Site (i.e. Corridor 2, and the southern sections of Corridor 3 which crossed this feature).

Following the identification of the emerging preferred corridor, a graduated swathe was identified. The graduated swathe is a way of showing the areas within the emerging preferred corridor where the required Project infrastructure is considered more or less likely to be located. The graduated swathe is 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, whilst 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. 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 and amenity.

During the non-statutory consultation, feedback will be gathered from consultation events and feedback forms on the preferences identified in this report and on the graduated swathe, which highlights where Project infrastructure is more likely to be located. The emerging preferred corridor 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. The feedback from the non-statutory consultation will inform the further development of the Project alongside information from surveys undertaken to obtain baseline data and ongoing design studies.

Following the completion of non-statutory consultation, including the analysis of the consultation feedback, NGET will progress to the Defined Proposal and Statutory Consultation Stage (Stage 3). As part of this, the design will be subject to an Environmental Impact Assessment (EIA), further statutory consultation and integrative design development prior to submission of the application for a Development Consent Order (DCO).

1. Introduction

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1. Introduction

1.1 Overview

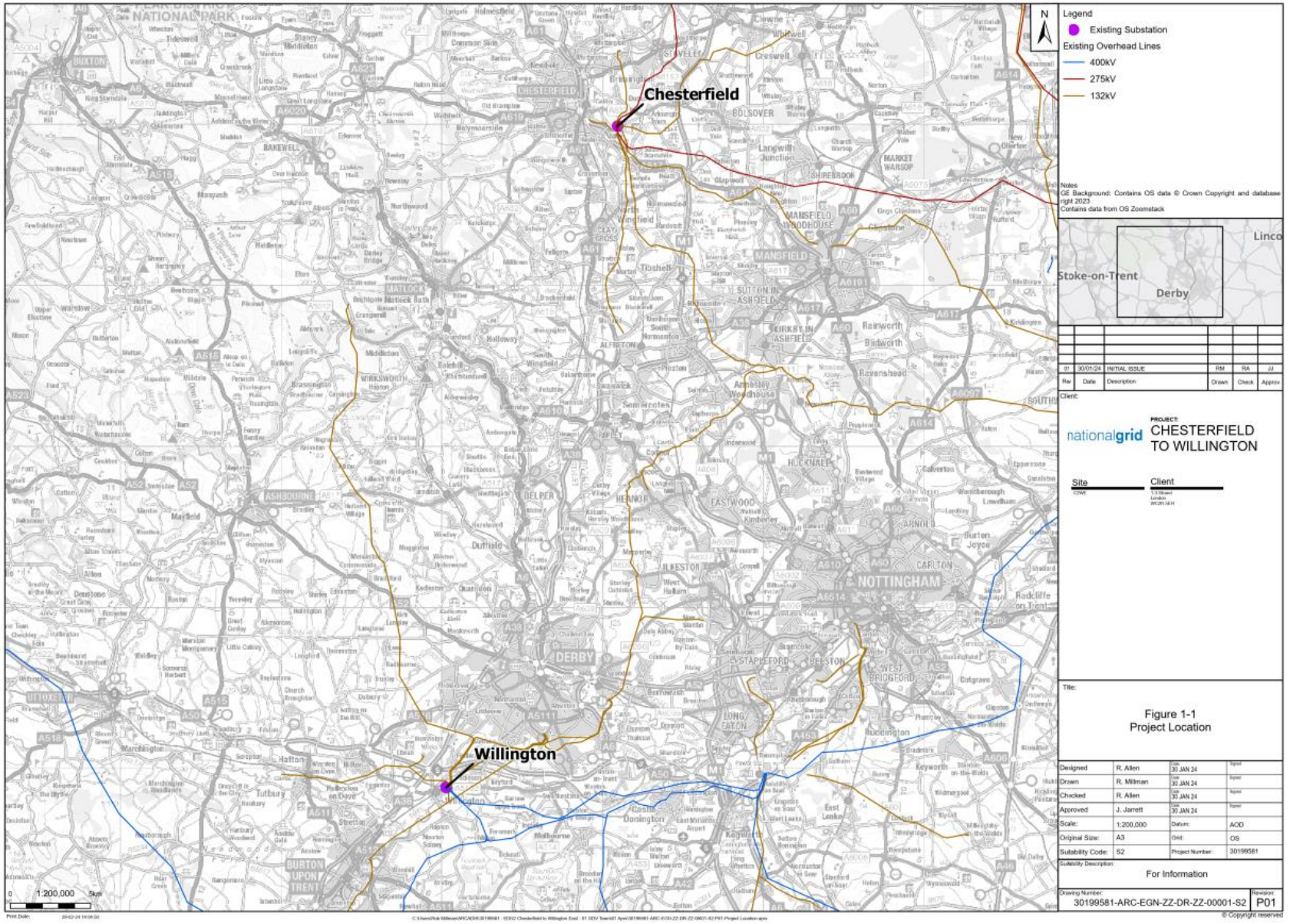
1.1.1 NGET owns and maintains the high-voltage electricity transmission system in England and Wales. NGET is responsible for ensuring electricity is transported safely and efficiently from where it is produced to where it is needed and for developing upgrades to the network, as agreed with the industry 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 summer 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 applicants seeking connections to the National Electricity Transmission System (NETS).

1.1.3 National Grid's transmission system in England and Wales consists of approximately 7,250km of overhead lines and a further 1,450km of underground cabling, operating at 400kV and 275kV. The 275kV grid was developed in the 1950s to provide a national transmission system and then further developed from the mid-1960s, at 400kV to increase the power carrying capacity. The overhead lines and underground cables connect over 300 substations to form a highly interconnected network. The substations provide points of connection to the local distribution networks, which operate at voltages from 132kV down to 240V (the voltage at which the power is distributed to domestic consumers). The distribution networks are owned by Distribution Network Operators (DNOs), including National Grid Electricity Distribution Plc (NGED) in the East Midlands region.

1.1.4 The Project is being developed by NGET. Located in the East Midlands region, the Project is required to reinforce the electricity transmission system to help deliver the UK Government's Net Zero targets. This would transport clean energy from the North of England to homes and businesses in the Midlands and play an important role in building a more secure and resilient future energy system. These proposals form part of The Great Grid Upgrade, which is the largest overhaul of the grid in generations. The Project will support the UK's Net Zero target by adding capacity to accommodate increasing power flows from offshore wind and interconnections in Scotland and North East England, which is expected to double within the next ten years, to areas of demand south to the Midlands and beyond. The Project location is shown in Figure 1.1.

Figure 1.1 – Chesterfield to Willington Project Location



1.1.5 National Grid's Approach to Consenting[4] outlines the project development process, divided into six stages for major infrastructure projects: Strategic Proposal (Stage 1); Options Identification and Selection (Stage 2); Defined Proposal and Statutory Consultation (Stage 3); Assessment and Land Rights (Stage 4); Application, Examination and Decision (Stage 5); and Construction (Stage 6).Figure 1.2 presents an overview of National Grid's Approach to Consenting stages, which is explained in more detail in Chapter 3 of this CPRSS.

Figure 1.2 – National Grid's Approach to Project Development and Delivery

1.1.6 The UK Government has set targets of 50GW of offshore wind generation by 2030[5] and up to 140GW by 2050[6]. There is particular growth forecast in offshore wind capacity in Scotland and the Northeast of England, as well as interconnectors to and from European power grids.

1.1.7 The need for this Project was first identified by the National Grid 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. This considered a wide range of options for providing the necessary north-south power flows and concluded that the establishment of a new electricity transmission route between Chesterfield and Willington Substations represented the most appropriate solution. The Strategic Options Appraisal is reported in the Strategic Options Report (SOR)[7].

1.1.8 The Project will establish a new 400kV transmission connection between a new 400kV Chesterfield Substation intended to be completed under a separate project, and the existing Willington Substation. The connection is expected to wholly or largely comprise a new overhead line. NGET will also need to facilitate other local network configurations.

1.1.9 Example images of NGET's transmission system infrastructure are shown in Figure 1.3.

[4] 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.

[5] UK Government, (2022), British Energy Security Strategy. Available at https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy.

[6] 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.

[7] National Grid, (2024), Strategic Options Report.

Figure 1.3 – Example Images of NGET's Transmission System Infrastructure

1.2 Purpose

1.2.1 This Report, the CPRSS, has been undertaken to facilitate feedback from all interested parties as part of the Project through non-statutory consultation. The CPRSS reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) previously shown in Figure 1.2 to identify an emerging preferred corridor 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 activities undertaken to date, including the identification, refinement and assessment of options for corridors and explains NGET's emerging preferences for the broad location of new infrastructure to meet the needs for the Project, as set out below. The 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 corridor where the required Project infrastructure is considered more or less likely to be located. The graduated swathe is 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, whilst lighter shading indicates less likely locations.

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. The feedback received from the non-statutory consultation will be taken into account during the detailed routeing work for the Defined Proposal and Statutory Consultation Stage (Stage 3). This feedback may also lead to modification of the emerging preferred corridor.

1.2.5 The graduated swathe is explained further in Chapter 10 of this Report.

1.3 Background and Summary of Need

Background

1.3.1 The UK Government has set targets of 50GW of offshore wind generation by 2030[8] and up to 140GW by 2050[9]. There is particular growth forecast in offshore wind capacity in Scotland and the Northeast 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 East Midlands region has been identified as necessary to secure the operation of the transmission system and ensure reliable, economic long-term supply.

Needs for the Project

1.3.2 As detailed in the SOR, the Project is needed to:

- Ensure Security and Quality of Supply Standards (SQSS) compliance; and
- Provide a cost-beneficial level of boundary uplift across network transmission boundary B8 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.

1.3.3 The network transmission boundaries across the UK are shown in Figure 1.4[10].

1.3.4 In considering the need for the Project, NGET had due regard to the policy, projects and investment decisions for the transmission system set out within 2020 Future Energy Scenarios (FES 2020), the Electricity Ten Year Statement 2020 (ETYS 2020) and Network Options Assessment 2020 / 2021 (NOA 2020 / 2021). NGET also had regard to government targets for offshore wind and any emerging outcomes from the Offshore Transmission Network review to ensure the options identified and selected are future proofed and able to facilitate Net Zero targets.

1.3.5 Other proposed projects that would reinforce the transmission system between the North of England, Midlands and Southern England were also taken into account. These include proposals to increase the operating voltage of the existing transmission line between Brinsworth (on the east side of Sheffield) and High Marnham (southeast of

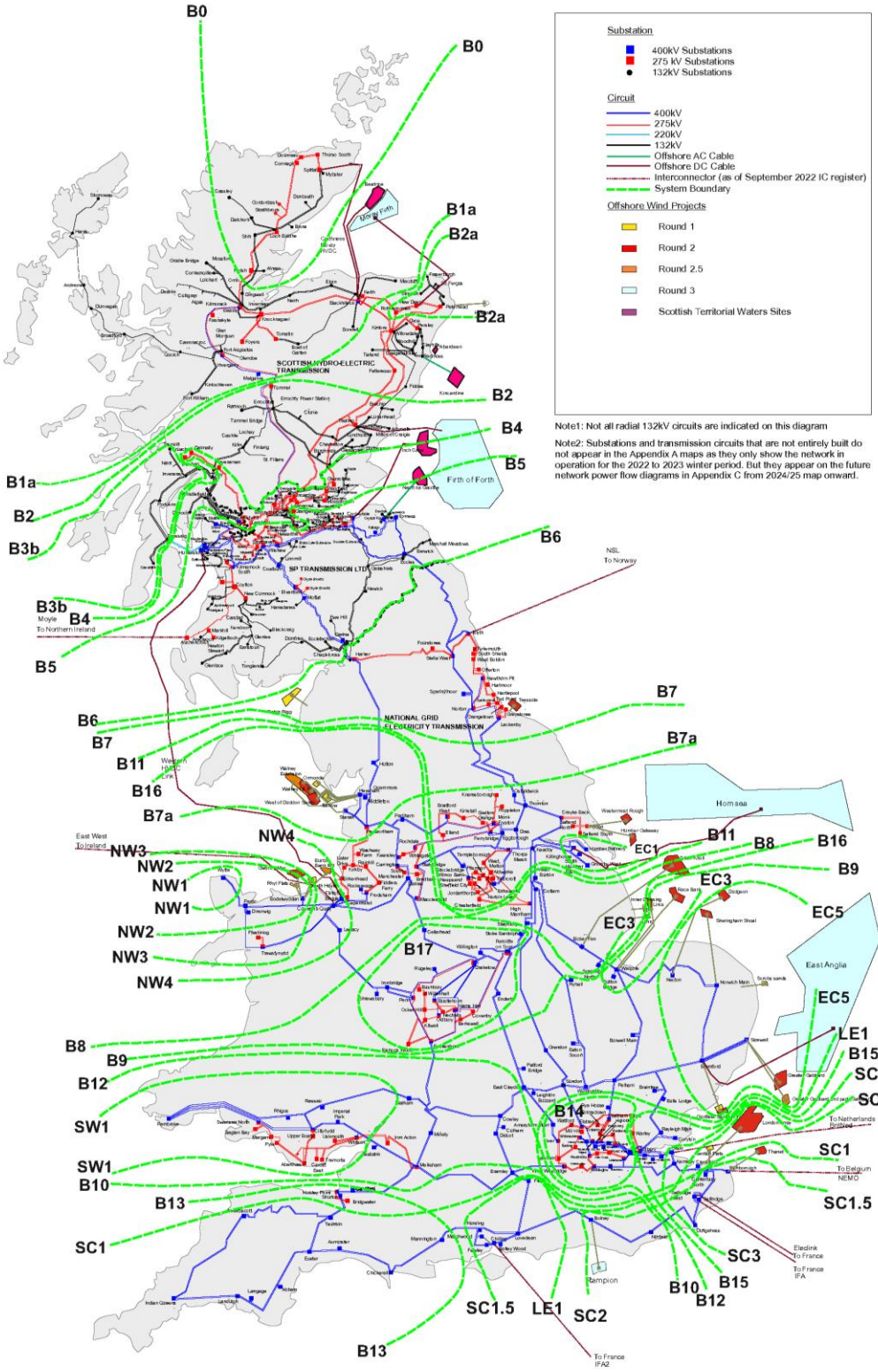
[8] UK Government, (2022), British Energy Security Strategy. Available at https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy.

[9] 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.

[10] National Grid, (2017), Electricity Ten Year Statement 2017. Available at https://www.nationalgrid.com/sites/default/files/documents/ETYS%202017%20Appendix%20A.pdf

Retford in Nottinghamshire), referred to in the ESO's latest Network Options Assessment[11] with the project code EDEU.

Figure 1.4 – Network Transmission Boundaries



[11] Network Options Assessment 2021/22 Refresh (July 2022).

1.4 Structure of this Report

1.4.1 The Report is structured as follows:

- Chapter 2: Aspects of the Chesterfield to Willington 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: Options Identification and Selection Process (Stage 2) – sets out the process used to identify, appraise and select corridors, following National Grid's guidance and in line with relevant policy.
- Chapter 5: Study Area and Corridor Definition – details the steps undertaken to identify the study area for the Project and to define the corridors for appraisal (including sections and links).
- Chapter 6: Options Appraisal – Preliminary Corridors – provides the key environmental, socio-economic and technical constraints for preliminary corridors.
- Chapter 7: Options Appraisal of Refined Corridors – provides the key environmental, socio-economic and technical constraints for refined corridors.
- Chapter 8: Cost and Programme Performance – shows the range of the best and worst performing cost and programme estimates for each of the corridors.
- Chapter 9: Option Selection – provides comparative analysis of the corridors to identify those emerging as preferred.
- Chapter 10: Development of the Graduated Swathe – summarises the approach taken to develop the graduated swathe for the Project, and its intended use.
- Chapter 11: Summary and Next Steps – the conclusions of the CPRSS and outlines the next steps in the Project.

2. Aspects of the Chesterfield to Willington Project

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2. Aspects of the Chesterfield to Willington Project

2.1 Introduction

2.1.1 The objective of the Project is to reinforce the electricity transmission system to help deliver the UK Government's Net Zero targets. This would transport clean energy from the North of England to homes and businesses in the Midlands and play an important role in building a more secure and resilient future energy system. These proposals form part of The Great Grid Upgrade, which is the largest overhaul of the grid in generations. The Project will support the UK's Net Zero target by adding capacity to accommodate increasing power flows from offshore wind and interconnections in Scotland and North East England, which is expected to double within the next ten years, to areas of demand south to the Midlands and beyond.

2.1.2 The Project would establish a new 400kV transmission connection between a new Chesterfield Substation and the existing Willington Substation. The connection is expected to wholly or largely comprise a new overhead line.

2.1.3 At its northern end, the new 400kV transmission connection would begin at a new Chesterfield Substation. At its southern end, the new 400kV transmission connection would connect to the existing Willington Substation, south west of Derby.

2.1.4 This chapter provides more information regarding the new 400kV transmission connection and other modifications that need to be undertaken in conjunction to facilitate the construction of the Project. Such modifications will be to the wider transmission system and local electricity distribution networks operated by NGET and National Grid Electricity Distribution Plc (NGED) respectively.

2.1.5 The chapter also includes information relating to the new Chesterfield Substation, which NGET expect to have been constructed in advance of construction activities commencing on the Project. The intention is that this new substation would be completed by another project, the 'Brinsworth to High Marnham Uprating', and is referenced for the purpose of completeness. This also forms part of The Great Grid Upgrade.

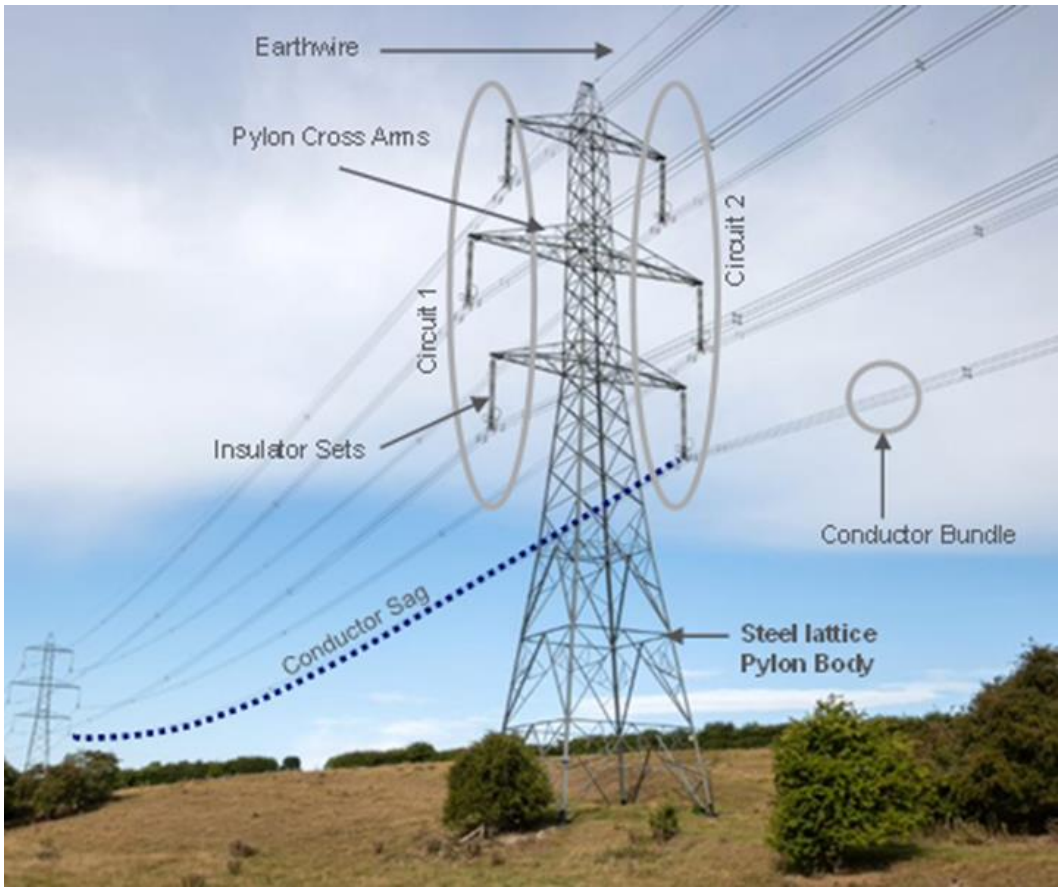
2.2 Overhead Lines

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, which shows a typical steel lattice pylon.

2.2.2 Like most overhead lines owned and maintained by NGET, the Project will carry a voltage of 400kV. The overhead line for the Project will carry two discrete electrical circuits that 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 pylon cross arms and the main structure. On a typical double circuit pylon, as shown in Figure 2.1, six pylon cross arms are stacked above each other, three on each side. Each cross arm supports a bundle of conductors, with three bundles together forming a single electrical circuit. 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 earth wire that carries data between substations and also provides shielding from lightning strikes for the conductors below. The overhead line on this Project is likely to comprise a maximum of three conductors per bundle, a total of 18 conductors per pylon together with the earth wire.

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 Minimum heights[12] between the conductors, the ground and various other features must be maintained, to ensure safe operation. The minimum clearance required between the conductors and the ground is typically between 7-8m at the maximum sag, as shown in Figure 2.1. In order 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

[12] 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.

temperature and conductor wire composition, the intervening topography and the use of the land being crossed. For example, navigable rivers, crossings of railways, road surfaces and motorways, such as the M1, may require far greater clearances (and hence greater pylon heights) to allow vehicles to pass beneath whilst maintaining safe separation.

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 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, 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. They are of greater bulk in order to ensure stability.

2.2.7 Figure 2.2 illustrates the difference between these three main pylon types.

2.2.8 A typical pylon operating at 400kV is approximately 50m in height[13]. A typical span distance between pylons is approximately 350m. In broad terms, there are typically three pylons for every kilometre of overhead line. Double circuit overhead lines of this voltage typically require a minimum corridor width of 70-100m to establish a route.

2.2.9 Major construction activities tend to be focused on the base of each pylon and to either side of tension pylons from where the conductors are winched into position. The major impacts of overhead lines are generally considered to be visual, due to the height of the pylons in relation to most buildings and trees.

Figure 2.2 – Suspension Pylon (Left), Angle Pylon (Middle) and Terminal Pylon (Right)

[13] Localised requirements may prompt the need for taller pylons.

Pylon Type and Design

2.2.10 The vast majority of transmission lines in Britain use lattice steel pylons with three sets of cross arms (as shown first in Figure 2.2). Alternative pylon types, such as steel monopole (similar to a modern wind turbine), have been approved for use, which may achieve the technical performance required for the Project[14]; however, at this stage of the Project, the starting assumption is that steel lattice overhead lines will be used (in accordance with National Grid's guidance and national planning policy).

2.2.11 In previous projects, the visual benefits of utilising standard lattice steel pylons have been recognised, especially when siting a new overhead line close to existing lines that use the pylon type. In proximity to the Project, this is the case where 132kV or 275kV overhead lines are present including at both substations, around Lower Pilsley, and between Locko Park and Dale Abbey.

2.2.12 The current assumption is to use lattice steel pylons. The type of pylons proposed for the Project will be determined through feedback from non-statutory consultation, information from surveys and ongoing design studies and assessments.

2.3 Underground Cables

2.3.1 Whilst it is currently assumed that the majority of 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 400kV, 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[15]. As a result, direct buried transmission cables at the capacity required for the Project are materially more expensive compared to an equivalent overhead line, and this has been assessed in the SOR. Moreover, and as noted within National Policy Statement (NPS) for electricity networks infrastructure EN-5 (2024) (described in more detail in Chapter 3), underground cables typically bear a significantly higher lifetime cost of repair and later uprating. 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[16].

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

[14] With the potential exception of localised requirements, such as major river crossings.

[15] More information can be found in National Grid's publication 'Undergrounding high voltage electricity transmission lines. The technical issues'.

[16] The National Policy Statement for Electricity Networks Infrastructure (EN-5) (2024) 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 re-routing overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line."

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, underground 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 400kV cable transmission system, the working width of the land required for construction is typically between 40m and 120m, subject to a range of factors such as the number of circuits and the number and size of cables needed. For a low-capacity single circuit, this could require only three cables. For a high-capacity two-circuit route, up to 18 individual cables could be required. An example of a cable construction is shown in Figure 2.3.

Figure 2.3 – Example Cable Construction

2.3.6 Due to the weight and size of underground cables operating at 400kV, the maximum single cable length that can be transported to a project location by road is typically between 800m and 1,000m. 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 120m.

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, they have the potential for greater temporary adverse impacts upon any archaeological resources, soils and drainage, agricultural operations, vegetation and wildlife along the working width during construction. However, effective restoration of the underground cable route following construction can result in less long-term landscape and visual impacts in comparison with an overhead line.

2.3.8 Where it is not feasible to excavate trenches to install the underground cables, trenchless techniques such as Horizontal Directional Drills (HDD) may be applied. These methods employ remotely controlled boring machines to drill and install ducts without the need to excavate above ground. Circumstances requiring trenchless techniques may include the crossing of large watercourses, railways and major

highways. The size and suitability of these methods is location specific and dependent upon the cable system, environmental conditions and local constraints.

2.3.9 Where excavated trenches or methods such as HDD are not technically viable, then a tunnelled solution for underground cables can be considered. At this stage of the Project, the assumption is that HDD will be utilised where trenchless techniques are required. 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 cooling of the underground cables.

Sealing End Compound (SEC)

2.3.10 A SEC is needed where a section of underground cable resurfaces to connect to 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 10m with a set of solid bars (referred to as 'busbars').

2.3.11 The conductor wires from the overhead line drop down to connect onto the solid bars within the secure compound. This connection is achieved structurally via either anchor blocks or standard gantries. The pylon nearest to the SEC, where the overhead line terminates on to the underground cable, is often of a heavier-duty construction than those along the rest of the line (terminal pylon). This is because the terminal pylon is designed to support the unbalanced forces caused by only having wires on one side of the structure.

2.3.12 An alternative configuration would be to use full line tension gantries. As opposed to standard gantries, these structures located within the SEC facilitate a tensioned connection to the pylon, balancing the unbalanced forces. Full line tension gantries may result in a reduction in the size of the pylon nearest the SEC but would increase the size of infrastructure required within the compound.

2.3.13 SECs typically extend to around 50m by 80m for a double-circuit 400kV transmission, but this will vary dependent upon local considerations. Examples of SECs are shown in Figure 2.4.

Figure 2.4 – Example 400kV Sealing End Compounds

2.4 Other Modifications

2.4.1 Associated minor temporary and permanent works will need to be carried out to facilitate the construction of the Project. Such modifications will be to the transmission system and electricity distribution networks operated by NGET and NGED.

2.4.2 The main elements of these works are detailed below.

Impact on Other Existing Transmission Overhead Lines

2.4.3 The 4ZV Route runs from Chesterfield to High Marnham and is currently operated at 275kV with plans to be uprated to 400kV.

2.4.4 Chesterfield Substation is planned to be extended; further details are provided in Section 2.5. Depending on the design of the substation extension and the locations of the overhead line terminations, a line swap-over with 4ZV might be possible, which would result in a rationalisation of the network in the area compared to a crossing. However, if a line swap-over is not possible or not recommended, the Project might need to cross the 4ZV Route.

2.4.5 For crossing overhead lines, two main methodologies are typically implemented. The first one would be to accommodate an overhead line “duck-under”, which consists of splitting up the two circuits of one of the lines by using single-circuit low-height structures with the conductors arranged in flat configuration to minimise their elevation and obtain statutory clearances to the oversailing double-circuit overhead line. Another option typically used for this type of crossing is to construct a short section of underground cables on one of the lines; this results in a more expensive solution but with operational and safety concerns substantially reduced.

Local Modifications to Other Utility Companies’ Overhead Lines

2.4.6 In addition to NGET transmission lines, it will be necessary for the new overhead line to cross overhead lines of lower voltage owned and operated by the local electricity distribution network operators. The electricity distribution networks in the vicinity of the Project are operated by NGED.

2.4.7 When crossing lower-voltage overhead lines, it may be cost-effective, and have reduced environmental impacts, to permanently replace a length of the lower voltage line with underground cables. The Project will need to cross the routes of existing LV, 11kV, 33kV and 132kV overhead lines in multiple locations dependent upon the route. As the Project design evolves, the mitigation measures will be developed and assessed on a case-by-case basis.

2.4.8 NGET will work with NGED to design and undertake the replacement of any affected lower-voltage overhead lines with underground cables wherever this would be technically practicable and not prohibitively expensive.

2.4.9 The local modifications to existing NGED overhead lines will form part of this Project.

2.5 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 stepdown – for example 132kV stepping up to 400kV), manage the frequency of the electricity and increase the 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:

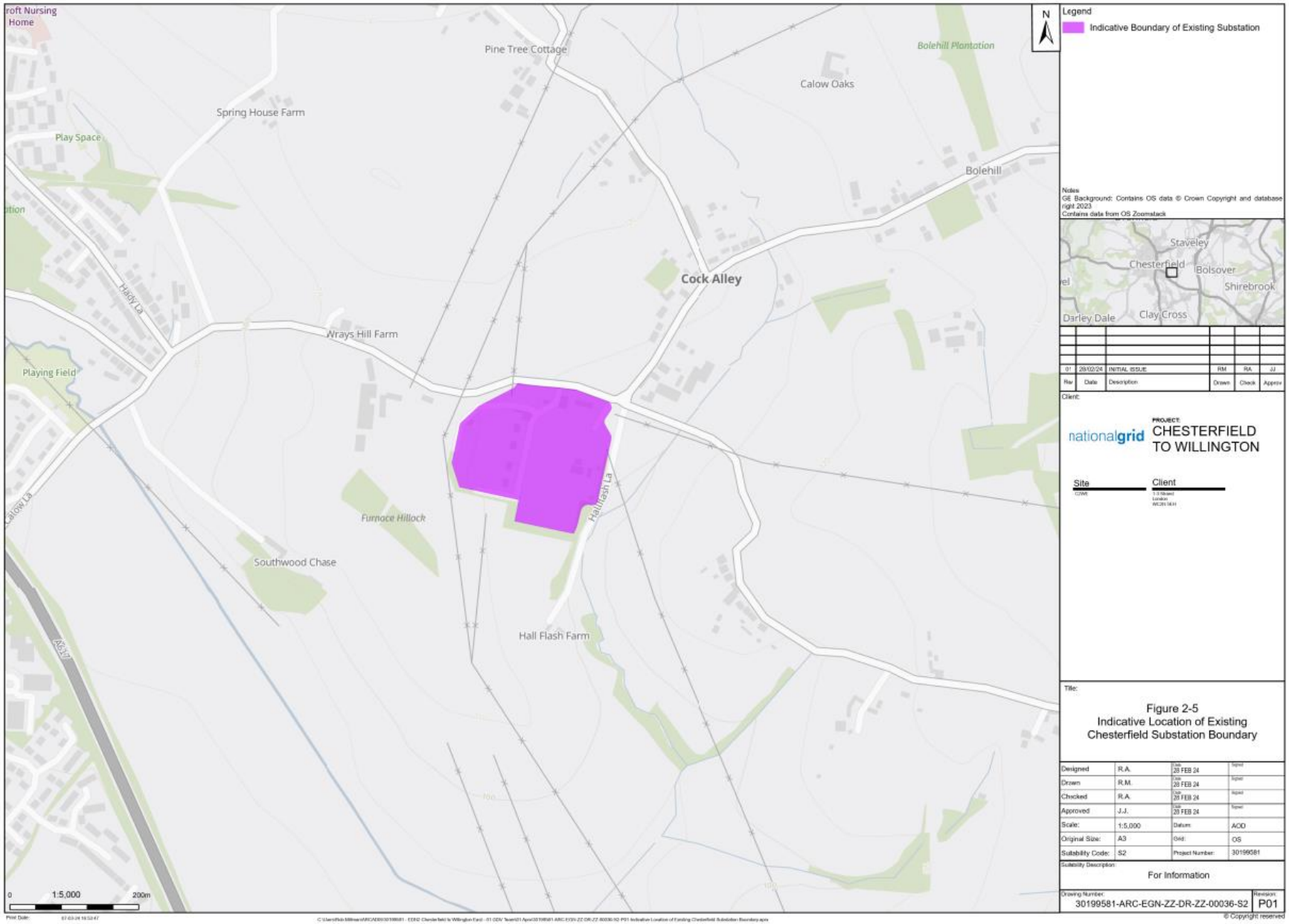
- Fault monitoring and identification, which allows for isolation to protect the network and allow repairs.
- Allow for redirection and disconnection of energy to allow for demand/maintenance.
- Provide data such as voltage, current and power flow to allow for efficient running and future predictions.

New Chesterfield Substation

Background

2.5.3 NGET's existing 275kV Chesterfield Substation is located south-east of Chesterfield in Derbyshire. The substation was built in the mid-1960s, and its location, together with connecting overhead lines, is shown in Figure 2.5.

Figure 2.5 – Indicative Location of Existing Chesterfield Substation



Other Improvements at Chesterfield to Reinforce the Transmission System

2.5.4 Chesterfield Substation forms a connection between existing overhead lines running from Brinsworth and Chesterfield, and Chesterfield and High Marnham. These lines currently operate at a voltage of 275kV; however, this line, built in the mid-1960s, is capable of operating at a higher voltage of 400kV and has necessary consents to do so. Uprating the operating voltage would allow more power to flow along this route to achieve greater power transfers between the North and the Midlands using the existing overhead line infrastructure.

2.5.5 The ESO has considered the potential consumer benefits of uprating the Brinsworth to Chesterfield, and Chesterfield to High Marnham circuits, known together as the Brinsworth to High Marnham project. The ESO has consequently recommended that the uprating should proceed. This is explained in more detail in the ESO's 'Network Options Appraisal Refresh' published in 2022, where the separate Brinsworth to High Marnham project is referenced by the code 'EDEU'. The Project has a current delivery date of 2029.

New Chesterfield Substation

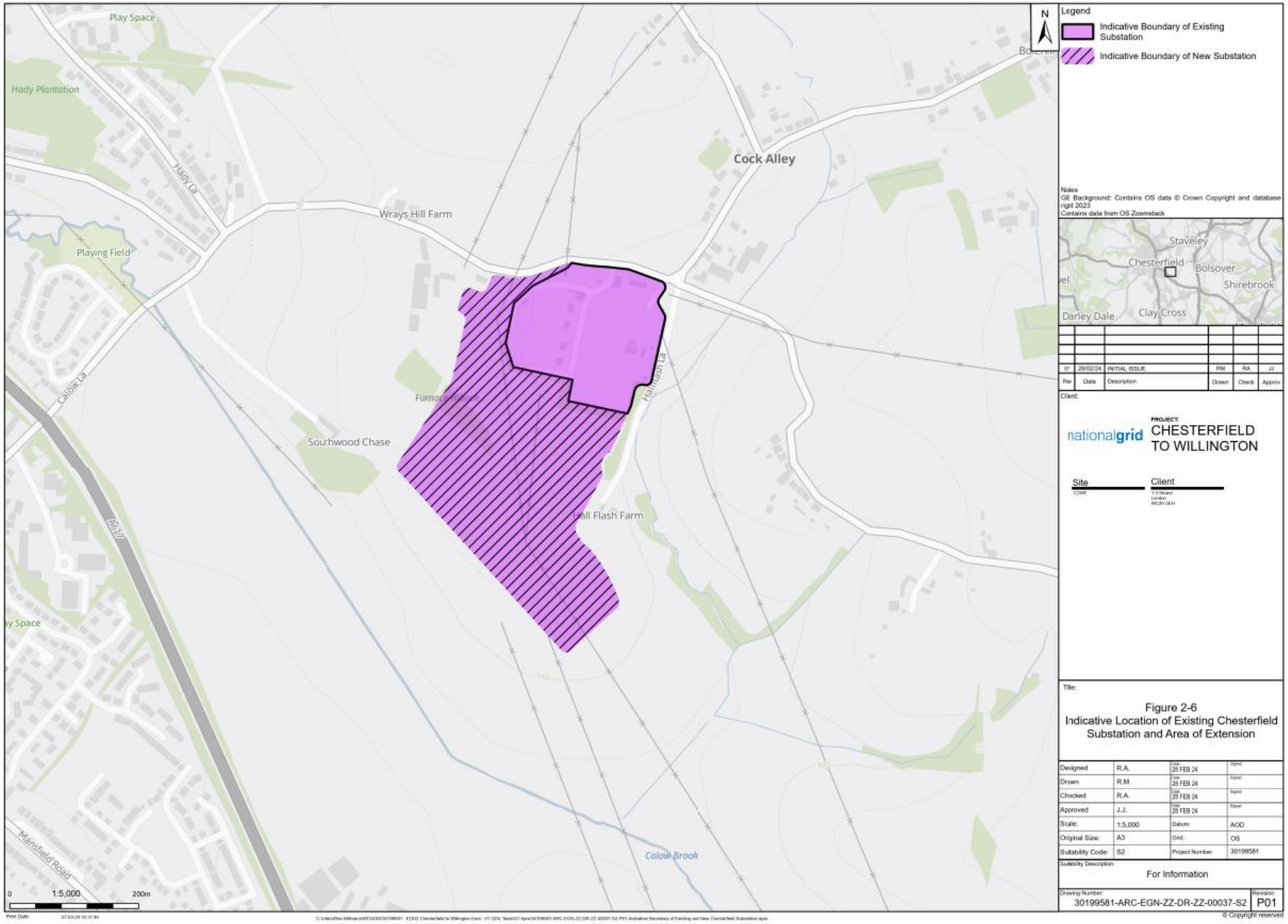
2.5.6 Whilst the uprating of the existing line to 400kV operation will involve only minor works to the overhead line, it will require the four-circuit supported by the line to be disconnected from the existing 275kV substation at Chesterfield. These circuits will instead need to be connected into a 400kV substation.

2.5.7 As such, NGET is proposing to develop a new 400kV substation in the vicinity of the existing substation site to connect the uprated circuits. This will replace the existing substation, which would become redundant. Temporary diversions of the routes may also be required to maintain electricity supplies whilst the permanent works are undertaken. It is currently proposed that the new Chesterfield Substation would not form part of this Project, instead being provided by the Brinsworth to High Marnham project.

2.5.8 At the time of writing, the Brinsworth to High Marnham Project Team are currently determining the most appropriate location for the new substation within an indicative search area. The final design for the new substation has not yet been confirmed; however, the emerging preference is that this would be located along the western and southern boundary of the existing site.

2.5.9 To help inform initial public and stakeholder feedback on this Project, the indicative location for the new Chesterfield Substation is shown in Figure 2.6 below, to which the proposed overhead line corridor will connect.

Figure 2.6 – Indicative Location of Existing and New Chesterfield Substation



2.5.10 NGET envisages that public consultation regarding the new Chesterfield Substation will take place during summer 2024. It is anticipated that consent for the substation will be sought by means of a local planning application to North-East Derbyshire District Council.

2.5.11 As such it is not currently envisaged that the new Chesterfield Substation will form part of this Project with it falling under the Brinsworth to High Marnham project; however, notwithstanding this, it would be considered during the ongoing design studies and when assessing cumulative effects as part of the EIA process.

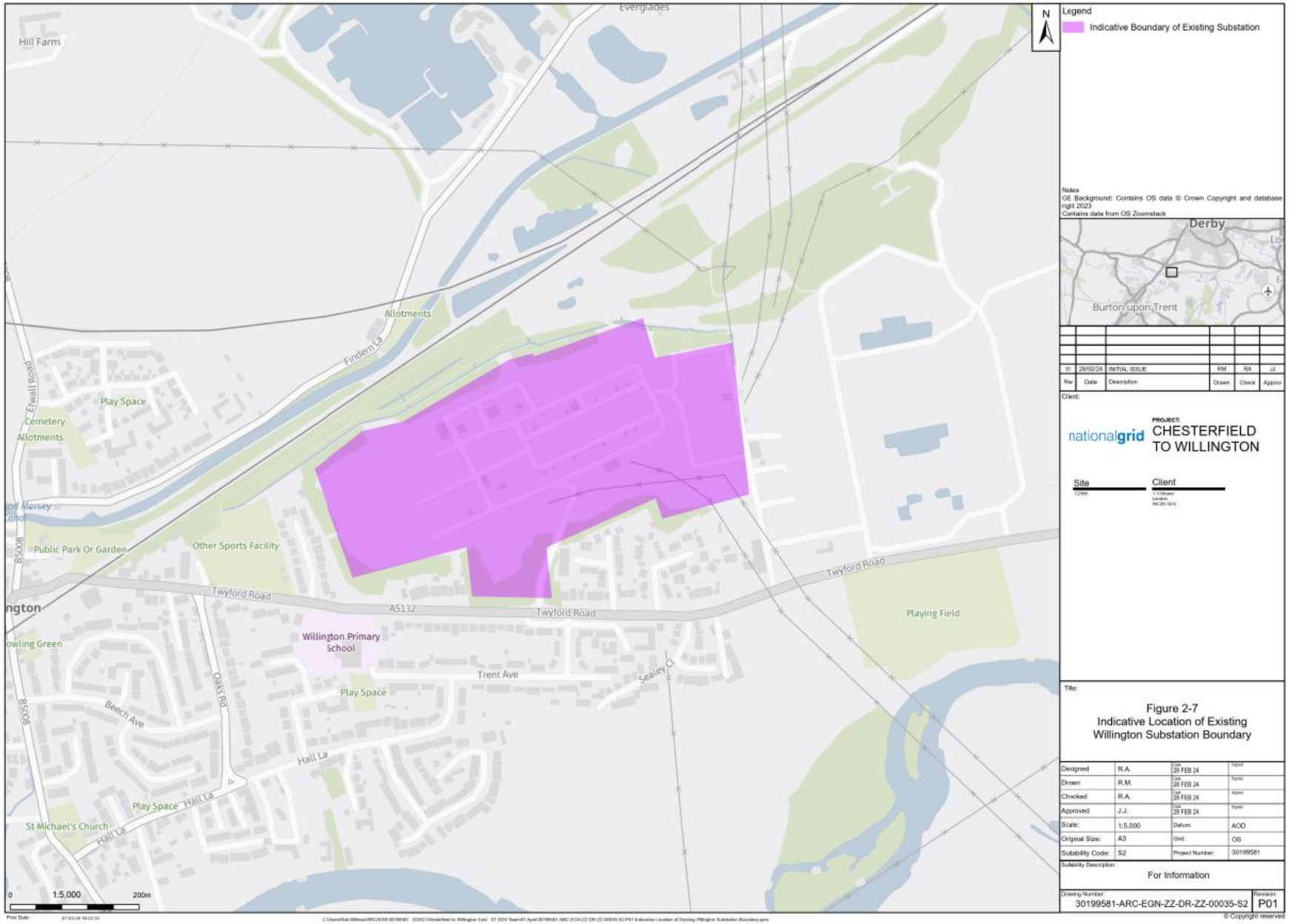
Existing Willington Substation

Background

2.5.12 NGET operates existing 275kV and 400kV substations east of Willington adjacent to the former Power Station site. An existing 132kV substation is also operated in this location by NGED.

2.5.13 Of relevance to this Project, the 400kV substation was built in the 1990s and will form the southern connection point for the Project. Its location, together with connecting overhead lines and the other referenced substations, is shown in Figure 2.7.

Figure 2.7 – Indicative Location of Existing Willington Substation



3. National Grid's Approach to Routeing and Siting

nationalgrid

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) and a summary of National Grid's approach to routeing and siting.

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 Project are set out below. Where NGET develops new infrastructure, such as this Project, 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:

  - *to develop and maintain an efficient, co-ordinated and economical system of electricity transmission;…"*

- Electricity Act – Schedule 9 (preservation of amenity), which includes 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 had due regard to other relevant 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 the British Energy Security Strategy in April 2022.

3.3.2 The British Energy Security Strategy proposes to accelerate the UK's transition towards a low-carbon, energy-independent future with a focus expanding domestic UK energy supply, accelerating the connecting network infrastructure to support an expansion in domestic UK energy supply and to work with international partners to maintain stable energy markets and prices.

3.3.3 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."

3.3.4 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."

3.3.5 The Powering Up Britain paper was published on 30 March 2023 and updated on 4 April 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.

3.3.6 When considering new electricity infrastructure, NGET have regard to the British Energy Security Strategy where appropriate.

3.4 National Policy Statements (NPS)

3.4.1 National Policy Statements EN-1 and EN-5 set the regulatory context within which the routeing and siting for electricity infrastructure networks is undertaken. Taken together, these 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 2023 revised NPSs (EN-1 to EN-5) were published on 22 November 2023 and came into force on 17 January 2024.

Overarching National Policy Statement for Energy – EN-1 (2024)

3.4.3 EN-1 sets out the need for new nationally significant infrastructure, which 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 Section 4.2 sets out the Government's commitments to prioritise low-carbon infrastructure. Paragraph 4.2.1 of the NPS states that 'Government has committed to fully decarbonise the power systems by 2035, subject to security of supply, to underpin its 2050 net zero ambitions'. Paragraph 4.2.4 states that the 'Government has therefore concluded that there is a critical national priority (CNP) for the provision of nationally significant low carbon infrastructure'. Paragraph 4.2.5 lists the types of infrastructure which meet the definition of nationally significant infrastructure, which includes electricity grid infrastructure in the scope of EN-5, including network reinforcement, upgrade works and associated infrastructure such as substations.

3.4.4 EN-1 sets out the impacts and means of mitigation that are anticipated to arise most frequently from energy projects. This CPRSS considers the following topics:

- Landscape and Visual (as described in EN-1);
- Historic Environment (as described in EN-1);
- Noise and Vibration (as described in EN-1);
- Biodiversity and Geological Conservation (as described in EN-1);
- Flood Risk (as described in EN-1)
- Water Quality and Resources (as described in EN-1);
- Socio Economic Impacts (as described in EN-1);
- Land Use, including Open Space, Green Infrastructure and Green Belt (as described in EN-1)
- Civil and Military Aviation and Defence (as described in EN-1); and
- Traffic and Transport (as described in EN-1).

3.4.5 Coastal change, dust, odour, artificial light, smoke, steam, insect infestation, resource and waste management impacts, greenhouse gas emissions and air quality, as described in EN-1, would not have a significant impact on the determination of the emerging 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).

3.4.6 Electromagnetic fields will be considered as the Project development progresses into the Defined Proposal and Statutory Consultation Stage (Stage 3). However, NGET designs all infrastructure to be compliant with current regulations and guidance[17] on such matters.

3.4.7 EN-1 explains that in terms of:

- Biodiversity and Geological Conservation – applicants, such as NGET, should show how a given project has taken advantage of opportunities to conserve and enhance biodiversity and geological interests;
- Historic Environment – there is a desirability for sustaining and, where appropriate, enhancing the significance of heritage assets, the contribution of their settings and the positive contribution they can make to sustainable communities including to their

[17] Energy Networks Association, (2017), Electric and Magnetic Fields: The Facts.

quality of life, their economic vitality and to the public's enjoyment of these assets. 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 – projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints, the aim should be to minimise harm to the landscape, providing reasonable mitigation where possible and appropriate. 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. Each of these designated areas has specific statutory purposes. Projects should be designed sensitively given the various siting, operational and other relevant constraints. For development proposals located within designated landscapes, measures which seek to further the purposes of the designation should be sufficient, appropriate and proportionate to the type and scale of the development. The 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 all or part of the development elsewhere outside the designated area or meeting the need for it in some other way, taking account of the policy on alternatives set out in Section 4.3 (of EN-1); and
  - any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated."
- Socio-Economic Impacts – applicants for a given project should identify the impacts of new energy infrastructure and potential mitigation measures.

National Policy Statement for Electricity Networks Infrastructure EN-5 (2024)

3.4.8 EN-5 sets out the factors influencing routeing and siting selection and the impacts and other matters which are specific to electricity networks infrastructure. In summary, it states that:

- Biodiversity – particular consideration should be given to the impacts on large birds, including feeding and hunting grounds, migration corridors and breeding grounds.
- Landscape and Visual – Paragraph 2.9.7 of EN-5 states that "Whilst the Government does not believe that development of overhead lines is generally incompatible in principle with developers' statutory duty under section 9 of the Electricity Act 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".

3.4.9 EN-5 also makes clear that the Holford Rules should be followed by developers when designing their proposals. Paragraphs 2.9.20 and 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."

3.5 The Holford and Horlock Rules

3.5.1 NGET consistently employs two sets of rules/guidelines for the routeing and siting of new energy 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[18].

Holford Rules

3.5.2 Paragraph 2.9.16 of NPS EN-5 (published November 2023, updated January 2024) 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[19] state that routeing of high-voltage overhead transmission lines should, where practicable:

- Avoid altogether the major areas of highest amenity value;
- Avoid smaller areas of high amenity value or scientific interest by deviation, provided this can be done without using too many angle towers;
- 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 medium or moderate levels of tree cover;
- Be kept as far as possible from smaller lines, converging routes and other poles, masts, wires and cables to avoid a concentration of wirescape[20]; and

[18] The National Policy Statement for Electricity Networks Infrastructure EN-5 (published November 2023, updated January 2024) 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."*

[19] National Grid, The Holford Rules. Available at https://www.nationalgrid.com/sites/default/files/documents/13795-The%20Holford%20Rules.pdf

[20] Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.

- Approach urban areas through industrial zones, where they exist; and when pleasant residential and recreational land intervenes between the approach line and the substations, carefully assess the comparative costs of undergrounding.

3.5.3 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.

3.5.4 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.

Horlock Rules

3.5.5 Paragraph 2.9.18 of NPS EN-5 makes clear that the Horlock Rules 'should be embodied in the applicant's proposals for the infrastructure associated with new overhead lines'. The Horlock Rules[21] state that:

- 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;
- 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 against the consequential environmental impacts, in order to avoid as far as possible adverse impacts;
- 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 is 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 impacts 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 equipment appropriate to individual locations;
- Space should be used effectively to limit the area required for the Project 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;
- For 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;

[21] National Grid, (2009), NGC Substations and the Environment: Guidelines on Siting and Design. Available at https://www.nationalgrid.com/sites/default/files/documents/13796-The%20Horlock%20Rules.pdf

- 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 terminal pylons on prominent ridges should be minimised by siting pylons against a background of trees rather than open skylines.

3.6 National Planning Policy Framework (NPPF) (2023)

3.6.1 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."

3.6.2 When considering new electricity infrastructure, NGET have due regard to the NPPF, where appropriate.

3.7 National Grid's Approach to Consenting

3.7.1 National Grid's Approach to Consenting[22] outlines the 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, Examination and Decision; and
- Stage 6: Construction.

3.7.2 A stepped approach has been adopted to identify potential routeing 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 within which the overhead lines, underground cables and upgrade works to existing transmission and distribution infrastructure could be routed, and locations where SECs could be sited (as appropriate).

[22] National Grid, (2022), Network and Infrastructure. Available at https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/planning-and-development.

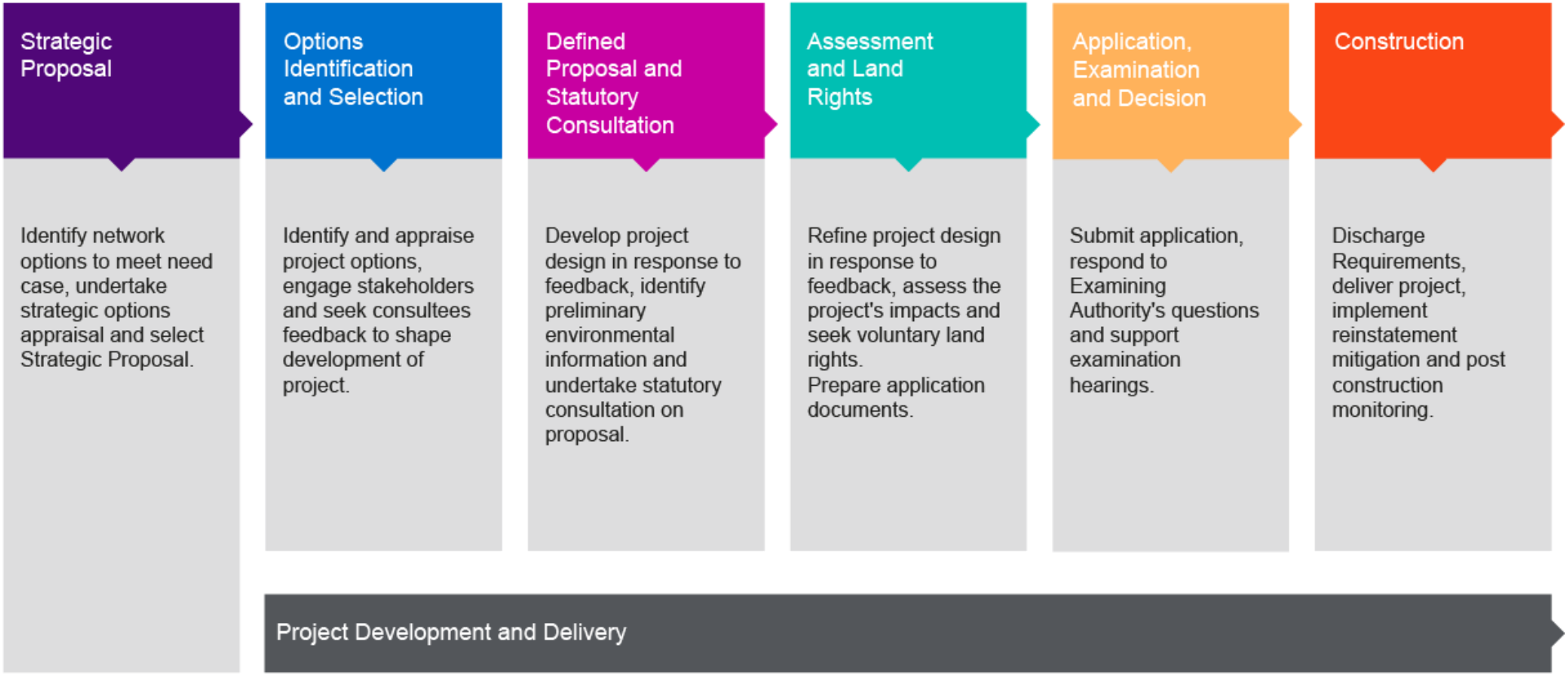
3.7.4 Figure 3.1 presents an overview of National Grid's Approach to Consenting; a summary of the main objectives of this stage of the consenting process can be seen below each stage. The Project is at the Options Identification and Selection Stage (Stage 2).

3.7.5 This CPRSS has been undertaken as part of 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 eight 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 – Identifying and defining corridors;
- Step 4 – Option appraisal of preliminary corridors;
- Step 5 – Refinement of corridors and sectioning of corridors;
- Step 6 – Options appraisal of refined corridors;
- Step 7 – Confirm emerging preferred corridor, undertake site visits for field observations at selected sites and develop graduated swathe for consultation; and
- Step 8 – Undertake non-statutory consultation.

3.7.6 This CPRSS sets out the findings of the first seven steps of Stage 2 for the Project. This CPRSS will inform subsequent non-statutory consultation, Step 8.

Figure 3.1 – NGET's Approach to Project Development and Delivery



4. Options Identification and Selection Process (Stage 2)

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4. Options Identification and Selection Process (Stage 2)

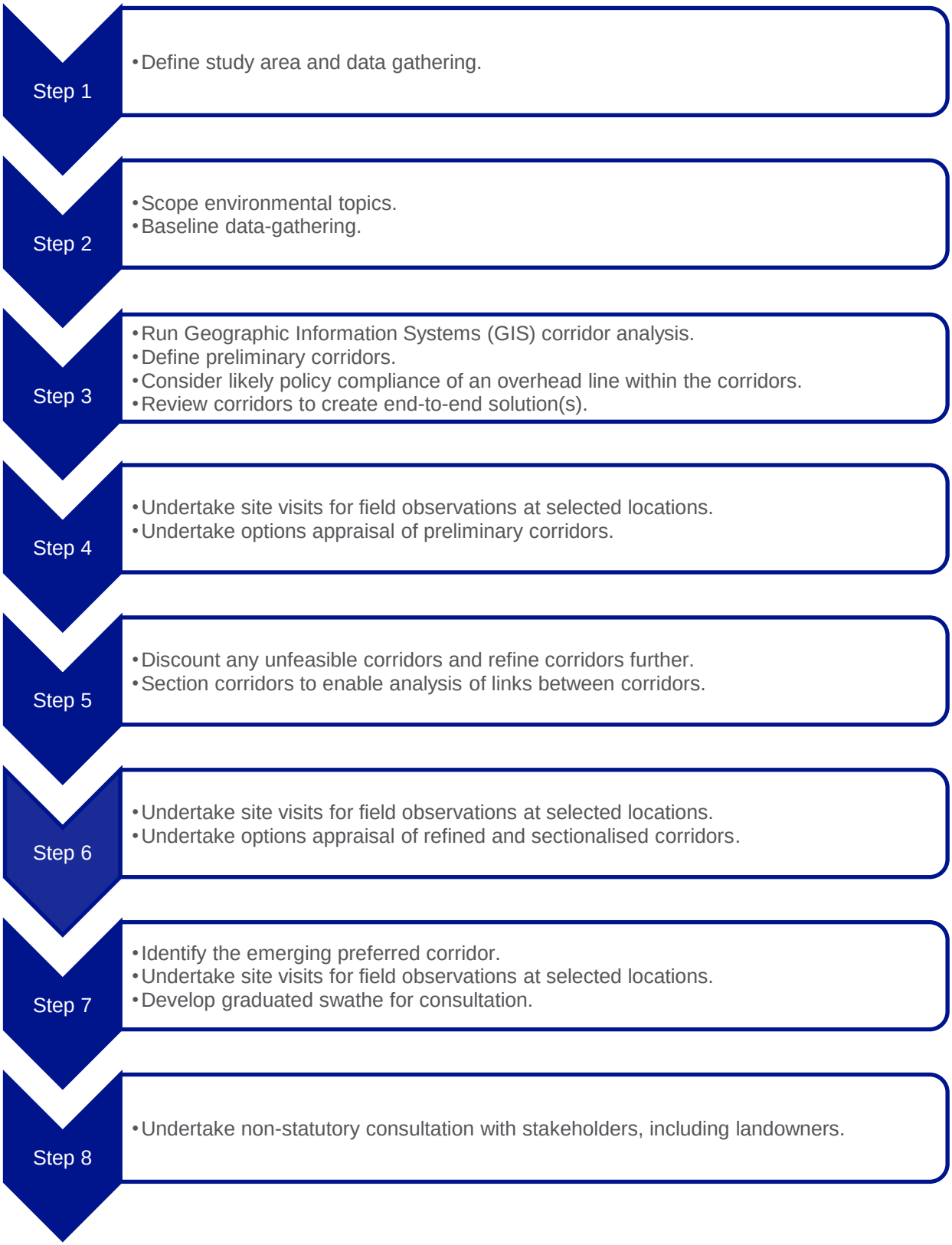
4.1.1 The Strategic Proposal (Stage 1) was completed in 2023 and a Preferred Strategic Proposal selected. This CPRSS presents the findings of the Options Identification and Selection Stage (Stage 2) and identifies the corridor which is emerging as preferred for the Project. The findings of this CPRSS will be used to inform the non-statutory consultation with stakeholders, including landowners. The feedback received on the Project during non-statutory consultation will be used to inform the design and alignment of the Project. Following the non-statutory consultation, the Project will progress into the Defined Proposal and Statutory Consultation Stage (Stage 3).

4.1.2 The methodologies employed for the eight steps, as defined for this Project, of the Options Identification and Selection Stage (Stage 2) are summarised in Figure 4 1 and described below.

4.1.3 The following key terms are used throughout this CPRSS:

- Study Area – the broad area within which the infrastructure required for the Project may be located and within which detailed environmental and socio-economic data is gathered to inform Stage 2.
- Corridor – a broad preliminary area within which new transmission infrastructure (overhead lines, SEC, underground cables (as appropriate)) could be routed.
- Emerging Preferred Corridor – a preferred broad area within which the infrastructure for the Project may be located, based on the findings of Stage 2.
- Graduated Swathe – shaded areas within the emerging preferred corridor 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 at this stage is likely to be better located, in NGET's emerging view, within the corridor.
- Non-statutory consultation – an engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the emerging preferred corridor and the graduated swathe. The feedback received will inform the onward development of the Project.

Figure 4.1 – CPRSS Methodology



4.2 Step 1: Define the Study Area

4.2.1 The Study Area is the broad area within which the transmission infrastructure required for the Project will be located. The Study Area is also the area within which detailed environmental and socio-economic data was gathered to inform Stage 2.

4.2.2 The Study Area was informed by:

- The connection points (start/end points) identified in the Strategic Proposal Stage (Stage 1) – i.e., the Chesterfield and Willington Substations.
- The distribution of extensive areas of the highest amenity value or environmental constraint (e.g., nationally designated sites such as the Peak District National Park and internationally designated sites such as the Derwent Valley Mills World Heritage Site).
- The nature of the physical and human geography. The presence of major geographical features such as topography, major infrastructure such as airports (e.g., East Midlands Airport), or major settlements (e.g., Chesterfield, Mansfield, Nottingham and Derby) may represent a natural boundary to the Study Area or dictate a need to extend the Study Area to support routes around such features.
- Consideration of the likely balance of environmental impacts between direct and indirect routes.
- Consideration of the Holford Rules (for routeing of an overhead line).

4.2.3 Based on these factors, the Study Area encompassed the maximum extent within which the Project design would satisfy the statutory duties and obligations of NGET and meet the Project objectives (as detailed in the SOR for the Project).

4.2.4 A broad indicative corridor was defined as part of the Strategic Proposal Stage (Stage 1) undertaken in 2023. The broad indicative corridor informed the Study Area developed at this Stage (Stage 2).

4.2.5 The Study Area developed encompassed the area within which preliminary corridors could be identified but excluded areas unlikely to be feasible. The Study Area was defined in part by Holford Rule 1 and allowed for the application of the principles of the Holford Rules as described in **Chapter 3**. The Study Area therefore encompassed an area within which the identification and assessment of preliminary corridors could be completed.

4.2.6 The Study Area and factors that influenced its 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).
- Cost: Capital Cost; Lifetime Cost; and Constraint Costs (where applicable).

4.3.2 The environment and socio-economic topics are aligned with the applicable requirements of Section 5 of EN-1 and Section 2 of EN-5.

4.3.3 National Grid 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 receptors (e.g., individual settlements, species and habitats, landscape character etc.) for a particular topic or sub-topic within the Study Area, and whether the Project could have a material impact on the receptors. If there were either no receptors 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 receptors for that sub-topic in the vicinity of the Study Area or option that could be impacted; or (ii) the different options could not be distinguished on the basis of 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, waste management impacts and air quality were scoped out on the basis that with the other topics applied, these topics would not be determining factors in the identification and selection of corridors.

4.3.7 With respect to air quality, the majority of the Study Area is not within an Air Quality Management Area (AQMA) and not considered to be a differentiator between corridors, and therefore this was scoped out.

4.3.8 National Grid designs all of its infrastructure to be compliant with current regulations and guidance on electromagnetic fields, and therefore this was scoped out.

4.3.9 The environmental and socio-economic topics scoped into this Project at Stage 2 include landscape and visual amenity, ecology, historic environment, noise and vibration, soils and geology, water, economic activity, traffic and transport, and aviation and defence.

4.3.10 At this stage of the Project, air quality and emissions are considered accounted for by considering proximity to settlements, residential and other sensitive receptors and therefore are scoped out. 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

4.3.11 To identify corridor 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 Area. As part of this process, geographical information system (GIS)[23] web mapping was developed, comprising available environmental, socio-economic and technical data within the Study Area.

4.3.12 Data for each topic was gathered through a desk-based review of information on potential internationally, nationally, regionally and locally important receptors. This included the following:

- Identification of designated sites and other constraints from British Geological Survey, Coal Mining Authority, Civil Aviation Authority, Crown Land, Environment Agency, Forestry Commission, Joint Nature Conservation Committee, Department for Levelling Up, Housing and Communities, Natural England, National Trust, Office for National Statistics, Ordnance Survey, River and Canal Trust, 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 to identify further environmental constraints and opportunities, such as county- and regional-level designations or other locations important to the public.
- Review of Landscape Character Assessments of relevance to the Study Area.
- Review of Ordnance Survey (OS) mapping (1:50,000 mapping and terrain data) and aerial photography to identify other potential constraints such as settlements, properties, walking routes, cycling routes etc.
- Extrapolation of OS OpenData to identify further environmental constraints including locations of watercourses and waterbodies.
- Review of other local information through online and published media such as tourism sites and walking routes.

4.4 Step 3: Identifying and Defining Preliminary Corridors

4.4.1 At this stage of the Project, the identification of preliminary routeing options involved limited detailed engineering design. It was led by landscape and environmental specialists who had due regard to the environmental and socio-economic considerations alongside the required technical parameters. The aim of identifying preliminary corridors was to balance high-level mitigation with engineering requirements, routeing to avoid designated sites and other large-scale constraints, to minimise impacts on the environment and local population as far as practicable, whilst ensuring options identified met the Project's engineering requirements.

4.4.2 As part of this process, GIS web mapping was used, comprising available environmental, socio-economic and technical data within the Study Area. Features representing potential constraints to development were categorised based on the level of constraint that the relevant Project Team subject matter experts considered them to

[23] GIS is a system that enables the creation, management, analysis and mapping of all types of data.

represent on the basis of professional judgement and relevant environmental legislation, policy and good practice. As a first step, the Project Team's environmental subject matter experts reviewed the constraints and opportunities within the Study Area to set Study Area-specific parameters. These parameters were used to focus the initial GIS-based investigation upon the areas considered most likely to yield environmentally preferrable options, as well as to ensure that multiple options were considered. These parameters were important to ensure that areas of potential opportunity were subject to thorough investigation as well as those that present constraints.

4.4.3 Once parameters were set, GIS was used initially to identify corridors or areas that may offer the most direct routes through the least constrained areas. These preliminary corridors or areas were then reviewed by the environmental subject matter experts, working with the wider Project Team as appropriate and employing professional judgement and their understanding of routeing considerations to identify technically feasible preliminary corridors. Preliminary corridors included aspects which couldn't be mapped but were important considerations to the routeing of a transmission connection. For the overhead line 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).

4.4.4 The process to identify and define preliminary corridors is described in Chapter 5.

4.5 Step 4: Options Appraisal of Preliminary Corridors

4.5.1 In Step 4, the preliminary corridors agreed at Step 3 were 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.

4.5.2 In line with National Grid's Approach to Consenting, the Options Identification and Selection was largely desk-based at this stage. For the purpose of appraising the preliminary corridors, only desk-based information was used. 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 CPRSS.

4.5.3 The overall objective throughout the Options Appraisal was to take full consideration of all known environmental and socio-economic factors to minimise the risk of significant adverse impacts on the environment and communities whilst considering engineering and economic considerations.

4.5.4 For each relevant environmental and socio-economic sub-topic (outlined in Step 2), the appraisal considered the potential impacts on relevant receptors, and whether such impacts could be avoided or mitigated through careful routeing. 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 pylon).

- Reduction of wirescape through distribution network rationalisation or undergrounding.
- Reduction of wirescape through transmission network rationalisation.
- Alternative transmission technology (such as undergrounding).

4.5.5 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 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).

4.5.6 The Project itself is designed to enable renewable energy generation, thus contributing to combating climate change. In subsequent stages, the Project will need to consider climate change both in terms of greenhouse gas emissions and climate resilience and adaptation. 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).

4.5.7 The environmental, socio-economic, technical, cost and programme findings of the Options Appraisal on preliminary corridors were discussed. Professional judgement was used by the FEED contractor and Project Team to recommend further amendments and refinements (i.e., to park, refine or expand) to the preliminary corridors to be undertaken in Step 5.

4.5.8 The findings of the Options Appraisal of the preliminary corridors are detailed within Chapter 6**.**

4.6 Step 5: Refinement of Preliminary Corridors

4.6.1 The first step in the refinement of the preliminary corridors was to remove settlements in accordance with the Holford Rules and NPS EN-5.

4.6.2 As part of the corridor refinement exercise, the distribution and density of constraints (environmental, technical and socio-economic) were 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 Grid's guidance and national planning policy) is that transmission connections are as overhead lines, except in nationally designated landscapes. Consideration was given to the use of underground cables throughout such landscapes, including through the Peak District National Park, Derwent Valley Mills World Heritage Site (and its buffer), together with other landscape, biodiversity and heritage designations of national importance.

4.6.3 Chapter 2 describes overhead line and underground cable technologies, and the associated SECs.

4.6.4 Corridors were further refined to remove any areas that would be unfeasible for an engineered solution (e.g., not enough clearance between constraints for an overhead line or an underground cable).

4.6.5 To enable a clear comparative analysis and understanding of the network of refined corridors, each refined corridor was then divided into 'sections', with some of the sections also providing connecting links to other refined corridors where feasible. This exercise was undertaken so that an emerging preferred corridor could potentially be

identified using a series of sections of one refined corridor via a link to a series of sections of another refined corridor, for example, in order to bypass an area of greater constraint and ultimately provide the best end-to-end solution. This approach therefore allowed for the continued appraisal of multiple and interrelated options.

4.6.6 The refined corridors, comprising their sections and links, were then further reviewed by NGET and the FEED Contractor to confirm their technical feasibility and ensure that key issues, and the interaction of constraints, had been fully considered. At this point, the network of refined corridors, sections and links was considered to offer a sufficient number of potential options to form feasible end-to-end solutions and be taken forward for further appraisal.

4.7 Step 6: Options Appraisal of Refined Corridors

4.7.1 In Step 6, the refined and sectionalised corridors previously developed in Step 5 were subject to Options Appraisal in accordance with National Grid's Approach to Consenting. The approach taken to Option Appraisal in Step 6 was similar to the approach taken in Step 4, except each section of the refined corridors was appraised individually to identify the best series of sections and links for the emerging preferred corridor.

4.7.2 The findings of the Options Appraisal of the refined corridors are detailed within Chapter 7.

4.8 Step 7: Confirm Emerging Preferred Corridor and Develop Graduated Swathe for Consultation

4.8.1 Following completion of Step 6, NGET, the FEED Contractor and the landscape and environmental specialists reviewed environmental and socio-economic preferences and, in accordance with EN-1 and EN-5, balanced these against technical, cost and programme considerations to reach a conclusion on the emerging preferred corridor that provides the optimum balance.

4.8.2 Following the identification of the emerging preferred corridor, site visits were undertaken by landscape 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 areas identified as particularly constrained during the desk studies for the emerging preferred corridor.

4.8.3 The likely areas within the emerging preferred corridor where the infrastructure for the Project may be located were identified by the FEED Contractor. Identified preliminary areas were then examined, taking into consideration environmental constraints and Holford Rules, with particular regard to rules 1, 2 and 3 to avoid areas of high amenity value. The Project Team reviewed the outputs of the routeing and the technical requirements for creating a graduated swathe for non-statutory consultation.

4.8.4 At this stage of the Project, a high-level cost exercise was undertaken. A summary of cost and programme considerations is provided in Chapter 8.

4.8.5 The selection of a preferred emerging corridor is detailed in Chapter 9.

4.8.6 The development of the graduated swathe is detailed in Chapter 10.

4.9 Step 8: Undertake Non-Statutory Consultation

4.9.1 The final step in the CPRSS was to report the entire process for 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.

4.9.2 A summary of the next steps for the Project is provided in Chapter 11.

5. Study Area and Corridor Definition

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5. Study Area and Corridor Definition

5.1 Defining the Study Area (Step 1)

5.1.1 The Study Area was defined through a five-phase process which is outlined below. The approach to developing the Study Area for the Project was based on balancing NGET's duty to develop an economical system of transmission (Section 9 of the Electricity Act 1989) with 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

5.1.2 The first phase involved joining the two connection points, the new Chesterfield Substation in the north and Willington Substation in the south, in the most economical manner: a straight line between the two connection points. All other things being equal, a straight line would be the shortest route and therefore both the least cost and the least amount of new development potentially giving rise to environmental impacts. In practice, this is not feasible, hence the need to adopt a more refined approach to developing the Study Area which accounted for the presence of environmental constraints.

Phase II: High-level Constraints Review

5.1.3 A high-level desk-based review was then undertaken of the environmental features representing major potential constraints between the two connection points (along the straight line defined in Phase I) including the areas of highest amenity value, main centres of population and major technical constraints. Major areas of highest amenity value found on the 'straight line' between the two connection points included the Derwent Valley Mills World Heritage Site. The main centres of population identified included Derby, Clay Cross and Belper. In addition, further technical constraints identified included other residential areas and crossing the River Derwent Valley.

Phase III: Initial Study Area

5.1.4 An initial Study Area was then introduced around the straight line to allow for the development of a reasonable range of preliminary corridor options and provide opportunities to avoid the major constraints that are present directly between the two connection points. An initial Study Area with a diameter of approx. 50km (approx. 25km radius from the centre point of the straight line) was considered sufficient to enable the development of preliminary corridor options that avoided the major constraints.

Phase IV: Refinement of Study Area

5.1.5 At this stage, the initial Study Area was refined to avoid the more highly populated areas of Nottingham and Mansfield, as these were situated on the outskirts of the initial Study Area, therefore, a preliminary corridor to the south or east of these populated areas would have significantly increased the overhead line or underground cable length in contradiction with the Holford Rules. The urbanised area of Derby remained in the initial

Study Area as there were opportunities to identify preliminary corridors to both the east and west of the city. The northwest of the initial Study Area was refined to minimise the footprint within the Peak District National Park in accordance with Holford Rule 1. However, an area of the Peak District National Park remained in the initial Study Area to assess opportunities for a preliminary corridor to the west of the Derwent Valley Mills World Heritage Site. The initial Study Area was refined to remove East Midlands Airport, as if it were included, it would have led to a preliminary corridor around the east and south of the feature, significantly increasing an overhead line or underground cable length in contradiction with the Holford Rules.

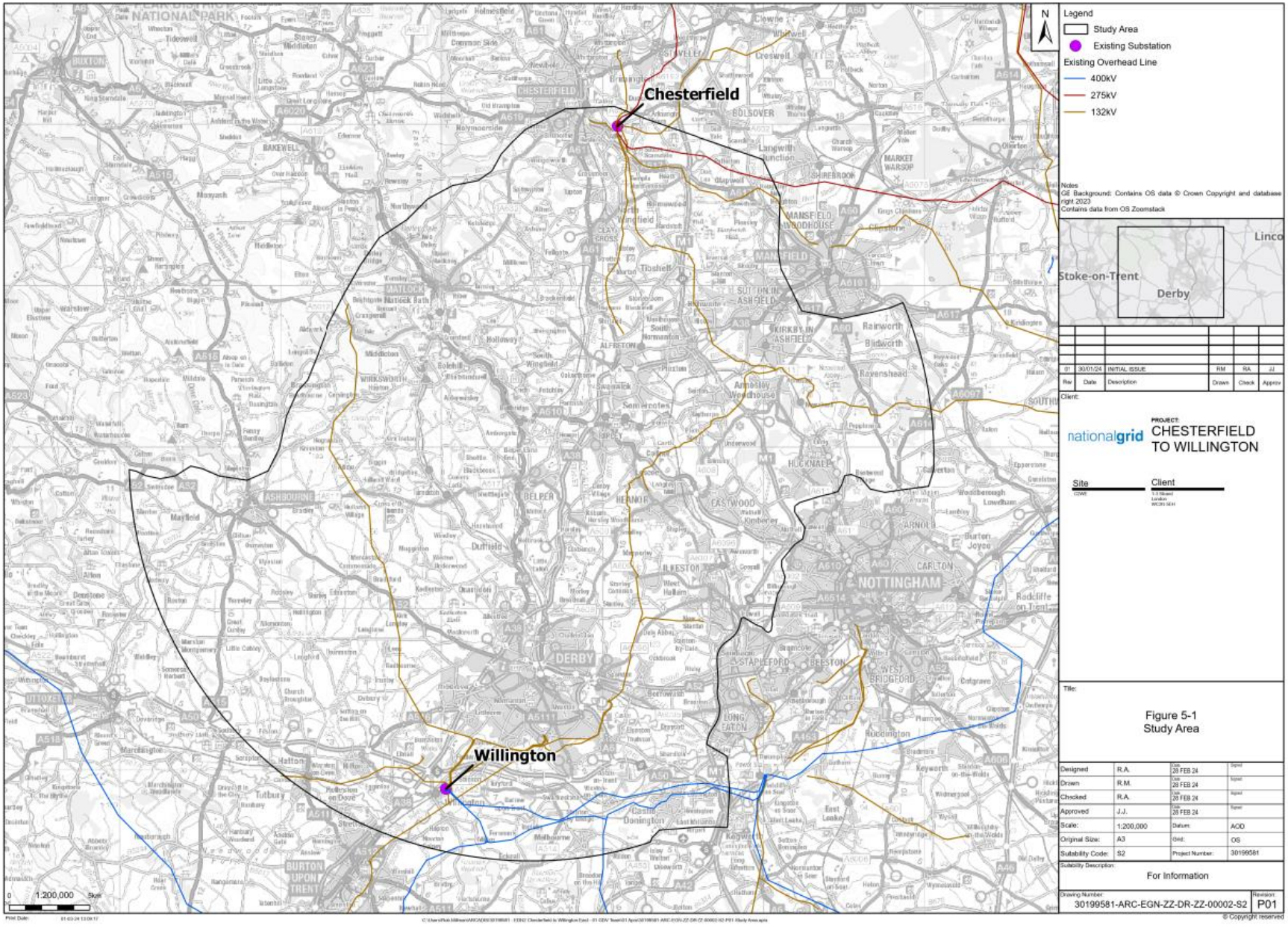
Phase V: Consideration of an Expansion of the Study Area

5.1.6 A high-level desk review of the unconstrained areas within the initial Study Area identified in Phase IV was then undertaken to identify where the initial Study Area could potentially be expanded to avoid constraints and provide opportunities to reduce potential environmental impacts.

5.1.7 One area that was identified for potential expansion was to the north-west of Darley Dale, due to the number and density of residential properties, the presence of quarries and industry, and ecological constraints in this area which limited the clearance available for an overhead line or underground cable through this part of the Study Area. It was concluded, however, that expanding the initial Study Area further north-west would present greater potential landscape and visual impacts on the special qualities of the Peak District National Park and the amenity of the sensitive visual receptors that use it. In addition, these parts of the Peak District National Park contain areas of steeper terrain and woodland, which, if they were to be avoided, would result in challenging technical solutions and a considerably longer corridor. The initial Study Area was therefore not expanded after reviewing these potential opportunities.

5.1.8 The refined Study Area which was developed to become the final ‘Study Area’ is presented in Figure 5.1 It begins at the new Chesterfield Substation as the northern connection point for the Project. The Study Area extends to the Willington Substation in the south, which is the most southern connection point for the Project.

Figure 5.1 – Study Area



5.2 Description of the Study Area

5.2.1 The Study Area is located between the Peak District National Park in the west and the edges of Mansfield and Nottingham, and smaller populated areas to the east.

5.2.2 Several National Character Areas (NCAs) are present within the Study Area, including the Potteries and Churnet Valley, White Peak, Needwood and South Derbyshire Claylands, Derbyshire Peak Fringe and Lower Derwent, Trent Valley Washlands, Melbourne Parklands, Nottinghamshire, Derbyshire and Yorkshire Coalfield, Southern Magnesian Limestone and Sherwood.

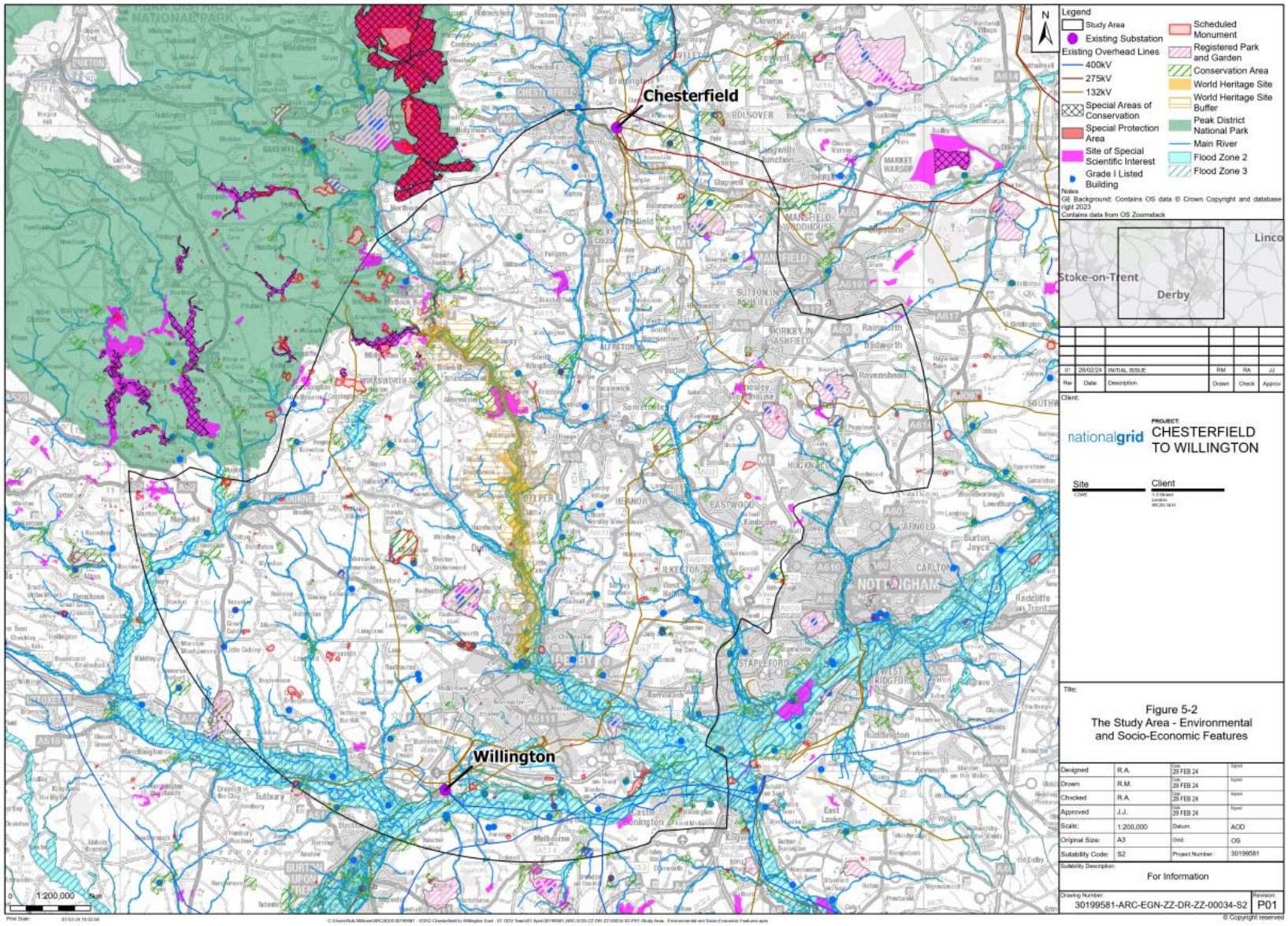
5.2.3 The Derwent Valley Mills World Heritage Site is a large linear feature approximately 24km in length that extends from the northwest of the Study Area at Matlock, to the central south of the Study Area at Derby. The Peak District Dales Special Area of Conservation (SAC), Gang Mine SAC and Bees Nest and Clay Pits SAC are present within the northwest of the Study Area. There are also several Sites of Special Scientific Interest (SSSIs) present within the Study Area. Larger SSSIs include: Clough Woods on the north western boundary; Via Gellia Woodlands located to the south west of Matlock and bounding the Derwent Valley Mills World Heritage Site; Shining Cliff Woods and Crich Chase located on opposite sides of the Derwent Valley adjacent to the Derwent Valley Mills World Heritage Site; Kirkby Grives and Annesley Woodhouse Quarries to the south of Kirkby-in-Ashfield; Kedleston Park to the north west of Derby; Hilton Gravel Pits to the west of Willington Substation; and Donington Park to the east of Willington Substation.

5.2.4 Several large rivers run through the Study Area, including: the River Rother, which extends from the north of the Study Area at Chesterfield to Moreton; the River Amber, which extends from Ogston in the north of the Study Area to Castle Hill; the River Trent, which intersects the southern extent of the Study Area from west to east; the River Derwent, which runs from the north west boundary of the Study Area and through Derby to its confluence with the River Trent in the south east of the Study Area; and the River Erewash, which runs from the north east of the Study Area at Mansfield to the south east of the Study Area at Nottingham.

5.2.5 The road network comprises major routes, including the M1, A6, A38, A50, A52, A61, A610 and A617, which connect the large settlements of Chesterfield, Mansfield, Derby, Nottingham and Ashbourne, as well as the Peak District National Park.

5.2.6 Key environmental and socio-economic features are shown in Figure 5.2.

Figure 5.2 – The Study Area – Environmental and Socio-Economic Features



5.3 Data Gathering (Step 2)

5.3.1 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 the potential for adverse impacts on a feature within the Study Area boundary (for example, impacts on migrating birds from a designated site). The extent of the data gathering was based on the professional judgement of the Project's environmental and engineering specialists, considering relevant environmental legislation, policy and good practice.

5.3.2 A list of the data obtained, to inform the onward steps, is listed in Table 5.1.

5.3.3 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.

As well as potential constraints to the Project, the data gathering and mapping exercise also identified features that might offer potential opportunities and therefore promote the inclusion of certain areas within preliminary corridors. A review of existing infrastructure that may offer close parallel opportunities was also undertaken. This included a review of the existing Transmission and Distribution network for voltages ranging between 132kV, 275kV and 400kV OHL network. Further discussion of the close parallel opportunities is provided in Section 5.7 below.

Table 5.1 – Data Gathering Features

Sub-topic	Feature Name
Aviation and Defence	Licensed Airfields
	Unlicensed Airfields with Buildings
	Unlicensed Airstrips
	Military Airfields, Military Sites and Military Practice Areas
	Civil Aviation Authority Airports
	Civil Aviation Authority Aerodromes
Ecology	Ancient Woodland
	National Nature Reserves (NNR)
	Ramsar Sites and Proposed Ramsar Sites
	Special Areas of Conservation (SAC) and Possible SAC
	Special Protection Areas (SPA) and Potential SPA
	Sites of Special Scientific Interest (SSSI)

Sub-topic	Feature Name
	Local Nature Reserves (LNR)
	Important Bird Areas
	Irreplaceable Priority Habitats (excluding Ancient Woodland and Veteran Trees)
	Veteran Trees
Socio-Economic	Buildings (other than residential properties e.g., retail, industrial estates)
	Aggregate and Mineral Resource Areas
	Woodland / Forestry Operations
	National Trust Inalienable Land
	Wind Farms and Solar Farms
	Planning Applications/Consents (only for NSIPs registered with the Planning Inspectorate)
	Local Plan Allocations
Geology and Soils	Geological Sites of Special Scientific Interest (SSSI)
	Local Geodiversity Sites
	Peaty Soils
	Best Most Versatile (BMV) Land and Agricultural Land Classification (ALC) Grades 4 and 5.
	Landfill Sites (historic and authorised landfill)
	Mines
Historic Environment	World Heritage Sites
	Scheduled Monuments
	Listed Buildings (Grade I, II and II*)
	Registered Parks and Gardens
	Conservation Areas
	National Trust Properties and Inalienable Land
Landscape and Visual	National Parks
	Special Landscape Areas (SLA)
	Local Landscape designations
	Residential Properties
	National Trails

Sub-topic	Feature Name
	Other Recreational Routes: regional trails / promoted long-distance paths and the National Cycle Network
	Green Belt
	Key Views
	Key Recreational Areas (e.g., country parks and Countryside and Rights of Way (CROW) open access areas)
	Other Outdoor Recreational Facilities (e.g., canals, caravan/campsites, visitor centres, outdoor recreation visitor centres)
Noise and Vibration	Residential Properties
	Education Establishments (e.g., Schools and Colleges)
	Buildings (other than residential properties e.g., retail, industrial estates)
Traffic and Transport	National Cycle Network
	National Trails
	European Long-Distance Paths
	Rail Network (including Railway Stations)
	Trunk Road Network
Water	Statutory Main Rivers
	Water Framework Directive (WFD) Surface Waters
	Flood Zones 2 and 3 (including storage areas)
	Groundwater Dependent Terrestrial Ecosystems
	Groundwater Source Protection Zones – Inner/Zone 1

5.4 Identifying and Defining Corridors (Steps 3 and 5)

Identifying and Defining Preliminary Corridors

5.4.1 Following the identification of environmental and socio-economic constraints using GIS analysis, preliminary corridors were developed between the potential start/end points by the Project Team subject matter experts. The preliminary corridors were identified by applying professional judgement and their knowledge of routeing considerations, in particular the Holford Rules. This was to minimise the potential for adverse impacts on the environment, including elements and nuances that cannot be digitised (e.g. Holford Rules 3 to 7).

5.4.2 The consideration of the Holford Rules in the development of the preliminary corridors was led by landscape and visual impact 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. Holford Rules 1 and 2 address the areas of high amenity (i.e. environmental constraints). Holford Rule 1 applies at a broader scale, primarily in setting the overhead line Study Area. Holford Rule 2 considers amenity areas at a smaller scale and therefore was the main driver in the GIS analysis, and critical in developing preliminary corridors. Holford Rule 3 considers the impact of angle pylons and the visual impacts that may be caused by an overhead line with frequent changes of direction. Holford 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. Holford Rule 6 considers wirescape, whilst Holford Rule 7 considers the approaches to urban areas.

5.4.3 As well as potential constraints to new infrastructure, the GIS analysis also identified opportunities to promote the inclusion of certain areas within the preliminary corridors. The principal opportunities were associated with the potential to follow existing 132kV overhead line routes, and to rationalise the existing network by removing or undergrounding the existing 132kV infrastructure and restrict the geographic extent of environmental and socio-economic impacts associated with such infrastructure.

5.4.4 The GIS analysis was used as a starting point to identify preliminary corridors that aimed to:

- Avoid the largest areas of highest amenity.
- Avoid the largest settlements.
- Allow for enough space to accommodate reasonable lengths of straight alignment at the detail design stage, in accordance with Holford Rule 3.
- Follow existing infrastructure corridors such as the M1 motorway and existing 132kV overhead line routes with the potential to remove or underground existing 132kV infrastructure and restrict the geographic extent of environmental and socio-economic impacts.
- Be wide enough to allow for smaller areas of high amenity and residential properties within the preliminary corridor to be avoided at the routeing stage.
- Be wide 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 routeing stage.

5.4.5 Eight preliminary corridors were identified for appraisal.

5.4.6 The identified preliminary corridors were then appraised by environmental, socio-economic and engineering and system factor specialists. A summary of the Options Appraisal for the preliminary corridors is detailed in Chapter 6.

5.4.7 Following the appraisal of the preliminary corridors, further technical feasibility analysis was undertaken by the FEED team. Through this process, it was determined that certain preliminary corridors were technically unfeasible. These preliminary corridors were therefore removed from further consideration.

Identifying and Defining Refined Corridors

5.4.8 Preliminary corridors that were deemed to be technically feasible were then subject to further refinement.

5.4.9 The refinements to preliminary corridors included:

- Smaller areas of higher amenity were avoided to the extent feasible.
- Other ‘smaller’ settlements were removed.
- Smaller areas of technical constraint were avoided to the extent feasible, which included removing land with potentially challenging topography (such as the River Amber Valley), and refining corridors to allow flexibility when designing a route into the new Chesterfield Substation and Willington Substation given the nearby constraints.
- Sections of corridor where an engineered solution was unfeasible (i.e., insufficient clearance for installation of an overhead line or an underground cable) were removed.
- Where there are opportunities for potential corridors on either side of settlements, this optionality was retained to allow for further refinement based on the options appraisal of the refined corridors.
- Technical, landscape and heritage specialists worked together to find the most feasible location for a corridor through the Derwent Valley Mills World Heritage Site, given its central location within the Study Area, and rationalised the corridor widths through this designation to find a potential corridor with the least impact.

5.4.10 Once refined, the corridors were then divided into sections and links to provide options to connect from one corridor to another so that constrained sections of an otherwise suitable corridor can be bypassed. During this process, certain corridors were combined to create a refined single corridor with links providing alternative routes, and an additional loop was added to create a new corridor. The Options Appraisal of the refined corridors is summarised in Chapter 7.

5.4.11 The refined corridors were then subject to a back-check review and further analysis and by the Project Team.

5.5 Mitigation of Impacts Through Avoidance

5.5.1 As previously stated, the Study Area and preliminary corridors were designed to comply with Holford Rules 1 and 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 refined corridors, and whether they have been avoided by this process, are detailed below in Table 5.2.

Table 5.2 – Major Features Representing Constraints within the Study Area

Topic	Name of Constraint	Avoided by Refined Corridors?
Aviation and Defence	East Midlands Airport	Avoided
	Ripley Airfield	Avoided
	Derby Airfield	Avoided
	Park Hall Airstrip	Avoided
Ecology	SSSIs	Within one or more refined corridor
	Peak District Moors (South Pennine Moors Phase 1) SPA	Avoided
	Bees Nest and Green Clay Pits SAC	Avoided
Socio-Economic	Wind Farms	Avoided
	Solar Farms	Within one or more refined corridor
	Golf Courses	Within one or more refined corridor
	Country Parks	Within one or more refined corridor
	National Trust Land	Avoided
Historic Environment	Derwent Valley Mills World Heritage Site	Within one or more refined corridor
	Registered Parks and Gardens	Within one or more refined corridor
Landscape and Visual	Peak District National Park	Within one or more refined corridor
	Major Urban Areas Including Derby, Nottingham and Mansfield	Avoided
Water	Statutory Main Rivers	Within one or more refined corridor
	Water Framework Directive (WFD) Surface Waters	Within one or more refined corridor
	Flood Zones 2 and 3 (including storage areas)	Within one or more refined corridor
	Groundwater Source Protection Zones – Inner/Zone 1	Within one or more refined corridor

5.5.2 There are two large areas of highest amenity value present within the Study Area and refined corridors, which include the Peak District National Park and the Derwent Valley Mills World Heritage Site. The Derwent Valley Mills World Heritage Site is a long linear designation that intersects the western and central extents of the Study Area running from the north west of the Study Area at Matlock in a south east direction to Derby. The eastern area of the Study Area is highly constrained, with a larger number of settlements than the western extent of the Study Area. Two corridors were therefore identified in the central extent of the Study Area which intersect the Derwent Valley Mills World Heritage Site to provide as direct a route as possible in accordance with Holford Rule 3, and alternative corridors for consideration should a route further east not be feasible. A refined corridor has also been identified along the western boundary of the Study Area that intersects the Peak District National Park. This refined corridor was developed to provide an alternative corridor in the western section of the Study Area that avoids the Derwent Valley Mills World Heritage Site, should other options be unfeasible. Three of the refined corridors avoid all areas of highest amenity value within the Study Area.

5.5.3 All refined corridors that intersect smaller areas of high amenity, such as SSSIs, listed buildings, scheduled monuments and Registered Parks and Gardens, have been developed to include enough clearance to allow avoidance of the designations without using too many angle towers, in accordance with Holford Rule 2.

5.5.4 Where possible, large settlements in the Study Area have been removed from the refined corridors. Refined corridors are considered sufficiently wide to accommodate a range of alternative routes.

5.6 Introduction to the Cost and Programme Model

NGET's Cost Estimates

5.6.1 Preliminary costs are developed by NGET's cost estimating function. Route lengths are determined through a desktop exercise that considers how the overhead line may navigate key constraints. The costs of applying industry 'best practice' mitigation measures during construction and operation are inherent within the cost base used. Costs can therefore be consistent in relative terms, noting that they may become higher or lower. The scope of substation work, to connecting the overhead line into the substations at Chesterfield and Willington, is identical for all corridor options. The costs of this work have therefore not been included and are not a differentiator between options.

5.6.2 The costs included were estimated based on prices from the financial year 2022/23 and as such will be adjusted over time. However, they provide a consistent cost point for comparison of options at this stage.

NGET's Programme Estimates

5.6.3 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.

5.7 Appraising 'Close Parallel' Opportunities

The Opportunity of a Close Parallel Alignment

5.7.1 In general terms, a close parallel route may have the potential to reduce the overall extent of environmental impacts arising from the Project by intensifying the degree of impact on receptors already affected by existing overhead lines, rather that spreading impacts to areas not currently affected.

5.7.2 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. In most circumstances, this is likely to be more achievable the closer the overhead lines are to each other, as local conditions would be likely to be similar for both overhead lines.

5.7.3 The minimum distance between lines is determined by technical and safety constraints and would typically be 80m. The maximum distance at which the benefits of close paralleling might be achieved depends on local factors which are described in more detail below. Whilst this maximum cannot be precisely defined, it is considered to be unlikely to be more than approximately 200m in most circumstances.

Challenges with a Close Parallel Alignment

5.7.4 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(s), and this can also result in an inconsistent span length and clearance level for the overhead line.

5.7.5 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. In some locations, there will be a need to cross the existing overhead line where routeing is not continually viable on one side. In these circumstances, a line swap-over, or duck-under would be required and it can be challenging to accommodate these within the existing infrastructure. For instance, existing overhead lines may need to be re-routed or require temporary diversions under system outages to accommodate a line swap-over or duck-under.

5.7.6 There are opportunities to have close parallel alignments to the existing 400kV, 275kV and 132kV lines in the Study Area. This has been considered whilst defining corridor options to restrict the environmental and socio-economic impacts of the new line.

5.7.7 The Study Area includes two 400kV routes in the south. These two routes are ZD and ZS and both enter Willington Substation from the south east. The ZD route, which comes from Ratcliffe, runs in a westerly direction within the Study Area from Castle Donnington to Willington Substation. The new overhead line could potentially be aligned closely for quite a long section before arriving at Willington; further details of this can be seen in Chapter 7. ZS is located further south and no interaction with it is anticipated as ZD would need to be crossed first.

5.7.8 The 4ZV route is currently operated at 275kV and approaches and enters the existing Chesterfield Substation from the south east. This route is planned to be uprated to 400kV and will also be entering the new 400kV Chesterfield Substation. This line provides a close parallel opportunity; however, this may be limited to the vicinity of Chesterfield.

5.7.9 A 132kV double-circuit line route section which extends from the southern ends of the Peak District to the Willington Substation paves an opportunity for a close parallel either to the east or west of the existing line. The route of this 132kV line is mostly through open lands, and no major constraints are identified for the close parallel approach. One of the corridor options considers this section within; details can be seen in **Chapter 7**.

5.7.10 Another three 132kV lines in the Study Area might bring opportunities for close parallel alignments. Two of these lines run from Annesley, one heading north west to Chesterfield and the other to the south west to Willington. The third line extends from Chesterfield to Alfreton. The three lines go, in general, through areas which are quite constrained, but close parallel alignment might be possible. This is assessed in the upcoming chapters.

5.8 Next Step – Options Appraisal (Steps 4 and 6)

5.8.1 As explained in Chapter 4, Options Appraisal (Steps 4 and 6) is a structured process by which the environmental, socio-economic, technical, cost and programme implications are identified, reported and compared. It is a tool used to facilitate an objective and justified decision on an emerging preferred corridor, and it enables NGET to document in a transparent manner the information on which judgements have been based. Options Appraisal is therefore focused on those sub-topics which best assist in distinguishing between options.

5.8.2 For environmental, socio-economic and technical issues, the Options Appraisal considers the potential impacts on relevant receptors, and whether such effects could be avoided or mitigated through careful routeing. 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 detailed in Chapter 4. The residual impacts considered in the Options Appraisal do not take account of 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).

5.8.3 The appraisal identifies potential impacts to receptors outside of the corridor boundaries, where it was considered that potentially significant indirect impacts could occur (for example, impacts to the setting of a heritage designation or impacts to flight paths of qualifying features of ecological designations). The extent of the zone of influence for each receptor was based upon the professional judgement of the relevant Project Team subject matter expert against relevant legislation, policy and good practice.

5.8.4 The environmental, socio-economic and technical appraisal of the preliminary corridors as defined by Step 4 is described in Chapter 6, whilst Chapter 7 describes the subsequent appraisal of the refined corridors as defined by Step 6. The cost and programme implications are outlined in Chapter 8.

6. Options Appraisal – Preliminary Corridors

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6. Options Appraisal – Preliminary Corridors

6.1 Introduction

6.1.1 This chapter presents a summary of the options appraisal undertaken for the preliminary corridors. The purpose of this chapter is to document the initial phase of the options appraisal process, which helped to further understand key constraints and subsequently inform the development of refined corridors (see Chapter 7).

6.2 Overview of the Options

6.2.1 Eight preliminary corridors were identified within the Study Area. The preliminary corridors are presented in Figure 6-1. The preliminary corridors ranged from approximately 280m wide to 6.5km wide at various points. As described in Chapter 5, the development of the preliminary corridors was largely led by environmental topic specialists, representing corridors through the least environmentally constrained areas within the Study Area. This chapter outlines an overview of the preliminary environmental and socio-economic and engineering and system appraisals relevant to each preliminary corridor. This preliminary appraisal then fed into further feasibility work, which led to a number of preliminary corridors being discounted.

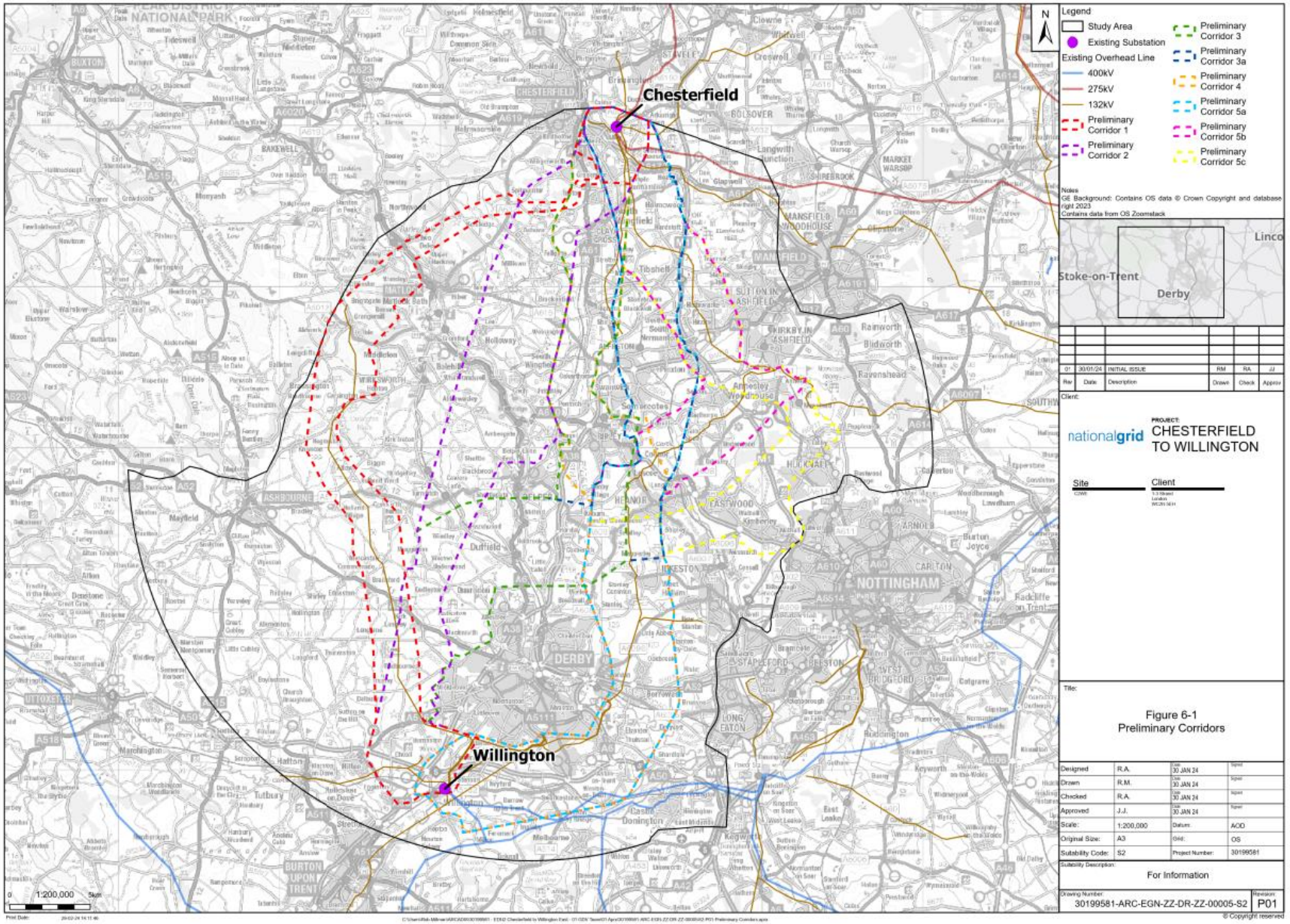
6.3 Preliminary Corridor 1

Introduction

6.3.1 Preliminary Corridor 1 is located furthest west within the Study Area. The corridor begins in the vicinity of Chesterfield Substation. The corridor continues south, following the existing overhead lines out of the existing Chesterfield Substation, before heading in a south-westerly direction in the vicinity of Grassmoor out towards Darley Dale and Upper Hackney, crossing the foothills of the Peak District National Park and the valleys that feed the River Amber and the River Derwent. The corridor then continues south, crossing into the Peak District National Park to the west of Matlock, in the vicinity of Oker and Darley Bridge. The corridor emerges from the Peak District National Park in the vicinity of Aldwark and continues over a relatively long stretch south through a predominantly agricultural landscape, before crossing several watercourses to the northwest of Derby, and in the vicinity of Etwall, turning to approach Willington Substation from the west.

6.3.2 Preliminary Corridor 1 was developed to potentially avoid the heavily constrained and urbanised eastern extent of the Study Area. This corridor also provides an alternative option in the western section of the Study Area that avoids direct incursion into the Derwent Valley Mills World Heritage Site, should other options not be feasible.

Figure 6.1 – Preliminary Corridors



Environment and Socio-Economic Preliminary Appraisal Summary

6.3.3 Preliminary Corridor 1 has the potential to impact the Peak District National Park and Derwent Valley Mills World Heritage Site, both of which are afforded the highest status of protection in NPS EN-1 and the Holford Rules. Crossing the Peak District National Park would be unavoidable, therefore there is potential for a route within this corridor to directly impact the Special Qualities of the Peak District National Park. It is assumed underground cables may be considered through the Peak District National Park, in line with NPS EN-5, to reduce long-term direct and indirect impacts to this designation. Whilst direct incursion into the Derwent Valley Mills World Heritage Site is avoided, there is potential for impacts to its setting and its buffer. Further assessment and appropriate routeing and siting would be required to reduce potential impacts to the Derwent Valley Mills World Heritage Site and the Peak District National Park.

6.3.4 There is potential for impacts on the setting of a number of heritage designations within or within close proximity to this corridor. Further assessment, as well as sensitive routeing and siting of infrastructure, would be required to reduce, and where possible avoid, impacts to heritage receptors. The corridor is most constrained to the south of Oker towards Grangemill, where several scheduled monuments are present. The corridor is less constrained in its more northern and southern sections, where designated heritage assets are smaller and scattered throughout the corridor.

6.3.5 There are highly constrained areas within this preliminary corridor, where passing within 100m of residential properties and settlements is likely to be unavoidable. Areas include between Milehill, Grassmoor and Wingerworth, Grassmoor and North Wingfield, Tupton and Wingerworth, and at Darley Dale and Upper Hackney. There is therefore the potential for impacts to visual amenity where an overhead line may be visible to residents in these areas. Careful routeing of infrastructure may reduce these visual impacts. The southern extent of the corridor is less constrained and follows the existing 132kV network from Hognaston to Derby through a predominantly agricultural landscape.

6.3.6 Preliminary Corridor 1 crosses the Peak District Dales SAC and Via Gellia Woodlands SSSI located to the northwest of Wirksworth, and Green Clay Pits SAC and SSSI to the west of Wirksworth. The corridor also crosses Cawdor Quarry SSSI, Masson Hill SSSI, Bonsall Leys SSSI, Wall Lands SSSI, Hulland Moss SSSI, Marcaston Marsh and Muggington Bottoms SSSI and Duckmanton Railway Cutting SSSI, in addition to multiple areas of lowland fen irreplaceable habitat. In addition to this, there are a number of statutory and non-statutory designations outside of the corridor, including the South Pennine Moors SAC, Gang Mine SAC, Birklands and Bilhaugh SAC, the River Mease SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, South Pennine and Peak District Moors IBA, and Sherwood Forest IBA. Potential indirect impacts on statutory and non-statutory ecological designations and their features (for example, impacts on the flight paths of qualifying features of statutory sites) would also need to be considered for all other Preliminary Corridors appraised. It is assumed that most designated ecological sites, features and important areas of habitat could be avoided within the preliminary corridor, particularly in the southern extent of the corridor, south of Hognaston, where there are fewer ecology designations. The Peak District Dales SAC/Via Gellia Woodlands SSSI covers approximately half the width of this preliminary corridor in the vicinity of Grangemill, and there are other limiting factors to routeing (e.g., an active quarry) within the remainder of the preliminary corridor in this section. Potential indirect impacts on the SAC may remain as a result of disturbance or

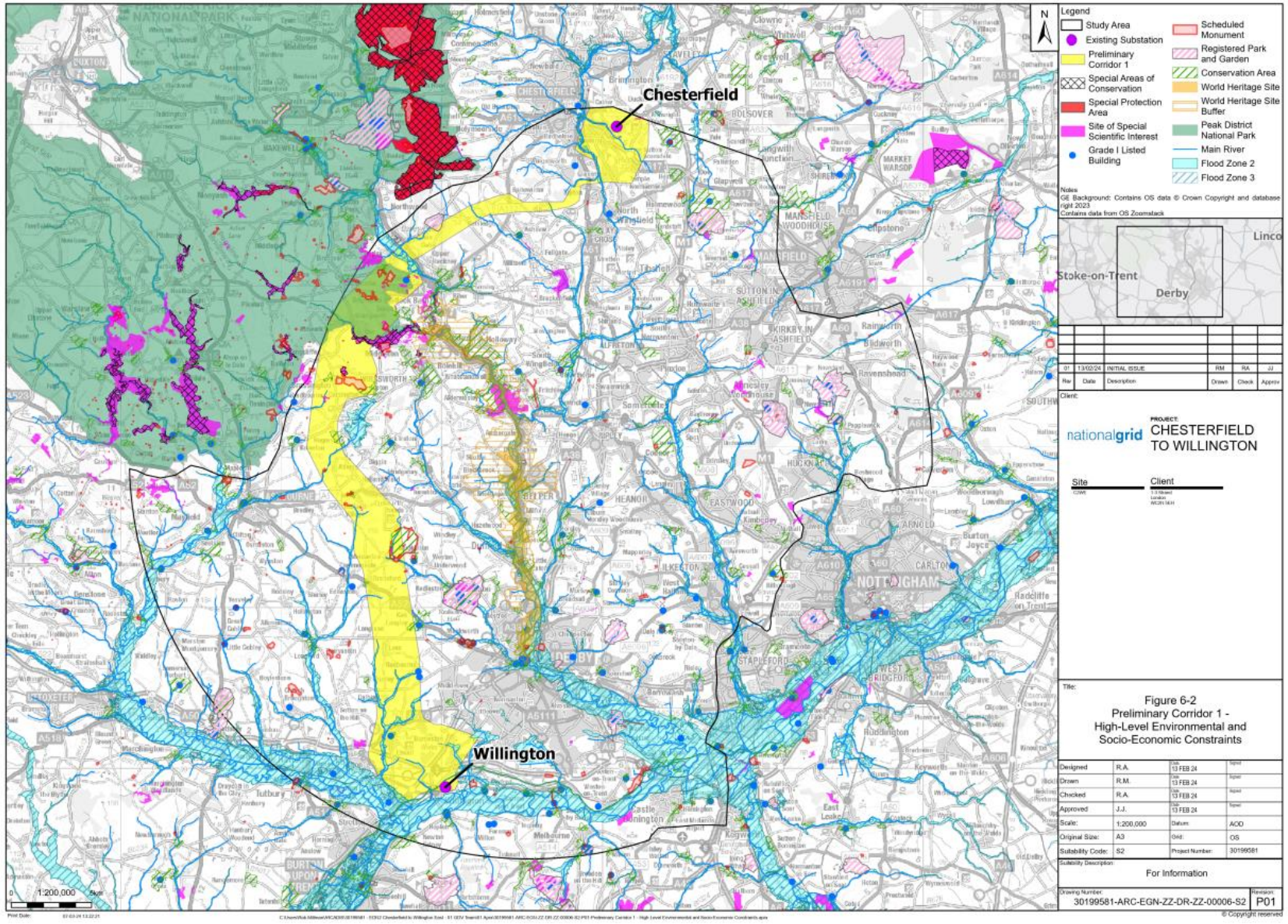
fragmentation (where connectivity between areas of the habitat may be reduced), as the SAC is made up of multiple parcels located to the east and west of the corridor, and a route within this corridor would lie between parcels of the same SAC. Further survey works will be undertaken to determine the potential impact on breeding bird populations associated with the SPA/IBAs and roosting bats associated with Masson Hill SSSI and Via Gellia Woodlands SSSI. A Habitat Regulations Screening Assessment and early engagement with Natural England would be required.

6.3.7 There is a Zone 1 Source Protection Zone located to the south-west of Matlock in Preliminary Corridor 1. This Source Protection Zone covers the width of the corridor, extending into the Peak District National Park and to the east of Wirksworth. Avoidance of this receptor would not be possible in Preliminary Corridor 1; therefore, engagement with the Environment Agency would need to be undertaken in addition to water quality protection measures and drainage systems being needed throughout the construction phase.

6.3.8 There are a number of socio-economic constraints within the corridor. Key socio-economic constraints include a wind farm at Carsington Pasture, solar farms, areas of public amenity, and existing infrastructure, such as 132kV overhead lines. Most utilities and amenities can be avoided with careful routeing. Derby Airfield, located to the west of Willington Substation, is located adjacent to the southern boundary of the corridor. An appropriate buffer would need to be adhered to during routeing to avoid potential impacts to the civil airfield. Within the southern section, there are a number of potential sites for development within the corridor, including a site to the south-west of the Toyota Island roundabout designated as part of the East Midlands Freeport – the East Midlands Intermodal Park – and south-east of this roundabout, outline planning is under consideration for the erection of up to 100,000sqm of commercial floorspace. Further, Mercia Marina village and park is located to the north of Willington Substation. It is also noted that there were previous plans to develop the Willington Power Station site immediately east of Willington Substation, including planning received for a gas turbine power station in 2017; however, this has lapsed. It is understood that the site has been put forward for mixed-use development in South Derbyshire District Council's Call for Sites exercise as part of the Local Plan review process; however, no other updates are publicly available.

6.3.9 The key environmental and socio-economic constraints in Preliminary Corridor 1 are presented in Figure 6.2**.**

Figure 6.2 – Preliminary Corridor 1 – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.3.10 Within the close vicinity of Chesterfield Substation, there are multiple challenging constraints that could impact heavily on routeing. These include a planned solar farm (Hasland Solar Farm), the A617, South Chesterfield Golf Club, multiple existing 132kV overhead lines and the existing 275kV 4ZV overhead line (scheduled to be uprated to 400kV). Routeing of an additional 400kV overhead line through this area is considered difficult but feasible, though to facilitate the crossing of the A617 and avoid the planned solar farm, three 132kV overhead lines would likely be undergrounded or re-routed. Consequently, an alternative underground cable solution was assessed here to mitigate the impact on existing services, but due to restricted crossing points along the A617 and a grade separated junction, this was also considered challenging.

6.3.11 West of Matlock, the corridor crosses the Peak District National Park. Due to its protected status, and in accordance with NPS EN-5 and Holford Rule 1, an underground cable solution has also been considered crossing the Peak District National Park. At this point, an underground cable crossing of the Peak District National Park could involve up to 10km of underground cable, between Darley Dale and a location north of Longcliffe. Routeing is restricted throughout by residential properties in the north, the River Derwent flood plains, and steep exposed land. Overall, constructability was assessed to be challenging due to steep and undulating topography, the exposed nature of the land and poor vehicle access. Increased cost and construction duration are also associated factors.

6.3.12 The approach to Willington Substation is constrained by the A38, A50, the Trent and Mersey Canal and railway lines. There are also multiple 132kV lines routeing out of Willington Substation, and at least one of them would need to be undergrounded or modified to allow the establishment of the new 400kV overhead line.

6.3.13 There are other technically constrained locations, which would affect the constructability and the delivery of the Project and maintenance of an overhead line or underground cable. Constrained locations include, but are not limited to, routeing in the vicinity of Darley Dale, crossing the A61 between Wingerworth and New Tupton, and four railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.3.14 Generally, vehicle access along the corridor is considered feasible, with areas where it would be more challenging than others. The main area within the corridor that is considered difficult is throughout the Peak District National Park, since access to this area is considered poor, given there are multiple locations isolated from the main access routes. Furthermore, in this area there are multiple bands of steep topography, which may restrict construction traffic and require long sections of temporary haul roads.

6.3.15 Throughout the corridor, there are multiple NGED overhead line assets present that may require mitigation. The majority of the 132kV crossings are in the vicinity of Chesterfield and Willington Substations, as described above. Where the corridor crosses these assets, it is likely that they would need to be undergrounded or re-routed if the new 400kV route comprises an overhead line. Within the corridor, there is one 132kV overhead line present which routes from the Peak District National Park south towards Willington Substation. This presents a long close parallel opportunity for the new 400kV overhead line over a distance of up to 25km.

6.3.16 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, the presence of peat, non-coal mining hazards, landslides, soluble rock, and

shrink-and-swell soils. The constraints are present along much of the corridor, which will require consideration throughout the detailed design phase to mitigate their impact on construction. The most challenging area within the corridor is located around Chesterfield Substation and Grassmoor, due to the number and extent of ground hazards encountered in these areas.

6.4 Preliminary Corridor 2

Introduction

6.4.1 Preliminary Corridor 2 begins in the vicinity of Chesterfield Substation. The corridor then continues broadly southwest towards Holloway, where the corridor intersects the Derwent Valley Mills World Heritage Site to the north of Belper. The corridor is widest at this point to allow for greater flexibility to determine a potential location to cross the Derwent Valley Mills World Heritage Site with the least impact. The corridor continues southwest from Holloway towards Etwall, crossing the River Ecclesbourne. In the vicinity of Etwall, the corridor turns to approach Willington Substation from the west, similar to Preliminary Corridor 1.

Environment and Socio-Economic Preliminary Appraisal Summary

6.4.2 Preliminary Corridor 2 crosses the Derwent Valley Mills World Heritage Site and its buffer, which is afforded the highest status of protection in NPS EN-1 and the Holford Rules. There is potential for a route within this corridor to impact the Outstanding Universal Values (OUV) of the Derwent Valley Mills World Heritage Site. Underground cables would also be considered, in line with the mitigation proposed in NPS EN-5. However, trenchless construction techniques may not be feasible for the entirety of the Derwent Valley Mills World Heritage Site buffer due to its size; therefore, there is potential for residual construction impacts on the setting of the Derwent Valley Mills World Heritage Site. There is also potential for physical impacts to heritage assets, including undesignated below-ground archaeology and, due to the requirements for SECs, within the setting of the Derwent Valley Mills World Heritage Site. Further assessment would be required to determine the least impactful location to route through the Derwent Valley Mills World Heritage Site. For the purposes of the options appraisal, this corridor considers a route through the Derwent Valley Mills World Heritage Site to the north of Belper, where the feature is generally narrower. The corridor was, however, kept relatively wide to allow flexibility during routeing owing to the range of other constraints within the corridor.

6.4.3 The corridor crosses several heritage assets, including scheduled monuments, Conservation Areas and Belper Cemetery Registered Park and Garden. Kedleston Hall Registered Park and Garden is also located approximately 100m from the corridor boundary. Further assessment, as well as sensitive routeing and siting of infrastructure, is required to reduce, and where possible avoid, impacts to heritage receptors.

6.4.4 This corridor has the potential for indirect landscape and visual impacts on the Special Qualities of the Peak District National Park (being, at its closest, approximately 3km away), which is also afforded the highest status of protection in NPS EN-1 and the Holford Rules.

6.4.5 The corridor has the potential for direct impacts on a designation of district value (as acknowledged in the supplementary notes of the Holford Rules), the Amber Valley Special Landscape Area.

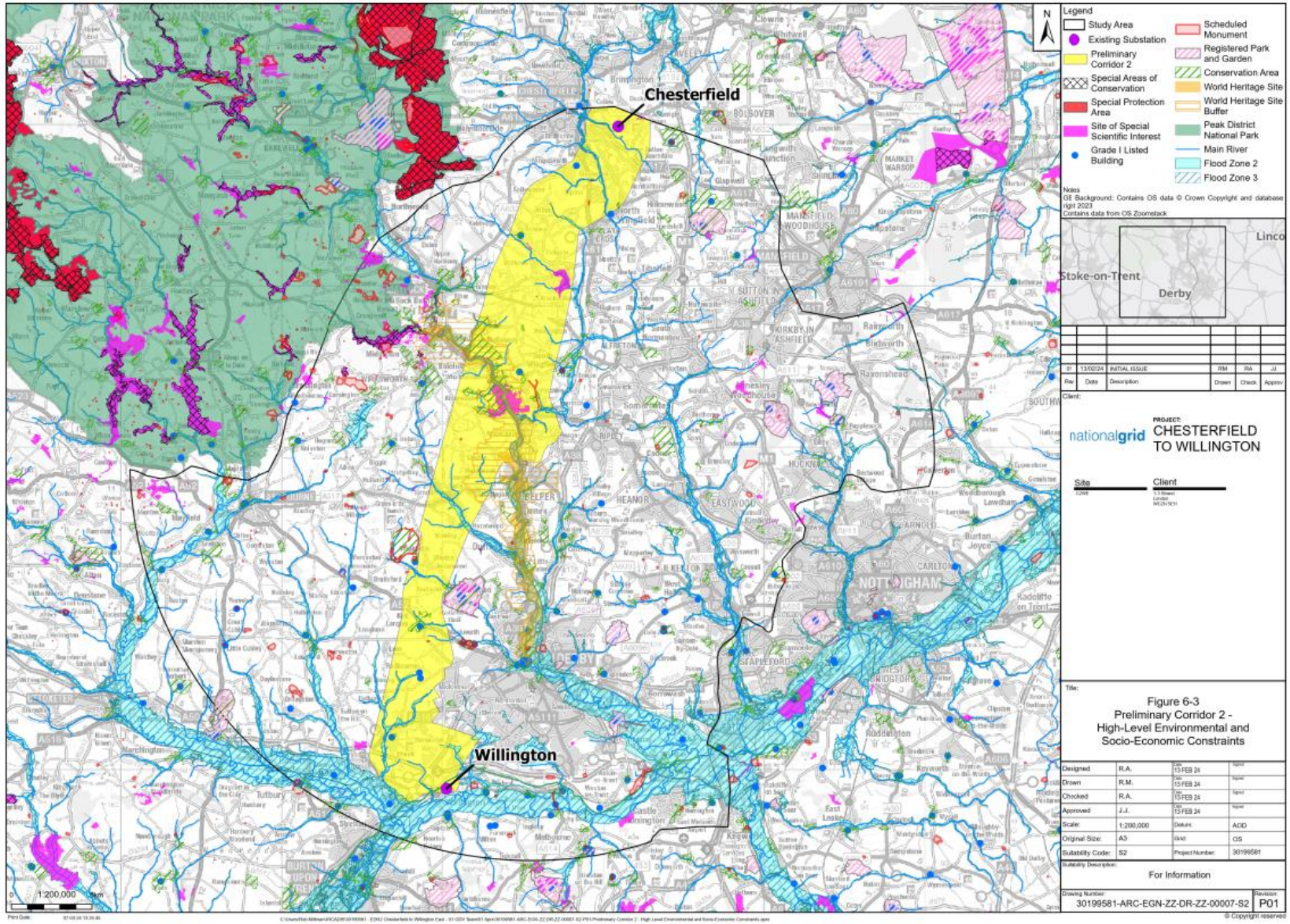
6.4.6 There are highly constrained areas within this corridor, where passing within 100m of residential properties and settlements is likely to be unavoidable. These include between Milehill, Grassmoor and Wingerworth, Grassmoor and North Wingfield, Tupton and Wingerworth, Tupton and North Wingfield and Clay Cross. There is the potential for impacts to visual amenity, where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these visual impacts.

6.4.7 This corridor has the potential to impact a number of ecological designations and features such as Crich Chase, Cromford Canal, Shining Cliff Wood and Ogston Reservoir SSSIs. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to most ecological designations and features. However, three SSSIs cross the centre of the corridor and lie along the Derwent Valley Mills World Heritage Site (Crich Chase SSSI, Cromford Canal SSSI and Shining Cliff Wood SSSI) and are likely to be the most difficult to avoid. Effective mitigation cannot be guaranteed at this stage and the potential still exists for ecological impacts on the integrity of Crich Chase SSSI, Cromford Canal SSSI and Shining Cliff Wood SSSI.

6.4.8 There are also a number of socio-economic constraints within the corridor. Key socio-economic constraints include solar farms, National Trust land, areas of public amenity and existing infrastructure such as overhead lines. The same constraints and considerations apply to Derby Airfield, Mercia Marina, East Midlands Freeport and the Willington Power Station site as previously outlined in the appraisal for Preliminary Corridor 1. Most utilities and amenities can be avoided with careful routeing and siting.

6.4.9 The key environmental and socio-economic constraints in Preliminary Corridor 2 are presented in Figure 6.3.

Figure 6.3 – Preliminary Corridor 1 – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.4.10 When routeing out of Chesterfield Substation in the north, and also into Willington Substation in the south, Preliminary Corridor 2 would follow the same route as Preliminary Corridor 1, and so would be subject to the same technical constraints and considerations within the vicinity of both substations as previously described within the appraisal for Preliminary Corridor 1.

6.4.11 The most technically constrained location within the corridor is where it crosses the Derwent Valley Mills World Heritage Site. The crossing is confined to a steep-sided valley, with a large quarry also present in the north. An overhead line option in this area is considered feasible; however, it would likely affect areas of ancient woodland and part of an SSSI. In accordance with Holford Rule 1 and NPS EN-5, an underground cable solution has also been considered here. In the base of the valley, there are multiple major crossings, including the Derwent Valley Railway, Cromford Canal, River Derwent and the A6. All of these would require trenchless crossings. Given the successive trenchless crossings, steep terrain, and environmental designations, underground cable routeing perpendicular to the Derwent Valley is considered challenging. Therefore, an overhead line is the likeliest option for consideration.

6.4.12 There are other technically constrained locations within the corridor, which would affect constructability and the delivery and maintenance of the Project. Constrained locations include, but are not limited to, crossing the A61 between Wingerworth and New Tupton; and six railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.4.13 Generally, vehicle access along the corridor is considered feasible; however, there is one main area within the corridor that is considered difficult. This is located in the vicinity of the River Derwent Valley, since access in this area would be required to use poor road networks that route through small towns and villages. Furthermore, in this area there are multiple bands of steep topography, which would restrict accessibility for construction traffic.

6.4.14 Throughout the corridor, there are multiple NGED overhead line assets present that may require mitigation. The majority of the 132kV crossings are in the vicinity of the Chesterfield and Willington Substations, and where the corridor crosses these assets, it is likely that they would need to be undergrounded or re-routed if the new 400kV route is an overhead line.

6.4.15 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, non-coal mining hazards, mine entries, landslides and shrink-and-swell soils. These constraints are present throughout the corridor, which will require consideration throughout the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around Chesterfield Substation and Grassmoor/Tupton, due to the number and extent of hazards in these areas. However, the rest of the corridor presents fewer ground challenges, becoming the most favourable corridor from a geotechnical perspective.

6.5 Preliminary Corridor 3

Introduction

6.5.1 Preliminary Corridor 3 begins in the vicinity of Chesterfield Substation. The corridor then continues south towards Ripley via Clay Cross. South of Ripley, the corridor heads west and intersects the Derwent Valley Mills World Heritage Site between Belper and Derby, providing a crossing through the World Heritage Site further south than Preliminary Corridor 2. The corridor crosses the World Heritage Site at this location, as the designation and its buffer are narrower than other areas. The corridor is widest at this point to allow for greater flexibility to determine a potential location to cross the Derwent Valley Mills World Heritage Site with the least impact. In the vicinity of Weston Underwood, the corridor continues south towards Etwall, crossing the River Ecclesbourne. Near Etwall, the corridor turns to approach Willington Substation from the west, as with Preliminary Corridors 1 and 2.

Environment and Socio-Economic Preliminary Appraisal Summary

6.5.2 Preliminary Corridor 3 crosses the Derwent Valley Mills World Heritage Site, which, as previously noted, is afforded the highest status of protection in NPS EN-1 and the Holford Rules. There is potential for a route within this corridor to impact the Outstanding Universal Values (OUV) of the Derwent Valley Mills World Heritage Site. Underground cables would also be considered, in line with the mitigation proposed in NPS EN-5. However, trenchless construction techniques may not be feasible for the entirety of the Derwent Valley Mills World Heritage Site buffer due to its size; therefore, there is potential for residual construction impacts on its setting. There is also potential for physical impacts to occur to heritage assets, including undesignated below-ground archaeology, and due to the requirements for SECs within the setting of the Derwent Valley Mills World Heritage Site. Further assessment would be required to determine the least impactful location to route through the Derwent Valley Mills World Heritage Site. For the purposes of the options appraisal, this corridor considers a route through the Derwent Valley Mills World Heritage Site to the south of Belper, where the feature and its buffer are narrower than other areas.

6.5.3 The corridor has the potential to impact the setting of a number of designated heritage assets, including several scheduled monuments, Conservation Areas, Kedleston Hall Registered Park and Garden and listed buildings. It is assumed that careful routeing and siting may reduce both direct and indirect impacts.

6.5.4 The corridor has the potential for direct impacts on a designation of district value (as acknowledged in the supplementary notes of the Holford Rules), the Amber Valley Special Landscape Area.

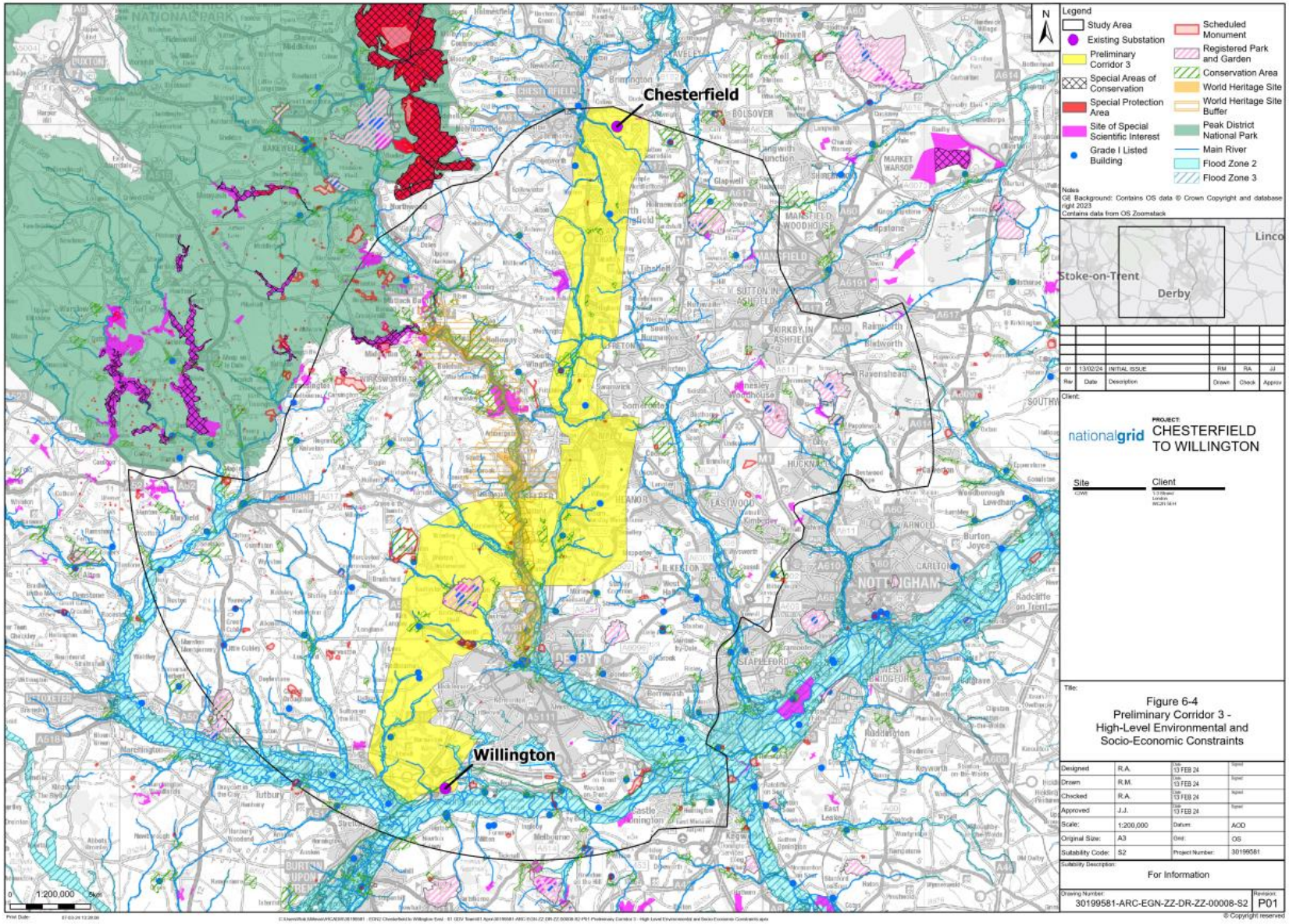
6.5.5 There are highly constrained areas within this corridor, where passing within 100m of residential properties and settlements is likely to be unavoidable. These include between Milehill, Grassmoor and Wingerworth, Grassmoor and North Wingfield, Tupton and Wingerworth, Tupton and North Wingfield, Clay Cross, and between Belper and Little Eaton. There is the potential for impacts to visual amenity, where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these potential visual impacts.

6.5.6 This corridor has the potential to impact a number of ecological designations and features, such as Morley Brick Pits and Kedleston Park SSSIs. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

6.5.7 There are a number of socio-economic constraints within the corridor. Key socio-economic constraints include National Trust land, areas of public amenity, existing overhead lines and industrial infrastructure. The same constraints and considerations apply with respect to Derby Airfield, East Midlands Freeport, Mercia Marina and the Willington Power Station site as previously outlined for Preliminary Corridors 1 and 2. Most utilities and amenities can be avoided with careful routeing and siting.

6.5.8 The key environmental and socio-economic constraints in Preliminary Corridor 3 are presented in Figure 6.4.

Figure 6.4 – Preliminary Corridor 3 – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.5.9 When routeing out of Chesterfield Substation in the north, and also into Willington Substation in the south, Preliminary Corridor 3 would follow the same route as Preliminary Corridors 1 and 2 and so would be subject to the same technical constraints within the vicinity of both substations as previously described within the appraisals for those corridors.

6.5.10 Within the corridor, one of the most challenging locations from an engineering and system perspective is the Derwent Valley Mills World Heritage Site. A potential overhead line route in accordance with the design assumptions outlined in Chapter 2 was initially not found through this location, due to the constrained landscape and built-up areas. By extending the corridor to the south of Little Eaton up to the A61/A38 junction for approximately 1.6km allowed for identifying an overhead line route through this section. Further details are included in Chapter 7. In accordance with NPS EN-5 and Holford Rule 1, an underground cable solution has also been considered for the Derwent Valley Mills World Heritage Site crossing. Residential and commercial developments around Belper, Hazelwood and Duffield restrict routeing to a small corridor north of Duffield. An underground cable route in this area would be approximately 2-3km long and involve crossing the River Derwent, A6, Derwent Valley Railway and Chevin Golf Course. An underground cable solution in this area is considered technically feasible.

6.5.11 There are other technically constrained locations within the corridor, which would affect the constructability and the delivery and maintenance of the Project. Constrained locations include but are not limited to: crossing the A61 between Wingerworth and New Tupton; routeing around Clay Cross; crossing the Derwent Valley Mills World Heritage Site; and five railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.5.12 Generally, vehicle access along the corridor is considered feasible, but there is one main area within the corridor that is considered challenging. This is located in the vicinity of the River Derwent Valley, and access in this area would be required to use poor road networks which route through small towns and villages. Vehicle access for an underground cable solution in this area is considered to be physically constrained, limited by the Derwent Valley Railway and River Derwent. Roads east of the River Derwent are unsuitable for construction traffic and limited to 7.5t vehicles. Access west of the railway would likely need to be through the golf course. Furthermore, in this area there are multiple bands of steep topography which might restrict accessibility for construction traffic.

6.5.13 Throughout the corridor there are multiple NGED overhead line assets present which may require mitigation. The majority of the 132kV crossings are in the vicinity of Chesterfield and Willington Substations. Where the corridor crosses these assets, it is likely that they would need to be undergrounded or re-routed if the new 400kV route is overhead line.

6.5.14 There is an existing 132kV overhead line erected along the eastern edge of the corridor, running from Chesterfield to a substation north of Alfreton. This line routes through physically constrained areas between Chesterfield Substation and Clay Cross and therefore does not present close parallel opportunities for the new 400kV overhead line.

6.5.15 The geotechnical hazards present along much of the corridor are largely influenced by, but not limited to, artificial ground, shrink-and-swell soils, mine entries, landslides, areas

of compressible ground and high-risk development areas as indicated by the Coal Authority. Constraints are present throughout the corridor, which will require consideration through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around Chesterfield Substation, Grassmoor/Clay Cross, from west of Alfreton and Ripley to Kilburn and Denby Village, due to the number and extent of ground hazards in these areas. However, the rest of the corridor presents fewer ground challenges, making this corridor one of the most favourable options from a geotechnical perspective, following Preliminary Corridor 2.

6.6 Preliminary Corridor 3a

Introduction

6.6.1 Preliminary Corridor 3a begins in the vicinity of Chesterfield Substation. The corridor then heads south between Chesterfield Substation and the vicinity of Smalley via Alfreton and Heanor. From this point, Preliminary Corridor 3a shares the same southern extent as Preliminary Corridor 3 (as previously described) and crosses the Derwent Valley Mills World Heritage Site to the south of Belper, routeing around the west of Derby and approaching Willington Substation from the west, similar to Preliminary Corridors 1, 2 and 3.

Environment and Socio-Economic Preliminary Appraisal Summary

6.6.2 Preliminary Corridor 3a crosses the Derwent Valley Mills World Heritage Site to the south of Belper, which is afforded the highest status of protection in NPS EN-1 and the Holford Rules. There is potential for a route within this corridor to impact the Outstanding Universal Values (OUV) of the Derwent Valley Mills World Heritage Site. Underground cables would also be considered, in line with the mitigation proposed in NPS EN-5. However, trenchless construction techniques may not be feasible for the entirety of the Derwent Valley Mills World Heritage Site buffer due to its size; therefore, there is potential for residual construction impacts on its setting. There is also potential for physical impacts to heritage assets including undesignated below-ground archaeology and due to the requirements for SECs within the setting of the Derwent Valley Mills World Heritage Site. Further assessment would be required to determine the least impactful location to route through the Derwent Valley Mills World Heritage Site.

6.6.3 The corridor has the potential to impact the setting of a number of designated heritage assets including several scheduled monuments, Conservation Areas, Kedleston Hall Registered Park and Garden, listed buildings, and particularly Carnfield Hall Conservation Area. Hardwick Hall Registered Park and Garden is also located in close proximity to the eastern boundary of this corridor near to Hardstoft and Glapwell, and this corridor has the potential to indirectly impact its setting. It is assumed that careful routeing and siting may reduce both direct and indirect impacts.

6.6.4 The corridor has the potential for direct impacts on a designation of district value (as acknowledged in the supplementary notes of the Holford Rules), the Amber Valley Special Landscape Area.

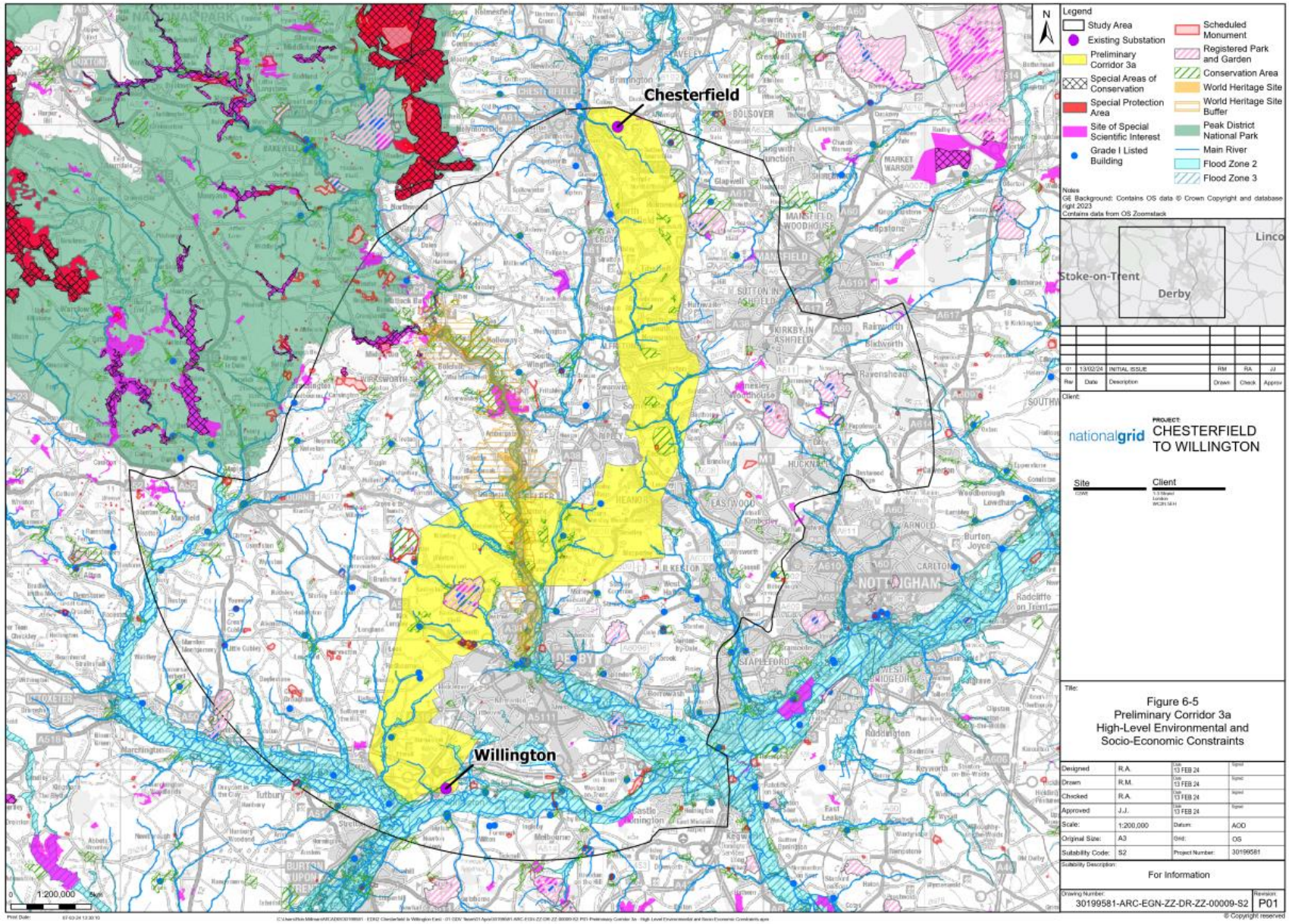
6.6.5 This corridor has the potential to impact a number of ecological designations and features, such as Morley Brick Pits and Kedleston Park SSSI. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

6.6.6 Within the corridor there are highly constrained areas, where passing within 100m of residential properties and settlements is likely unavoidable (between Milehill, Grassmoor and Wingerworth, Grassmoor and North Wingfield, and between Belper and Little Eaton). There is the potential for impacts to the landscape and visual amenity where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these visual impacts.

6.6.7 There are also a number of socio-economic constraints within the corridor. Key socio-economic constraints include solar farms, National Trust land, areas of public amenity, industrial infrastructure and existing overhead lines. Park Hall airstrip, located near Stanley Common, is crossed by this corridor and, similar to other corridors that approach Willington Substation from the west, the boundary of Preliminary Corridor 3a borders Derby Airfield. An appropriate buffer would need to be adhered to during the routeing to avoid potential impacts to the civil airfields. The same constraints and considerations apply with respect to East Midlands Freeport, Mercia Marina and the Willington Power Station site as previously outlined for Preliminary Corridors 1, 2 and 3. Most utilities and amenities may be avoided with careful routeing and siting.

6.6.8 The key environmental and socio-economic constraints in Preliminary Corridor 3a are presented in Figure 6.5.

Figure 6.5 – Preliminary Corridor 3a – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.6.9 Preliminary Corridor 3a routes out of Chesterfield Substation to the southeast, unlike previous corridors which run in a more south-westerly direction. In the close vicinity of Chesterfield Substation, there are multiple challenging constraints present. These include two solar farms, one existing and one that has gained planning permission (Hasland Solar Farm); crossing the A617; South Chesterfield Golf Club; multiple existing 132kV overhead lines; and the existing 275kV 4ZV overhead line (scheduled to be uprated to 400kV). An overhead line route out of Chesterfield in Preliminary Corridor 3a is considered less constrained than other corridors that run in a more south-westerly direction.

6.6.10 When routeing into Willington Substation, Preliminary Corridor 3a would follow the same route as Preliminary Corridors 1, 2 and 3, and so would be subject to the same technical constraints within these areas as previously described within the appraisals for those corridors.

6.6.11 Along the corridor, there are three areas that are considered extremely technically constrained, and in these locations, it is considered highly probable that neither an overhead line nor an underground cable route could be established. These locations are in the areas between Alfreton and South Normanton, between Cross Hill, Loscoe and Heanor, and where the corridor crosses the Derwent Valley Mills World Heritage Site.

6.6.12 One of the highly constrained sections of this corridor relates to the area between Alfreton and South Normanton, which consists of residential properties and industrial estates. The only potential routeing corridor identified in which an overhead line could be established is in the Clover Nook Industrial Estate. An overhead line here would have to cross in between the area south of Red Lane and southwest of the A38-Birchwood Lane crossing. However, in order for this option to be pursued, a pylon would likely need to impact a residential property north of the A38. An underground cable proposal in this area is also not recommended due to the absence of available routeing that provides sufficient area for construction through the residential and industrial areas adjacent to the A38. It is considered that there is no realistic technical solution to pass through this section.

6.6.13 The area between Cross Hill, Loscoe and Heanor is also highly constrained. The only possible routeing corridor identified through this area is currently used by an NGED 132kV overhead line. This existing overhead line passes through a small corridor which is approximately 55-65m wide, surrounded by residential properties (this area is between Brook Street and Sheldon Road). A route through this corridor would likely require the pylons to be located close to properties reducing the clearances even further. In order to facilitate the new 400kV overhead line in this location, the existing 132kV would be required to be undergrounded or reconfigured. This solution would be considered extremely difficult to implement due to the close proximity of the residential dwellings and the required construction works.

6.6.14 The third location in Preliminary Corridor 3a considered highly technically constrained is the section that crosses the Derwent Valley Mills World Heritage Site. In this area, the same route as Preliminary Corridor 3 was followed, as previously described in the appraisal for that corridor. An overhead line route in accordance with the design assumptions outlined in Chapter 2 was initially not found through this section, due to the constrained landscape and built-up areas present. However, extending the corridor to the south of Little Eaton up to the A61/A38 junction by approximately 1.6km allowed for identifying an overhead line route through this section.

6.6.15 In accordance with NPS EN-5 and Holford Rule 1, an underground cable solution has also been considered for the Derwent Valley Mills World Heritage Site crossing. Residential and commercial developments around Belper, Hazelwood and Duffield restrict routeing to a small corridor north of Duffield. An underground cable route in this area would be approximately 2-3km long and involve crossing the River Derwent, A6, Derwent Valley Railway and Chevin Golf Course. An underground cable solution in this area is considered technically feasible.

6.6.16 Generally, vehicle access along the corridor is considered feasible, and there is one main area within the corridor that is considered challenging. This is located in the vicinity of the River Derwent Valley, and access in this area would be required to use road networks which route through small towns and villages, which may introduce accessibility constraints. Furthermore, in this area there are multiple bands of steep topography which might restrict accessibility for construction traffic.

6.6.17 Throughout the corridor there are multiple NGED overhead line assets present which may require mitigation. The majority of the 132kV crossings are in the vicinity of Chesterfield and Willington Substations. Where the corridor crosses these assets, it is likely that they would need to be undergrounded or re-routed if the new 400kV route is overhead line.

6.6.18 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, artificial ground, mine entries, areas of compressible ground, shrink-and-swell soils and high-risk development areas as indicated by the Coal Authority. These constraints are present throughout the corridor, which will require consideration through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around Chesterfield Substation and Grassmoor and from Somercotes to Kilburn, due to the number and extent of ground hazards in these areas. However, the rest of the corridor presents fewer ground challenges, making this corridor one of the most favourable options from a geotechnical perspective, following Preliminary Corridor 2.

6.7 Preliminary Corridor 4

Introduction

6.7.1 Preliminary Corridor 4 shares the same northern extent from Chesterfield Substation south to the vicinity of Ripley as Preliminary Corridor 3 (as previously described). Instead of turning west to cross the Derwent Valley Mills World Heritage Site, Preliminary Corridor 4 continues south towards Borrowash and Elvaston, providing a corridor option to the east of Derby. Around Elvaston, Preliminary Corridor 4 heads southwest towards Barrow upon Trent and then broadly follows the River Trent to Willington Substation, approaching from the east.

Environment and Socio-Economic Preliminary Appraisal Summary

6.7.2 Due to the number of settlements within the eastern extent of the Study Area, there are highly constrained areas within this corridor where passing within 100m of residential properties and settlements is likely to be unavoidable. These include areas between Milehill, Grassmoor and Wingerworth, Grassmoor and North Wingfield, Tupton and Wingerworth, Tupton and North Wingfield and Clay Cross; between Denby Village and

Denby Common, and Denby Common to Loscoe and Heanor; between Horsley Woodhouse and Smalley, and Smalley and Heanor; between Morley and Stanley Common, Stanley Common and West Hallam, and West Hallam and Ilkeston; and between Spondon and Borrowash, and Borrowash and Draycott. There is the potential for impacts to visual amenity where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these visual impacts.

6.7.3 This corridor has the potential to impact a number of ecological designations and features such as Morley Brick Pits and Breadsall Railway Cutting SSSIs. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

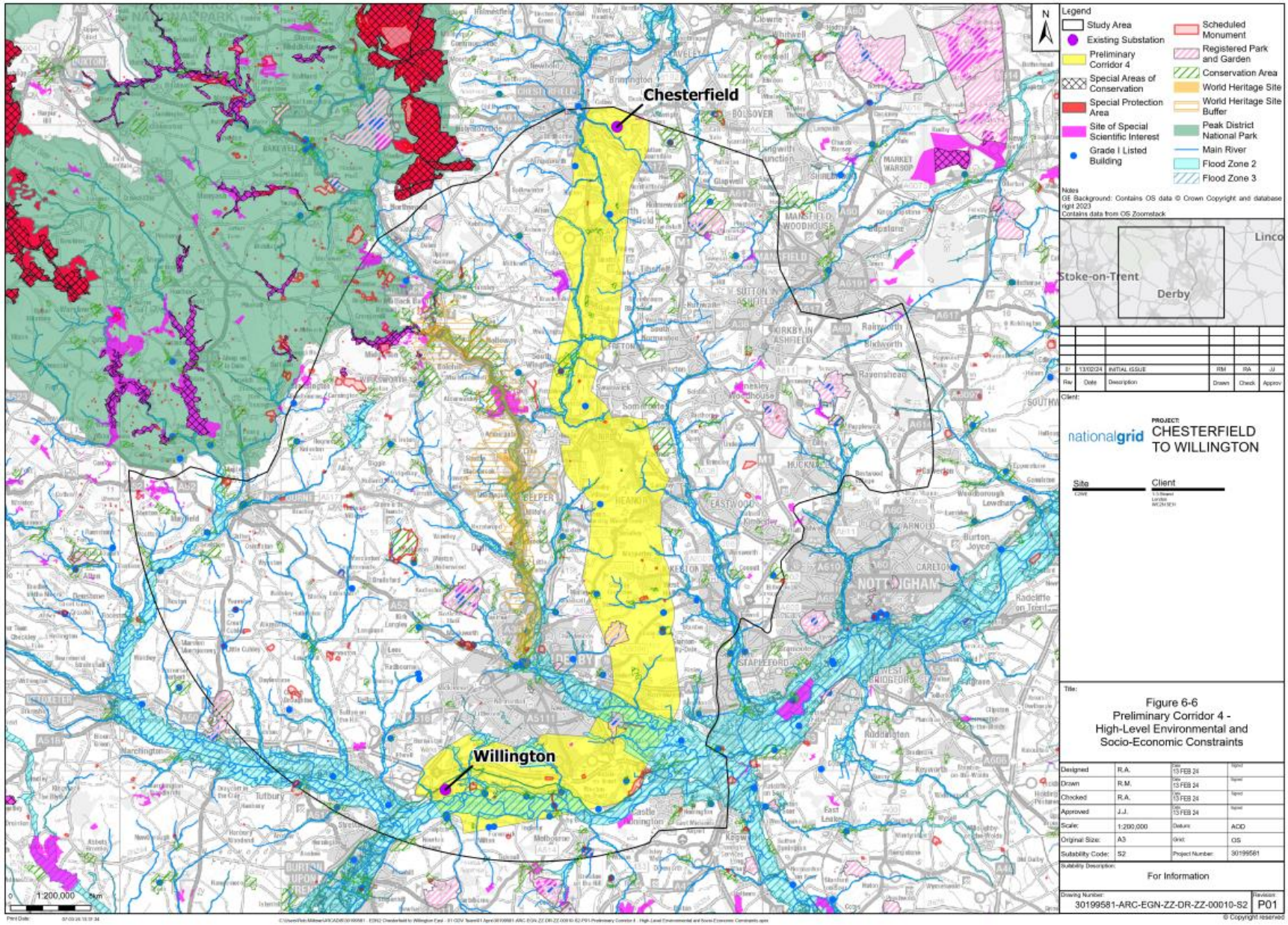
6.7.4 The corridor crosses a number of designated heritage assets including several scheduled monuments, Conservation Areas, three Registered Parks and Gardens (Elvaston Castle, Swarkestone Old Hall, and Locko Park), and listed buildings. The corridor has the potential to impact these heritage assets and their settings. It is assumed that careful routeing and siting may reduce both direct impacts and impacts to the setting of these heritage assets.

6.7.5 There are also a number of socio-economic constraints within the corridor. Park Hall airstrip, located near Stanley Common, is crossed by this corridor. An appropriate buffer would need to be adhered to during the routeing to avoid potential impacts to this civil airfield. As with other Preliminary Corridors, the Willington Power Station site and Mercia Marina represent constraints for consideration. Other socio-economic constraints include solar farms, a burial ground, National Trust land, areas of public amenity, industrial infrastructure and existing overhead lines. Most utilities and amenities may be avoided with careful routeing and siting.

6.7.6 Preliminary Corridor 4 contains extensive areas of Flood Zones 2 and 3, where there is a higher likelihood of flooding. There are large areas of Flood Zones 2 and 3 associated with the River Trent and tributaries to the southeast of Derby that would be unavoidable in this corridor. A detailed Flood Risk Assessment and engagement with the Environment Agency would be required.

6.7.7 The key environmental and socio-economic constraints in Preliminary Corridor 4 are presented in Figure 6.6.

Figure 6.6 – Preliminary Corridor 4 – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.7.8 When routeing out of Chesterfield Substation, Preliminary Corridor 4 would follow the same route as Preliminary Corridors 1, 2 and 3, and so would be subject to the same technical constraints within this area as previously described within the appraisals for those corridors.

6.7.9 This corridor considers routeing into Willington Substation from the east as opposed to previous corridors which approached from the west. This routeing is considered more challenging than when entering from the west, due to the fact there are five existing 132kV lines that will need to be crossed if they are not undergrounded. In addition, there are two 400kV overhead lines entering into Willington Substation from the south which constrain the route further and reduce the flexibility within the corridor.

6.7.10 There are other technically constrained locations within the corridor, which would affect the constructability and the delivery and maintenance of the Project. Constrained locations include, but are not limited to, crossing the A61 between Wingerworth and New Tupton; routeing around Clay Cross; and five railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.7.11 Generally, vehicle access along the corridor is considered feasible, and the main area within the corridor that is considered challenging is along the length of the A38 as it is expected there will be small, isolated areas where access might not be possible.

6.7.12 Along the corridor, there are multiple areas of Flood Zones 2 and 3[24]. The largest Flood Zones present within this corridor are associated with the River Trent and its respective tributaries. These large Flood Zones pose a risk to construction, delivery of the Project and maintenance of an overhead line. This could impact construction by requiring dewatering of excavations through excess groundwater or surface flooding and possible access restrictions due to flood waters or poor ground conditions. Cost and programme durations may also be significantly impacted.

6.7.13 A 132kV line extends from Willington to Heanor through areas of this corridor; however, close parallel alignments along long sections would not be possible as the existing overhead line deviates into built-up areas at multiple locations which would have amenity impact and impose restrictions on the available working corridor for construction. Some sections of the existing line would also need to be re-routed or undergrounded between Stanley and Ockbrook.

6.7.14 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, localised areas of landfill, non-coal mining hazards, artificial ground, mine entries, landslides, areas of compressible ground, shrink-and-swell soils and high-risk development areas as indicated by the Coal Authority. These constraints are present along most of the corridor, which will require consideration through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around Chesterfield Substation, Grassmoor to Clay Cross, west of Alfreton, Ripley to Dale Abbey, and around the A50 north of Weston-on-Trent, due to

[24] Flood Zone 3 is considered the worst, as areas within this zone have a 1% or greater probability of flooding from rivers, whilst areas within Flood Zone 2 have a 0.1% to 1% probability of flooding from rivers. For smaller flood zones along the corridor, it might be feasible to design out these areas with strategic placement of the pylons. However, for the larger flood zones along the corridor, this might not be an option and the pylons will need to be positioned within the flood zones.

the number and extent of ground hazards in these areas, particularly ones related to coal mining.

6.8 Preliminary Corridor 5a

Introduction

6.8.1 Preliminary Corridor 5a shares the same northern extent as Preliminary Corridor 3a, between Chesterfield Substation and the vicinity of Smalley via Alfreton and Heanor (as previously described). From this point, instead of crossing the Derwent Valley Mills World Heritage Site to the south of Belper, Preliminary Corridor 5a shares the same southern extent as Preliminary Corridor 4, traversing to the east of Derby and approaching Willington Substation from the east.

Environment and Socio-Economic Preliminary Appraisal Summary

6.8.2 Due to the number of settlements within the eastern extent of the Study Area, there are highly constrained areas within this corridor, where passing within 100m of residential properties and settlements is likely unavoidable: between North Wingfield and Holmewood, and Holmewood and Heath; between Codnor Cross and Cross Hill, Cross Hill and Loscoe, and Loscoe and Heanor; between Denby Village and Denby Common, and Denby Common to Loscoe and Heanor; between Horsley Woodhouse and Smalley, and Smalley and Heanor; between Morley and Stanley Common, Stanley Common and West Hallam; and between Spondon and Borrowash, and Borrowash and Draycott. There is the potential for impacts to visual amenity where an overhead line may be visible to residents in these areas.

6.8.3 This corridor has the potential to impact a number of ecological designations and features such as Morley Brick Pits and Breadsall Railway Cutting SSSIs. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

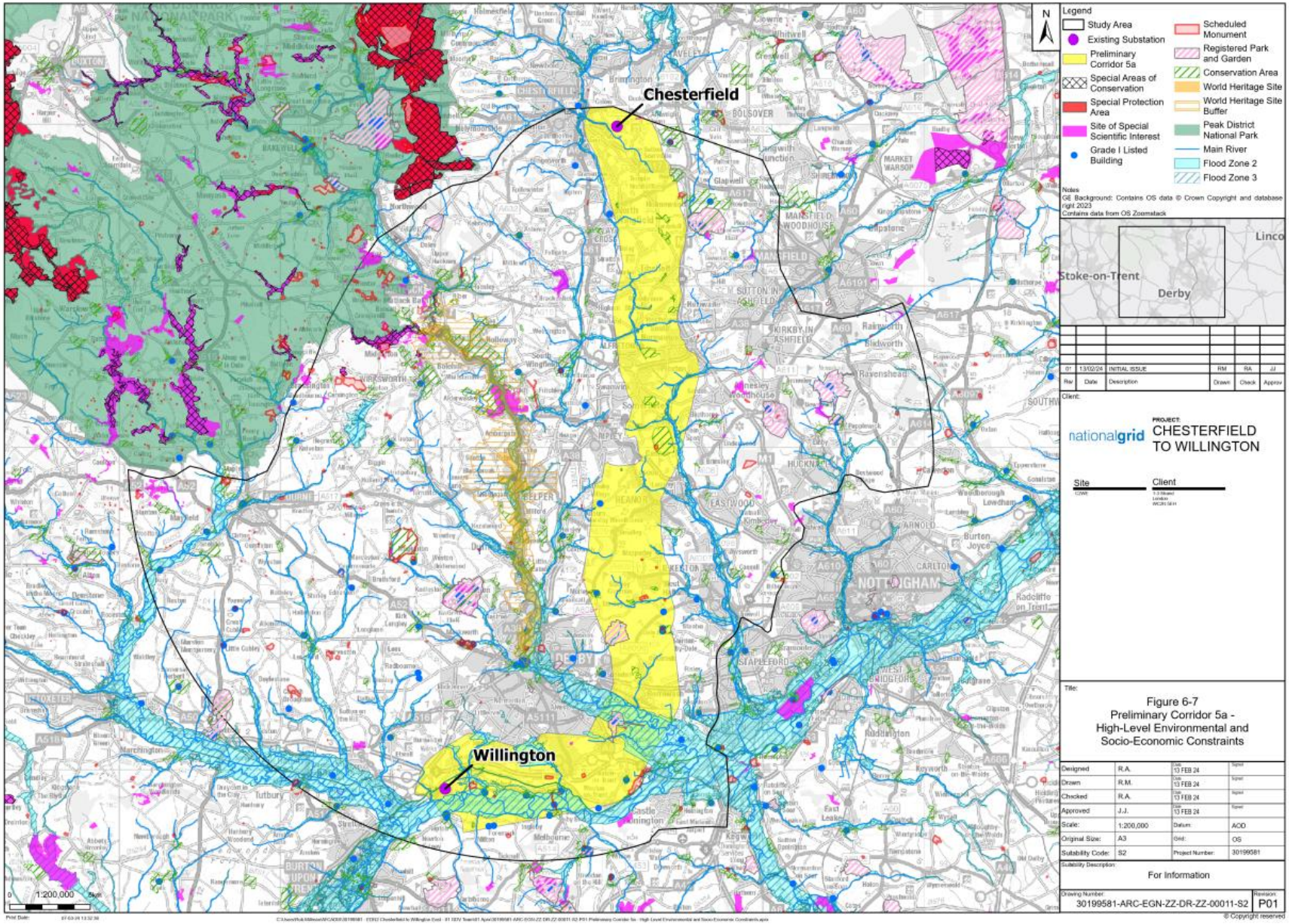
6.8.4 The corridor has the potential to impact the setting of a number of designated heritage assets including several scheduled monuments, Conservation Areas, three Registered Parks and Gardens (Elvaston Castle, Swarkestone Old Hall and Locko Park) and listed buildings, and particularly Carnfield Hall Conservation Area. Hardwick Hall Registered Park and Garden is also located in close proximity to the eastern boundary of this corridor near to Hardstoft and Glapwell, and this corridor has the potential to indirectly impact its setting. It is assumed that careful routeing and siting may reduce both direct and indirect impacts.

6.8.5 There are also a number of socio-economic constraints within the corridor. Park Hall airstrip, located near Stanley Common, is crossed by this corridor. An appropriate buffer would need to be adhered to during the routeing and siting to avoid potential impacts to this civil airfield. As with other Preliminary Corridors, the Willington Power Station site and Mercia Marina represent features for consideration. Other socio-economic constraints include solar farms, a burial ground, areas of public amenity, existing overhead lines, and industrial infrastructure. Most utilities and amenities can be avoided with careful routeing.

6.8.6 Similar to Preliminary Corridor 4, which shares the same southern section as Preliminary Corridors 5a, 5b and 5c, Preliminary Corridor 5a contains extensive areas of Flood Zones 2 and 3. There are large areas of Flood Zones 2 and 3 associated with the River Trent and its tributaries to the south east of Derby that would be unavoidable in this corridor. A detailed Flood Risk Assessment and engagement with the Environment Agency would be required.

6.8.7 The key environmental and socio-economic constraints in Preliminary Corridor 5a are presented in Figure 6.7.

Figure 6.7 – Preliminary Corridor 5a – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.8.8 Preliminary Corridor 5a follows Preliminary Corridor 3a from Chesterfield to Alfreton and then follows Preliminary Corridor 4 to Willington Substation. Preliminary Corridor 5a will be comprised of constraints from both Preliminary Corridor 3a and Preliminary Corridor 4, and so would be subject to the same technical constraints within these areas as previously described within the appraisals for those corridors.

6.8.9 Within the corridor, as with Preliminary Corridor 3a, there are two areas which are considered extremely technically constrained (as discussed above in Section 6.6). In these locations it is considered highly probable that neither an overhead line nor an underground cable route could be established. The first section is in the area between Alfreton and South Normanton and the second section in the area is between Cross Hill, Loscoe, and Heanor. As previously described for Preliminary Corridor 3a, upon further investigation it is considered that there is no realistic technical solution to pass through these two areas.

6.8.10 As with Preliminary Corridor 3a, this corridor exits Chesterfield Substation in a southeasterly direction, providing an opportunity to avoid major constraints south of Chesterfield Substation.

6.8.11 There are other technically constrained locations within the corridor, which would affect the constructability and the delivery and maintenance of the project, including, for example, five railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.8.12 Along the corridor, there are multiple areas of Flood Zones 2 and 3 present. The largest Flood Zones present within this corridor are associated with the River Trent and its respective tributaries. These large Flood Zones pose a risk to construction, delivery, and maintenance of the project. This could impact construction by requiring dewatering of excavations through excess groundwater or surface flooding and possible access restrictions due to flood waters or poor ground conditions.

6.8.13 An existing 132kV line extends from Willington to Heanor through areas within this corridor. Close parallel alignments along long sections would not be possible as the existing overhead line deviates into built-up areas, which would have amenity impact and impose restrictions on the available working corridor for construction. Some sections of the line would also need to be re-routed or undergrounded between Stanley and Ockbrook.

6.8.14 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, non-coal mining hazards, artificial ground, mine entries, areas of compressible ground, shrink-and-swell soils and high-risk development areas as indicated by the Coal Authority. These constraints are present along the majority of the corridor, which will require consideration through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around the vicinity of Chesterfield Substation, Grassmoor, Alfreton, Ripley to Dale Abbey, and around the A50 north of Weston-on-Trent, due to the number and extent of ground hazards in these areas, particularly ones related to coal mining.

6.9 Preliminary Corridor 5b

Introduction

6.9.1 Preliminary Corridor 5b begins in the vicinity of Chesterfield Substation. The corridor then follows an existing 132kV overhead line which heads southeast from Chesterfield Substation towards Kirkby-in-Ashfield, crossing the M1 motorway. To the west of Kirkby-in-Ashfield, Preliminary Corridor 5b continues to follow the existing 132kV overhead line from Kirkby-in-Ashfield, southwest towards Loscoe via Annesley Woodhouse. From this point, Preliminary Corridor 5b then shares the same southern extent with Preliminary Corridors 4 and 5a, routeing to the east of Derby and approaching Willington Substation from the east.

Environment and Socio-Economic Preliminary Appraisal Summary

6.9.2 Due to the number of settlements within the eastern extent of the Study Area, there are highly constrained areas within this corridor, where passing within 100m of residential properties and settlements is likely unavoidable: between North Wingfield and Holmewood, and Holmewood and Heath; the area around Annesley Woodhouse, between Cross Hill and Loscoe, and Loscoe and Heanor; between Denby Village and Denby Common, and Denby Common to Loscoe and Heanor; between Horsley Woodhouse and Smalley, and Smalley and Heanor; between Morley and Stanley Common; and between Spondon and Borrowash, and Borrowash and Draycott. There is the potential for impacts to visual amenity where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these visual impacts.

6.9.3 This corridor has the potential to directly and indirectly impact a number of ecological designations and features within the corridor including Morley Brick Pits SSSI, Breadsall Railway Cutting SSSI, Kirkby Grives SSSI, Bagthorpe Meadows SSSI, Friezeland Grassland SSSI, Boulton Moor SSSI, Annesley Woodhouse Quarries SSSI, Bogs Farm Quarry SSSI and part of Sherwood Forest IBA. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

6.9.4 The corridor crosses a number of designated heritage assets including several scheduled monuments, Conservation Areas, Elvaston Castle, Annesley Hall, Locko Park and Swarkestone Old Hall Registered Parks and Gardens, and listed buildings. Whitworth Institute Registered Park and Garden, and Hardwick Hall Registered Park and Garden are also located in close proximity to the corridor. This corridor has the potential to indirectly impact the setting of these Registered Parks and Gardens. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to these features.

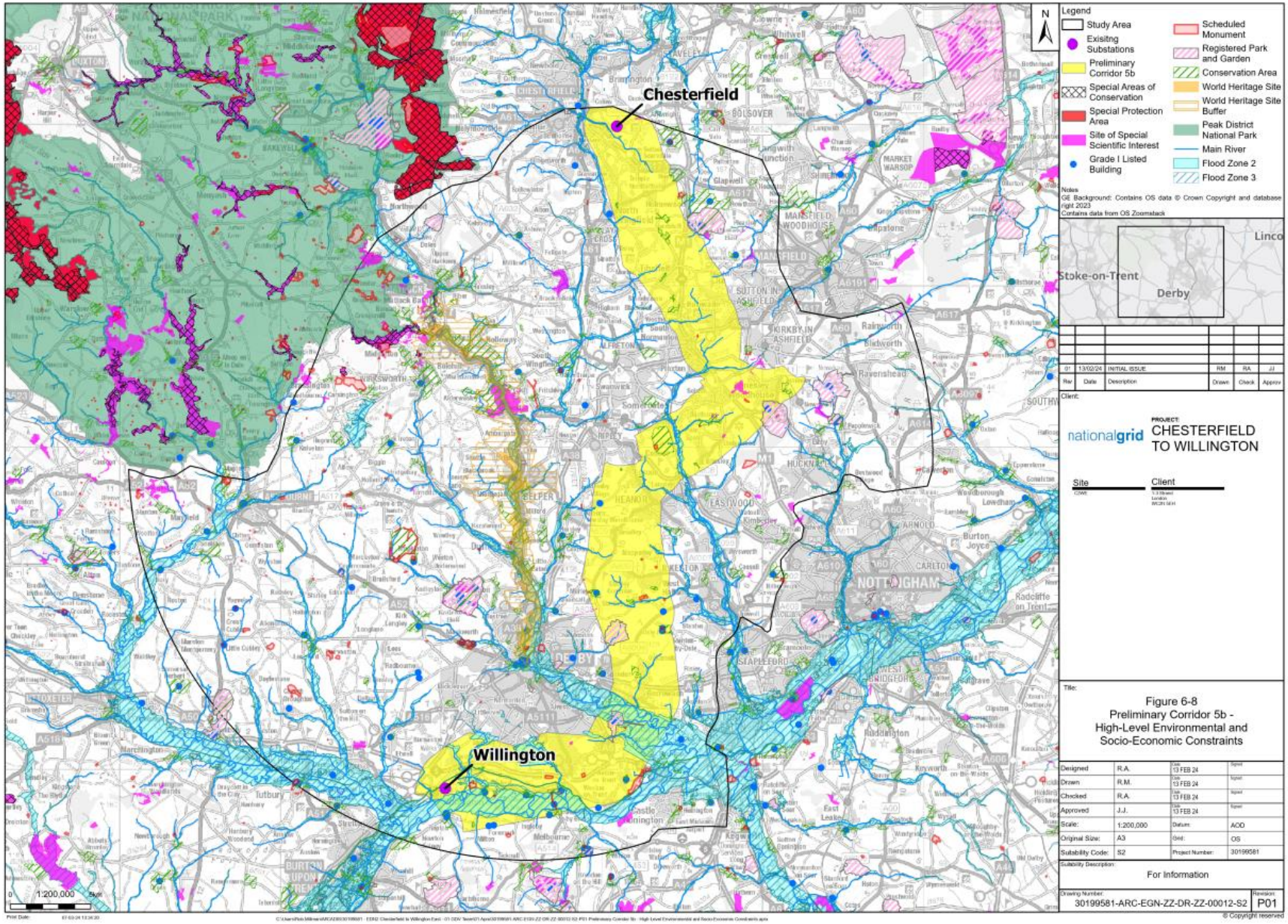
6.9.5 There are a number of socio-economic constraints within the corridor. Park Hall airstrip, located near Stanley Common, is crossed by this corridor. An appropriate buffer would need to be adhered to during the routeing and siting to avoid potential impacts to this civil airfield. There is potential for indirect impacts to the setting of the Dale Hill Natural Burial Ground and the Trent Valley Crematorium depending on the alignment of an overhead line. Careful routeing and siting, screening of infrastructure or undergrounding

in sensitive areas may reduce impacts. As with other Preliminary Corridors, the Willington Power Station site and Mercia Marina represent constraints for consideration. Other socio-economic constraints include solar farms, areas of public amenity, a burial ground, existing overhead lines, and industrial infrastructure. Most utilities and amenities can be avoided with careful routeing and siting.

6.9.6 Similar to other corridors in the eastern part of the Study Area, Preliminary Corridor 5b contains extensive areas of Flood Zones 2 and 3. There are large areas of Flood Zones 2 and 3 associated with the River Trent and its tributaries to the southeast of Derby that would be unavoidable. A detailed Flood Risk Assessment and engagement with the Environment Agency would be required.

6.9.7 The key environmental and socio-economic constraints in Preliminary Corridor 5b are presented in Figure 6.8.

Figure 6.8 – Preliminary Corridor 5a – Key Environmental and Socio-Economic Constraints



Engineering and System Preliminary Appraisal Summary

6.9.8 Preliminary Corridor 5b from Chesterfield to Pilsley follows Preliminary Corridor 3a, and then from there to Cross Hill and Loscoe via Annesley Woodhouse, Preliminary Corridor 5b is considered a new option. Upon reaching Cross Hill and Loscoe, Preliminary Corridor 5b links with Preliminary Corridor 3a again, before merging into Preliminary Corridor 4 and continuing to Willington Substation.

6.9.9 For this reason, Preliminary Corridor 5b will largely be subject to substantially the same technical constraints within these areas as previously described for the appraisals for Preliminary Corridor 3a and Preliminary Corridor 4.

6.9.10 The area between Cross Hill, Loscoe and Heanor (identical to Preliminary Corridor 3a) is considered extremely technically constrained. In this location it is considered highly probable that neither an overhead line nor an underground cable route could be established. As such, there is no technical solution at this time, as previously described in that section.

6.9.11 As with Preliminary Corridor 3a and Preliminary Corridor 5a, this corridor exits Chesterfield Substation in a southeasterly direction, providing an opportunity to avoid major constraints south of Chesterfield Substation, as previously described in those sections.

6.9.12 There are other technically constrained locations within the corridor, which would affect the constructability of this route and the delivery and maintenance of the project. Constrained locations include but are not limited to: crossing the A38 between South Normanton and Sutton in Ashfield; routeing in the area of Annesley Woodhouse Quarries SSSI Bogs Farm Quarry SSSI; routeing between Selston and Underwood; and four railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.9.13 Along the corridor, there are multiple areas of Flood Zones 2 and 3 present. The largest Flood Zones present within this corridor are associated with River Trent and its respective tributaries. These larger Flood Zones pose a risk to construction, delivery, and maintenance of the Project. This could impact construction by requiring the dewatering of excavations through excess groundwater or surface flooding and possible access restrictions due to flood waters or poor ground conditions.

6.9.14 Two 132kV lines are present which extend throughout the length of the corridor. Close parallel alignments along long sections would not be possible as multiple built-up areas are present at several locations.

6.9.15 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, localised areas of landfill, non-coal mining hazards, artificial ground, mine entries, areas of compressible ground, shrink-and-swell soils and high-risk development areas as indicated by the Coal Authority. These constraints are present along most of the corridor, which will require consideration through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around the vicinity of Chesterfield Substation, Grassmoor, Church Hill to the east of South Normanton, south of Ripley to Dale Abbey, and around the A50 north of Weston-on-Trent, due to the number and extent of ground hazards in these areas, particularly ones related to coal mining.

6.10 Preliminary Corridor 5c

Introduction

6.10.1 Preliminary Corridor 5c begins in the vicinity of Chesterfield Substation. The corridor shares its northern extent with Preliminary Corridor 5b and follows an existing 132kV overhead line which heads southeast from Chesterfield Substation towards Kirkby-in-Ashfield. To the west of Kirkby-in-Ashfield, Preliminary Corridor 5c extends further southeast towards Hucknall, before traversing southwest via Eastwood to south of Heanor. Preliminary Corridor 5c then shares the same southern extent with Preliminary Corridors 4, 5a and 5b, routeing to the east of Derby and approaching Willington Substation from the east.

Environment and Socio-Economic Preliminary Appraisal Summary

6.10.2 Due to the number of settlements within the eastern extent of the Study Area, there are highly constrained areas within this corridor, where passing within 100m of residential properties and settlements is likely unavoidable: between North Wingfield and Holmewood, and Holmewood and Heath; between Annersley Woodhouse and Kirkby in Ashfield; between Eastwood and Kimberley and Nuthall; between Heanor and Shipley, and Shipley and Cotmanhay; between Morley and Stanley Common, and Stanley Common and West Hallam; and between Spondon and Borrowash, and Borrowash and Draycott. There is the potential for impacts to visual amenity where an overhead line may be visible to residents in these areas. Careful routeing and siting of infrastructure may reduce these visual impacts.

6.10.3 This corridor intersects Shipley Country Park located between Heanor and Ilkeston, which spans the width of the corridor and is therefore likely unavoidable. Appropriate routeing and siting to minimise visual impacts on users of the Country Park may be possible; however, there would still be areas in the Country Park where an overhead line would be visible.

6.10.4 This corridor has the potential to directly and indirectly impact a number of ecological designations and features within the corridor including multiple SSSIs and Sherwood Forest IBA. In addition to this, similar to other Preliminary Corridors, there are a number of statutory and non-statutory designations outside of the corridor that may be indirectly impacted by a route within this corridor. It is assumed that careful routeing and siting may reduce both direct and indirect impacts to ecological designations and features.

6.10.5 The corridor crosses a number of designated heritage assets including several scheduled monuments, Conservation Areas, six Registered Parks and Gardens (Elvaston Castle, Swarkestone Old Hall, Annesley Hall, Newstead Abbey, Locko Park and Papplewick Hall) and listed buildings. The corridor has the potential to directly impact these heritage assets and their settings. Hardwick Hall Registered Park and Garden is also located in close proximity to the eastern boundary of this corridor near to Hardstoft and Glapwell, and this corridor has the potential to indirectly impact its setting. It is assumed that careful routeing and siting may reduce both direct and indirect impacts.

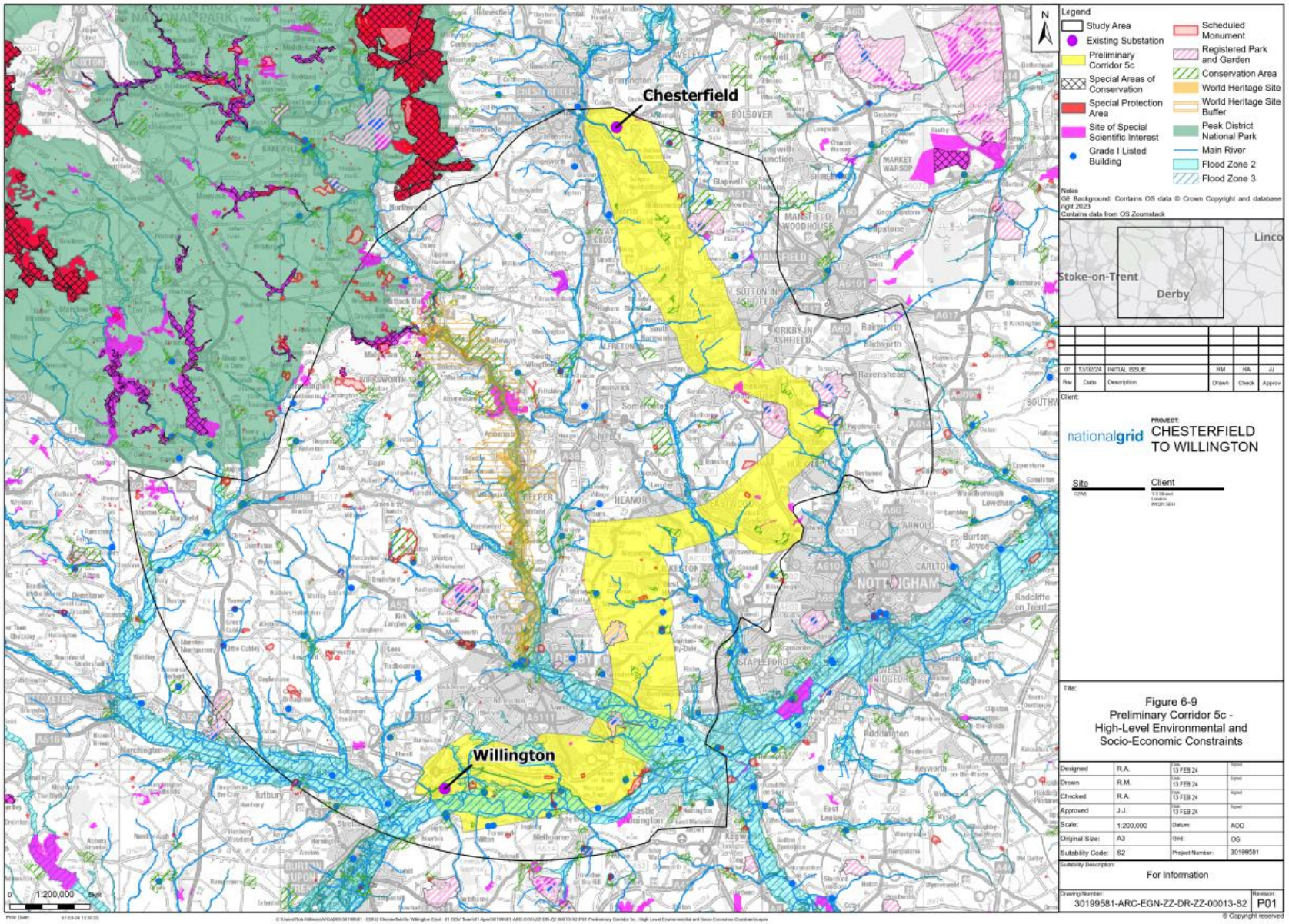
6.10.6 There are also a number of socio-economic constraints within the corridor. Park Hall Airstrip, located near Stanley Common, and Watnall Airstrip, situated between Moorgreen and Hucknall, are crossed by this corridor. An appropriate buffer would need

to be adhered to during the routeing stage to avoid impacts to the civil airfields. As with other Preliminary Corridors, the Willington Power Station site and Mercia Marina represent constraints for consideration. Other socio-economic constraints include areas of public amenity, a burial ground, existing overhead lines, and industrial infrastructure. Most utilities and amenities can be avoided with careful routeing and siting.

6.10.7 As with the previous three preliminary corridors, Preliminary Corridor 5c contains extensive areas of Flood Zones 2 and 3. There are large areas of Flood Zones 2 and 3 associated with the River Trent and its tributaries to the south east of Derby that would be unavoidable in this corridor. A detailed Flood Risk Assessment and engagement with the Environment Agency would be required.

6.10.8 The key environmental and socio-economic constraints in Preliminary Corridor 5c are presented in Figure 6.9.

Figure 6.9 – Preliminary Corridor 5c – Key Environmental and Socio-Economic Constraints



6.10.9 Preliminary Corridor 5c from Chesterfield to Annesley follows Preliminary Corridor 5b, and so would be subject to the same technical constraints within these areas as previously described within the appraisal for that corridor. From Annesley to Smalley, Preliminary Corridor 5c is considered a new option. Upon reaching Smalley, Preliminary Corridor 5c merges with Preliminary Corridor 4 and continues to Willington Substation, following the same route as Preliminary Corridor 4, and so would largely be subject to the same technical constraints within these areas as previously described within the appraisal for that corridor.

6.10.10 Within the corridor there are two areas which are considered extremely technically constrained. In these locations it is considered highly likely that neither an overhead line nor an underground cable route could be established. The two locations within this corridor that have been identified are in the areas around Annesley and between Eastwood and Kimberley.

6.10.11 In the vicinity of Annesley, the entire width of the corridor is uninterrupted residential and commercial properties, with the exception of two narrow corridors. One crosses through Sherwood Business Park and the other crosses at the junction between the A611/B6021. It is considered that there is not enough space to allow for a route to be established through these corridors.

6.10.12 Similarly, in the area between Eastwood and Kimberley, the entire width of the corridor is also uninterrupted by residential and commercial properties. The A610 also bisects the corridor at this location introducing significant technical complexity. Only one potential routeing corridor was identified in this area, though this would involve crossing through or adjacent to Giltbrook Retail Park. An overhead line in this area is technically feasible but would likely require the installation of a large angle pylon in the car park. An underground cable solution was considered; however, there is also insufficient space to facilitate crossing of the A610. Alternative routeing for underground cabling involving installation within the B6010 was also considered, utilising both carriageways and the underpass, or through adjacent commercial properties. Routeing within the roadways is subject to gaining consent for multiple lane closures introducing disruption to the Strategic and Local Road Networks and has the potential to be precluded by existing infrastructure.

6.10.13 As with Preliminary Corridors 3a, 5a and 5b, this corridor exits Chesterfield Substation in a southeasterly direction, providing an opportunity to avoid major constraints south of Chesterfield Substation, as previously described in those sections.

6.10.14 There are other technically constrained locations within the corridor, which would affect the constructability and the delivery of the project and the maintenance of an overhead line or underground cable. Constrained locations include but are not limited to: crossing the A38 between South Normanton and Sutton in Ashfield; routeing around Shipley; and six railway crossings. Although many of these are highly constrained, all are considered technically feasible.

6.10.15 Along the corridor, there are multiple areas of Flood Zones 2 and 3 present. The largest Flood Zones present within this corridor are associated with the River Trent and its respective tributaries. These larger Flood Zones pose a risk to construction, delivery, and maintenance of the Project, namely through potential waterlogging and possible access restrictions. This could impact construction by requiring the dewatering of

excavations through excess groundwater or surface flooding and possible access restrictions due to flood waters or poor ground conditions.

6.10.16 Two 132kV line sections are present in this corridor option, but close parallel alignments along long sections would not be possible as multiple built-up areas are present at several locations.

6.10.17 The geotechnical hazards associated with this corridor are largely influenced by, but not limited to, localised areas of landfill, non-coaling mining hazards, artificial ground, mine entries, shrink-and-swell soils and high-risk development areas as indicated by the Coal Authority. These constraints are present along most of the corridor, which will require considerations through the detailed design phase to mitigate their impact on construction. The most challenging areas within the corridor are located around the vicinity of Chesterfield Substation, Grassmoor, Church Hill to east of South Normanton, Greasley to Dale Abbey, and around the A50 north of Weston-on-Trent, due to the number and extent of ground hazards in these areas, particularly ones related to coal mining.

6.11 Conclusions from Appraisal of Preliminary Corridors

6.11.1 Following the appraisal of the preliminary corridors, NGET, the FEED Contractor and the Landscape, Environmental and Socio-Economic Specialists reviewed the findings of the preliminary corridor appraisal process.

6.11.2 The key environmental and socio-economic constraints appraised included the Peak District National Park and the Derwent Valley Mills World Heritage Site, which are both afforded the highest level of protection under the Holford Rules and NPS EN-1. Preliminary Corridor 1 intersects the Peak District National Park, and Preliminary Corridor 2 is located within close proximity to the Peak District National Park. There is potential for a route within these corridors to impact the Special Qualities of the Peak District National Park. Preliminary Corridors 2, 3 and 3a intersect the Derwent Valley Mills World Heritage Site, and Preliminary Corridor 1 is located in close proximity to the buffer of the Derwent Valley Mills World Heritage Site. There is potential for a route within these corridors to impact the Outstanding Universal Values (OUV) of the Derwent Valley Mills World Heritage Site. A corridor through these designations should be avoided where possible; however, given the technical constraints present in other Preliminary Corridors, these Preliminary Corridors were not discounted at this stage to provide alternative options.

6.11.3 To understand which corridors were technically feasible, further technical assessments were performed and concluded that in some locations a viable route via overhead line or underground cable as per design assumptions outlined in Chapter 2 could not be established.

6.11.4 One of the common pinch points for Preliminary Corridors 3a, 5a and 5b is the Cross Hill, Loscoe, and Heanor area where no routeing solution was identified without impacting residential properties. Another extremely constrained area common to Preliminary Corridor 3a and 5a is where there are large built-up areas between Alfreton and South Normanton consisting of residential properties and industrial estates. Within Preliminary Corridor 5c, two areas (Annesley and between Eastwood and Kimberley) are considered extremely technically constrained. In these locations it is considered highly likely that neither an overhead line route nor an underground cable route could be established due to the density of existing infrastructure across the width of the corridor. The significant level of technical complexity associated with facilitating engineering

solutions to overcome constraints in the areas mentioned above would result in socio-economic, cost and programme impacts.

6.11.5 As a result, Preliminary Corridors 3a, 5a, 5b and 5c were removed from further appraisal.

6.11.6 Preliminary Corridors 1, 2, 3, and 4 were taken forward for further refinement as subsequently described in Chapter 7.

7. Options Appraisal of Refined Corridors

nationalgrid

7. Options Appraisal of Refined Corridors

7.1 Introduction

7.1.1 This chapter describes the refinement of preliminary corridors and presents a summary of the options appraisal undertaken for the subsequent refined corridors. The purpose of this chapter is to present the key environmental, socio-economic and technical constraints associated with each refined corridor. The appraisal considers whether potential impacts on relevant receptors can be mitigated through careful routeing or by other forms of mitigation.

7.1.2 As described in Chapter 4, to enable a clear comparative analysis and understanding of the refined corridors, the network of corridors was divided into 'sections', with a series of connecting links. This exercise was undertaken so that an emerging preferred corridor could be identified, where appropriate, using a series of sections of one corridor via a link to a series of sections of another corridor, in order to bypass an area of greater constraint in an otherwise suitable corridor. For each refined corridor, possible links to other corridors are detailed.

7.2 Overview of the Options and Refinement of Corridors

Refinement of Corridors

7.2.1 Preliminary Corridors 1, 2, 3 and 4 were taken forward for refinement as previously detailed in Chapter 6.

7.2.2 Two additional corridors were then identified (Corridor 5 and 6). The purpose of identifying Corridors 5 and 6 was to provide additional potential routeing options within the eastern extent of the Study Area, which potentially avoided the highly constrained areas further to the west, and to maximise potential opportunities associated with following major infrastructure corridors such as the M1 motorway in certain locations. Neither of these two additional corridors forms an end-to-end corridor, instead requiring linkages with other corridors.

7.2.3 Corridor 5 provides an alternative route to the southeast out of Chesterfield Substation, connecting with Corridor 1 east of Chesterfield Substation and traversing towards Junction 29 of the M1 motorway, therefore avoiding the constraints immediately south of the existing Chesterfield Substation. Corridor 5 then heads southwest towards Alfreton, providing potential links to Corridor 3 in two locations in the vicinity of Clay Cross and north of Alfreton.

7.2.4 Corridor 6 links to Corridor 3 north of Ripley. Corridor 6 then heads southeast towards Junction 26 of the M1 motorway, keeping to the north of the A610 and settlements in this area, before turning southwest towards Ockbrook, broadly following the M1 motorway corridor towards Sandiacre, before linking to Corridor 4 east of Ockbrook.

7.2.5 The six corridors were then refined. As described in Chapter 5, the refinements to the preliminary corridors included:

- Smaller areas of higher amenity (such as SSSIs, ancient woodland, scheduled monuments etc.) were avoided to the extent feasible.
- Other ‘smaller’ settlements were removed.
- Smaller areas of physical constraint were avoided to the extent feasible, which included removing land with potentially challenging topography (such as the River Amber Valley), and refining corridors to allow flexibility when designing a route into the new Chesterfield Substation and Willington Substation given the nearby constraints.
- Sections of corridor where an engineered solution was unfeasible (i.e., insufficient clearance for installation of an overhead line or an underground cable) were removed.
- Where the removal of ‘smaller’ settlements resulted in opportunities either side of these, this optionality has been retained and allows for further refinement based on consultation feedback.
- Technical, landscape and heritage specialists worked together to find the most feasible location for a corridor through the Derwent Valley Mills World Heritage Site and rationalised the corridor widths through this designation to find a potential corridor with the least impact.

Green Belt

7.2.6 As set out throughout the report, all options have been considered against National and Local policy. The ‘Derby and Nottingham Green Belt’ emerges to the East and North of Derby and surrounds the conurbation of Nottingham. Except for preliminary corridor 1, where a range of assets and constraints are present and afforded significant protection under the NPS, all other preliminary corridors identified pass through areas of Green Belt. On the basis that options seeking to achieve a connection between Willington and Chesterfield, asides from routeing westwards into the Peak District, would have to pass through the Green Belt, this was not assessed to be a differentiating factor in the refinement of preliminary corridors, or their subsequent appraisals.

HS2

7.2.7 A number of the preliminary corridors detailed in Chapter 6 (3a, 5a, 5b and 5c), together with sections dealt within this Chapter and are yet to be discussed, include areas of land safeguarded for Phase 2b of High Speed Two (HS2). Although the government have announced the cancellation of this section of railway, these areas remain in safeguarding. The Network North Command Paper states that safeguarding for Phase 2b is expected to be amended by Summer 2024 with retention of land needed for Northern Powerhouse Rail (NPR)[25]. It is not expected that lands within the Study Area will be included within NPR and therefore this was not considered a differentiating factor in the refinement of preliminary corridors or their subsequent appraisals.

[25] Network North - GOV.UK (www.gov.uk) Available at https://transportforthenorth.com/wp-content/uploads/Northern-Powerhouse-Rail-Connect.pdf

Overview of the Options

7.2.8 For the purpose of further analysing and appraising these refined corridors, the naming convention of Corridors 1, 2, 3, 4, 5 and 6 was consistently adopted.

7.2.9 The six refined corridors did not all form end-to-end solutions. Corridor 1 provides a complete end-to-end solution between Chesterfield and Willington Substations, and at each of these end points provides the connecting link for all other corridors regardless of the path followed through the remainder of the Study Area. However, Corridors 2, 3, 4, 5 and 6 require links with other corridors to form a complete corridor through the Study Area connecting Chesterfield and Willington Substations.

- Corridor 2 links to Corridor 1 in its northern extent in the vicinity of Clay Cross and Tupton, and in its southern extent across a relatively wide area broadly bounded by the A52 and Kirk Langley to the north and by the A516 and Burnaston to the south.
- Corridor 3 links to Corridor 2 in its northern extent in the vicinity of Clay Cross, and in the southern extent in the vicinity of Duffield. Corridor 3 links to Corridor 4 in its southern extent in the vicinity of Morley, as well as to Corridor 5 in its northern extent in the vicinity of Clay Cross, and again north of Alfreton. Corridor 3 also links to Corridor 6 north of Ripley.
- Corridor 4 links to Corridor 1 in its southern extent to enter Willington Substation. Corridor 4 links to Corridor 3 in its northern extent in the vicinity of Morley. Corridor 4 also links to Corridor 6 in the vicinity of Ockbrook.
- Corridor 5 links to Corridor 1 in its northern extent in the vicinity of Sutton Scarsdale and to Corridor 3 in the vicinity of Clay Cross and again north of Alfreton.
- Corridor 6 links to Corridor 3 north of Ripley and to Corridor 4 east of Ockbrook.

7.2.10 The refined corridors were then split into discrete ‘sections’ with a series of connecting links to other corridors. This approach allowed for the continued appraisal of multiple and interrelated options. The refined corridors subject to appraisal comprised the following sections:

- Corridor 1; comprising sections C1a – C1g.
- Corridor 2; comprising sections C2a – C2g.
- Corridor 3; comprising sections C3a – C3h.
- Corridor 4; comprising sections C4a1 – C4a.
- Corridor 5; comprising section C5a.
- Corridor 6; comprising section C6a.

7.2.11 The refined corridors and their sections subject to options appraisal are shown in Figure 7.1.

7.2.12 In some cases, these discrete sections were developed to enable alternative routes around a receptor or constraint. This included:

- Alternative sections at the southern extent of Corridor 1 to avoid the settlement of Etwall and an industrial park that an overhead line could likely not cross (C1e and C1f).
- Alternative sections of Corridor 2, north of Whatstandwell (C2d) and south of Ambergate (C2e), to provide alternative routes around a heavily constrained area

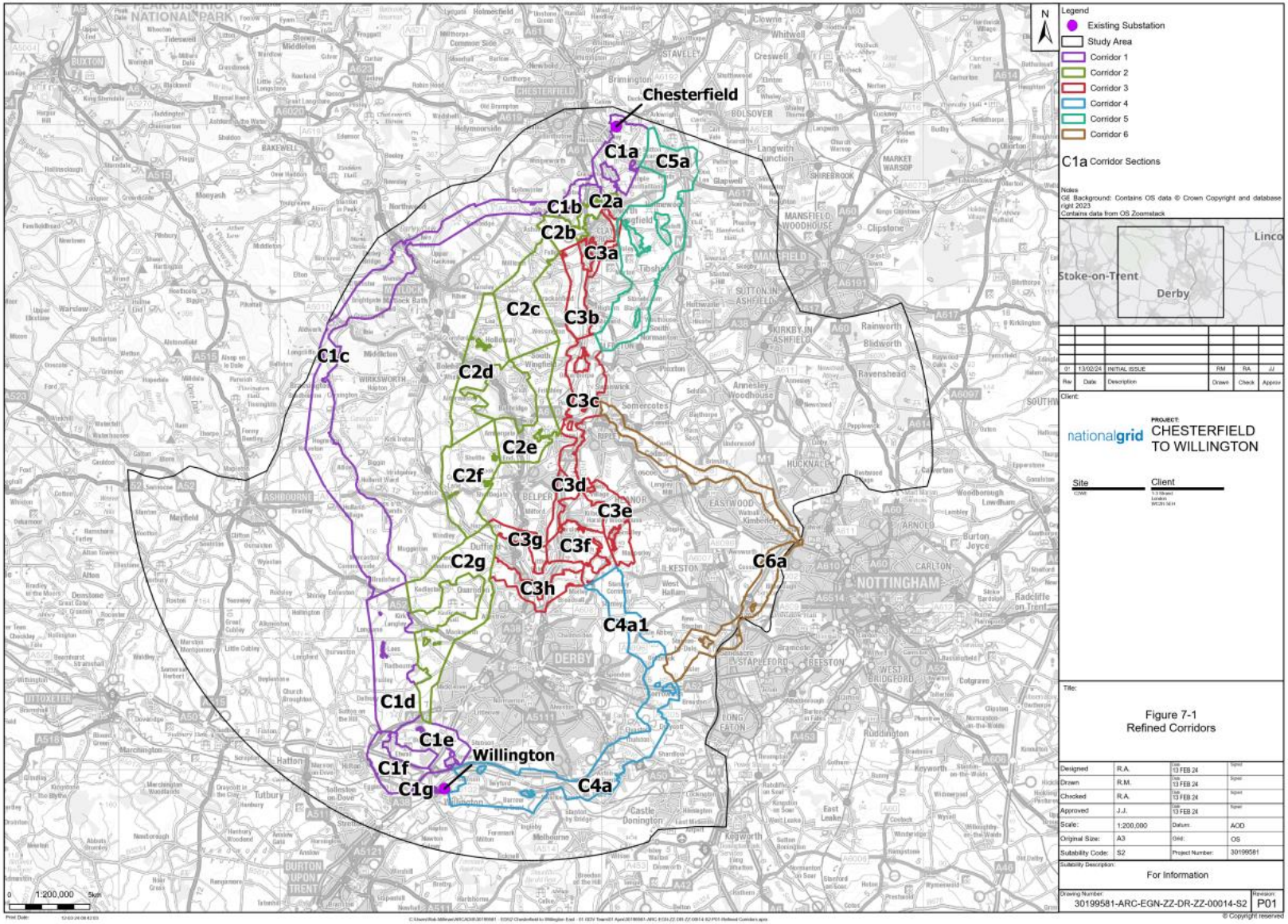
containing the Derwent Valley Mills World Heritage Site, Crich Chase SSSI, areas of ancient woodland and the River Derwent.

- Alternative sections in Corridor 3 to avoid the settlements of Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse (C3d and C3e).
- Alternative sections in Corridor 3 to provide alternative routes across the Derwent Valley Mills World Heritage Site at Makeney (C3g) or south of Little Eaton (C3h).

7.2.13 As described in Chapter 4, the refined corridors, comprising of their sections and links, were then further reviewed by NGET and the FEED Contractor to confirm their technical feasibility and ensure that key issues, and the interaction of constraints, had been fully considered. At this point, the network of refined corridors, sections and links was considered to offer a sufficient number of potential options to form feasible end-to-end solutions and be taken forward for further appraisal.

Strategic option EDN-1 involves the construction of a new transmission circuit connection between a new Chesterfield 400 kV Substation and the existing Ratcliffe 400 kV Substation following a route between Derby and Nottingham. It has a route length of approximately 48 km, as shown in Figure 7.1Figure 7.1 below.

Figure 7.1 – Refined Corridors



7.3 Corridor 1

Introduction

7.3.1 Corridor 1 begins in the vicinity of the existing Chesterfield Substation, immediately to the east of Chesterfield. It continues in a southerly direction broadly following the existing overhead lines out of Chesterfield Substation, before heading in a south-westerly direction towards Grassmoor, where the corridor provides optionality to either side of the settlement within Section C1a. From here, the refined corridor heads west around the north of Tupton in Section C1b, where it then continues through the longer Section C1c to between Darley Dale and Upper Hackney, crossing the foothills of the Peak District National Park and valleys that feed the River Amber and the River Derwent.

7.3.2 The refined corridor then continues in a southerly direction, crossing into the Peak District National Park to the west of Matlock in the vicinity of Oker and Darley Bridge. The refined corridor emerges from the Peak District National Park in the vicinity of Aldwark and continues south through a predominantly agricultural landscape, before crossing several watercourses around the northwest of Derby and providing optionality to either side of the settlement of Lees within Section C1d.

7.3.3 South of Lees, the refined corridor splits into two possible sections (C1e and C1f) to avoid the settlement of Etwall and the nearby Toyota manufacturing park, and to provide alternative routeing options to the north or south of these features respectively into Willington Substation in Section C1g. Section C1e further provides optionality to either side of the settlements of Burnaston and Findern.

7.3.4 Corridor 1 is located furthest west within the Study Area. Key constraints for this refined corridor include: the Peak District National Park; the setting of the Derwent Valley Mills World Heritage Site; the number and proximity of residential settlements between Chesterfield and Clay Cross, and between Darley Dale and Matlock; major road and river crossings, notably the River Derwent Valley and other key tributaries of the River Trent; a number of listed buildings and scheduled monuments; five Conservation Areas (Wensley, Aldwark, Etwall, Hulland, Trent and Mersey Canal); three SSSIs (Masson Hill, Wall Lands, Hulland Moss), a Country Park (Grassmoor); and several areas of ancient woodland. Key constraints in the corridor are shown in Figure 7.2.

7.3.5 This refined corridor was progressed to avoid the higher-density urbanised areas in the eastern extent of the Study Area. This refined corridor also provides an option that avoids direct incursion into the Derwent Valley Mills World Heritage Site, routeing to the northwest of the designation west of Matlock.

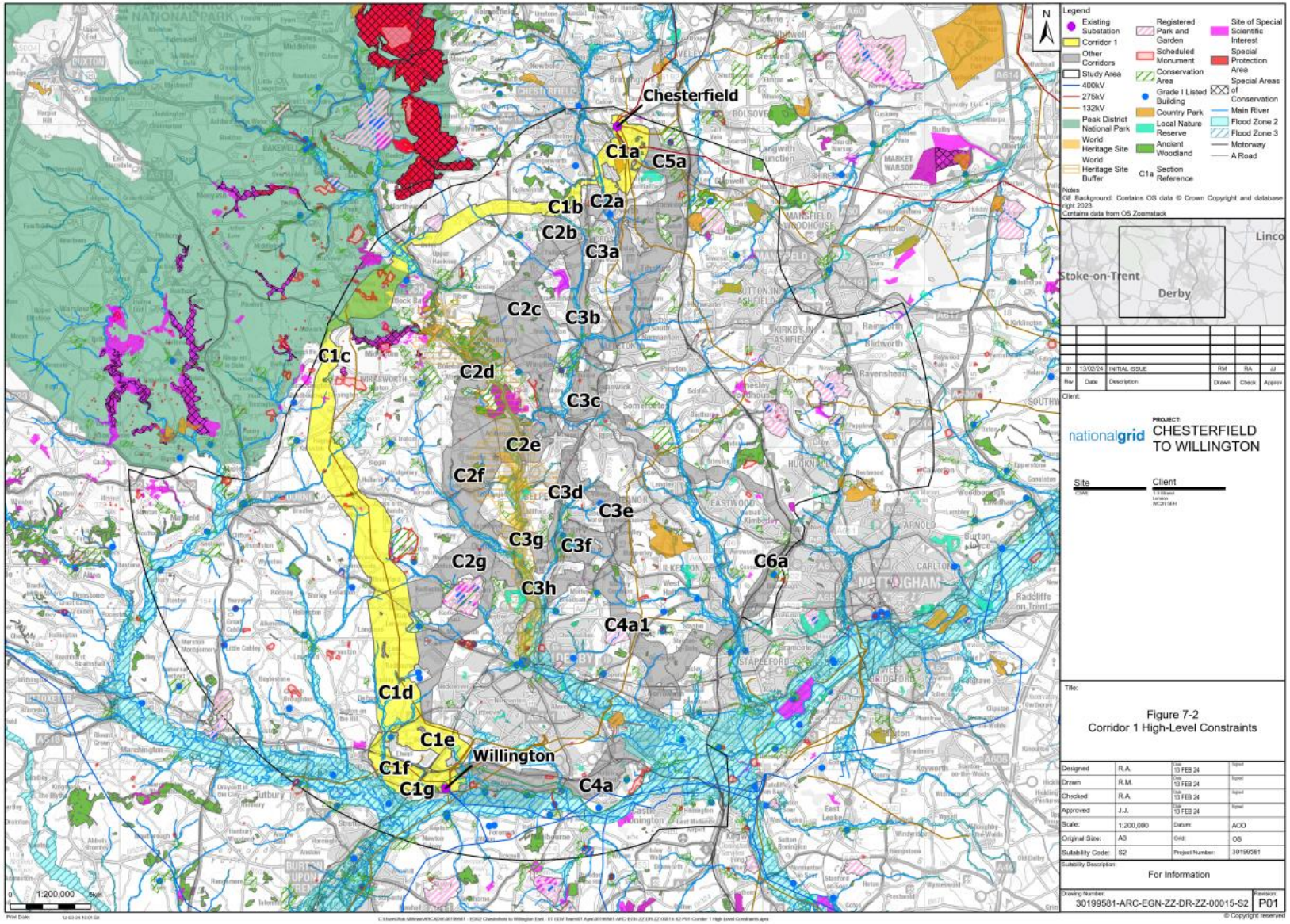
7.3.6 Given the presence of the Peak District National Park, in accordance with Holford Rule 1 and NPS EN-5, the appraisal of this refined corridor has considered an underground cable solution through the National Park.

7.3.7 There are also six possible links between this refined corridor and other refined corridors to allow flexibility in the options appraisal process and selection of the preferred corridor. These include:

- Link 1; which connects Corridor 1 at Section C1a to Corridor 2 at Section C2a.
- Link 2; which connects Corridor 1 at Section C1a to Corridor 5 at Section C5a.
- Link 3; which connects Corridor 1 at Section C1b to Corridor 2 at Section C2b.

- Link 4; which connects Corridor 2 at Section C2g to Corridor 1 at Section C1d.
- Link 5; which connects Corridor 2 at Section C2g to Corridor 1 at Section C1e.
- Link 6; which connects Corridor 4 at Section C4a to Corridor 1 at Section C1g.

Figure 7.2 – Corridor 1 Key Constraints



Environment and Socio-Economic Appraisal Summary

Ecology

7.3.8 Corridor 1 crosses multiple areas of ancient woodland. The ancient woodland is largely concentrated to the south east of Chesterfield (Section C1a), and to the west of Tupton (Section C1b). With careful routeing and siting, it should be possible to avoid these areas given the discrete nature of the woodland blocks and the relatively restricted development footprint associated with overhead lines. Multiple areas of lowland fen irreplaceable priority habitat are also within the refined corridor within Section C1c but are also considered avoidable with careful routeing and siting.

7.3.9 Corridor 1 crosses three SSSIs, which include Masson Hill SSSI, located to the west of Matlock, Wall Lands SSSI, located to the west of Carsington, and Hulland Moss SSSI, located to the south of Hulland Village. All three SSSIs are located within the centre of Section C1c; however, they are relatively small in size and are therefore considered avoidable with careful routeing and siting.

7.3.10 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the South Pennine Moors SAC, Peak District Dales SAC, Gang Mine SAC, Birklands and Bilhaugh SAC, Bee's Nest and Green Clay Pits SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, Derbyshire Dales NNR, South Pennine and Peak District Moors IBA, Sherwood Forest IBA, River Mease SAC, multiple LNRs, multiple SSSIs, veteran trees and multiple areas of ancient woodland. There is the potential to indirectly impact the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and during operation. A more detailed assessment and/or mitigation would be required if this option were to be taken forward.

7.3.11 In accordance with Holford Rule 1 and NPS EN-5, the appraisal of this corridor has considered an underground cable solution through the Peak District National Park in Section C1c. The installation of an underground cable has the potential to cause fragmentation impacts on the Peak District Dales SAC, (which is made up of multiple parcels located to the east and west of the corridor), by lying between parcels of the same SAC. There is potential for the disturbance of birds in all parcels of the designation and roosting bats associated with Masson Hill SSSI. During construction, there is also the potential for the disturbance of qualifying birds of the Peak District Moors (South Pennines Moors Phase 1) SPA/IBA and Sherwood Forest IBA. A Habitats Regulations Assessment would be required for the SPA and SAC designations if this option were to be taken forwards.

7.3.12 With careful routeing and siting, it should be possible to avoid the majority of ecological impacts on a range of designated sites given the discrete nature of the sites and the relatively restricted development footprint associated with overhead line infrastructure. If the key ecological features cannot be avoided, sensitive construction methods may be adopted, such as the use of trenchless construction techniques to minimise impacts.

Landscape and Visual

7.3.13 Corridor 1 contains (or is visible from) sections of one National Trail (the Pennine Bridleway), multiple regional and promoted long-distance paths (Chesterfield Round Walk, Five Pits Way, Derwent Valley Heritage Way, Limestone Way, Midshires Way,

High Peak Trail, Centenary Way (Derby), Bonnie Prince Charlie Walk), six National Cycle Network (NCN) routes (54, 67, 68, 547, 549 and 680), the waterway and towpath of the Trent and Mersey Canal, several key viewpoints and CRoW Open Access Areas.

7.3.14 Section C1c of Corridor 1 crosses through the Peak District National Park and passes (at its closest point) within approx. 1.7km of the buffer to the Derwent Valley Mills World Heritage Site. The Peak District National Park is a receptor of national importance and is afforded the highest status of protection in relation to landscape and scenic beauty. The routeing of the 400kV line through this section has potential to significantly impact upon the Special Qualities of the Peak District National Park. If underground cables were considered, there may still be potential for impacts due to the unavoidable physical changes to the fabric of the landscape during and following construction. There is also potential for impacts to the setting of the Peak District National Park due to the placement of the overhead line and SEC within 10km of its boundary.

7.3.15 There are potential visual impacts upon the users of the National Trail (Pennine Bridleway) and the regional / promoted long-distance paths given the long distance and broad views available (particularly those in the 'upland' part of the Study Area such as the Limestone Way, Midshires Way and High Peak Trail). There is also potential for impacts on the other regional / promoted long-distance paths and the National Cycle Network (NCN) routes given the overhead line would pass near to or cross over them. A route in this corridor would not be able to avoid crossing through CRoW Open Access land (at Farley Moor); therefore, there would likely be potential impacts on the visual amenity of users.

7.3.16 There are multiple outdoor recreational facilities within Corridor 1 including Grassmoor Country Park located between Grassmoor and Temple Normanton in the northern extent of the corridor. With careful routeing and siting, it should be possible to avoid the majority of significant visual impacts to users.

7.3.17 Three towns (Chesterfield, Matlock and Darley Dale) and multiple villages are adjacent or near to the corridor. Additionally, there are numerous scattered settlements and individual residential properties along its length. There are four points through which the route has no option but to pass within 100m of a residential property (between Grassmoor and Wingerworth in Section C1a; Grassmoor and North Wingfield in Section C1a; Tupton and Wingerworth in Section C1b; and Darley Dale and Upper Hackney in Section C1c). There is potential for significant visual impacts upon residential communities located either side of these ‘pinch-point’ locations. Impacts could be reduced by positioning overhead lines and associated infrastructure away from the most sensitive views experienced by these communities, careful routeing and siting to maximise the ability of existing landform and vegetation to visually integrate and backcloth built infrastructure and selecting visually appropriate overhead line pylons. Further mitigation of impacts may be possible by using planting schemes to reduce the degree of overhead line infrastructure visible.

7.3.18 There is the potential for cumulative landscape and visual impacts along the corridor where the overhead line would cross and/or be located close to other existing 132kV overhead lines (creating a potential ‘wirescape’) and/or other similar infrastructure. This includes existing 132kV and 275kV overhead lines around Chesterfield Substation in Section C1a, as well as the 132kV overhead line that runs in a southeast direction for a large part of the corridor length from Winster Substation in Section C1c to Willington Substation in Section C1g via Grangemill within the Peak District National Park, passing east around Longcliffe Brassington Moor Quarry and the west of Carsington Reservoir. Whilst there are opportunities for the new overhead line to close parallel with one or

more of these (and therefore potentially reduce impacts), there is still a potential for 'wirescape' to occur due to the numeracy of existing overhead lines in these sections and their differing angled approaches to Willington. Whilst located outside of the refined corridor, there would be visibility of a wind farm at Carsington Pasture. Subsequently, these impacts would need to be considered further if this option were to be taken forwards.

Historic Environment

7.3.19 There are multiple listed buildings and scheduled monuments within Corridor 1. There are also many listed buildings outside the corridor that require consideration, as well as some scheduled monuments, for example Ravensdale Deer Park. There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated that impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of listed buildings and scheduled monuments.

7.3.20 Wensley, Aldwark and Hulland Conservation Areas are crossed by the corridor in Section C1c, in addition to Etwall Conservation Area in Section C1f and Trent and Mersey Canal Conservation Area in Section C1g. There are also a number of Conservation Areas close to the boundary of the corridor. There is potential for impacts to the setting of Conservation Areas depending on the overhead line alignment. Impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of Conservation Areas.

7.3.21 The Derwent Valley Mills World Heritage Site (an area of Outstanding Universal Value) is approximately 1.7km away at its closest point and requires consideration from a setting perspective and in terms of the impacts of underground cabling due to the requirements for SEC within its setting.

7.3.22 There are no Registered Parks and Gardens within the corridor; however, Sydnope Hall and Whitworth Institute lie adjacent to the corridor and their settings require consideration.

7.3.23 There may be physical impacts to heritage assets including undesignated below-ground archaeology during construction. Undergrounding through the Peak District National Park has potential to cause physical impacts to, for example, historic lead mines and prehistoric archaeological remains; both designated and non-designated items.

7.3.24 Further assessment as well as ongoing design and routeing and siting of infrastructure may reduce, and where possible avoid, impacts to identified receptors. If Corridor 1 were taken forward, then engagement with Historic England would be undertaken to determine appropriate mitigation.

Socio-Economic

7.3.25 Key features in Corridor 1 include the Peak District National Park near Matlock (which traverses across Section C1c), Grassmoor Country Park and The Avenue Washlands Nature Reserve (in Section C1a), and Cowlishaw and Sutcliffe Woods (Section C1b). There are also equestrian centres (e.g. in Section C1c), golf clubs (e.g. South Chesterfield, Brailsford), farms, parks and CRoW access lands (e.g. in Section C1c), office/industrial estates, aggregate sites (e.g. in Section C1c), and the Mercia Marina (in Section C1g). The corridor also crosses multiple existing overhead lines.

7.3.26 There are also two solar farms that are present or have been granted planning permission in the northern extent of Corridor 1 in Section C1a. The Hasland Solar Farm, which has gained planning permission, is located to the north of the A617 between Chesterfield Substation and Winsick and could constrain a route if constructed. An existing solar farm is located to the north of the A617, near Wynneholme. The two solar farms identified in Section C1a represent a significant constraint in the northern section of the corridor for an option routeing directly south immediately out of Chesterfield Substation. A further solar farm (Dayfields Farm) has been identified off Ridge Lane in Section C1c.

7.3.27 In the northern sections of the corridor, there are two areas of allocated land for residential development, to the east of Wingerworth (C1a) and to the north of Tupton (C1b). With careful routeing, it should be possible to avoid these areas. Within the southern section there are a number of potential sites for development within the corridor including a site to the south-west of the Toyota Island roundabout designated as part of the East Midlands Freeport – the East Midlands Intermodal Park (Section C1f) and south-east of this roundabout outline planning is under consideration for the erection of up to 100,000sqm of commercial floorspace (Section C1g), which could constrain a route if approved. It is also noted that there were previous plans to develop the Willington Power Station site immediately east of Willington Substation including planning received for a gas turbine power station in 2017; however, this has not been implemented. It is understood that the site has been put forward for mixed-use development in South Derbyshire District Council's Call for Sites exercise as part of the Local Plan review process; however, no other updates are publicly available.

7.3.28 There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN) that fall into the corridor including the A617, A61, A632, A6, A5012, A517, A52, A516, A38, A50, A5132. There are also railway lines (e.g. Chesterfield-Loughborough, Rowsley South-Burton on Trent, Uttoxeter-Derby, Uttoxeter-Burton on Trent, Derby-Burton on Trent), multiple National Cycle Network (NCN) routes, long-distance paths and Public Rights of Way (PRoW) within the corridor. There is potential for disruption on the SRN and LRN roads from construction traffic and activity, which similarly may also lead to temporary disruption of recreational PRoW and NCN routes.

7.3.29 Adopting appropriate alignments that either avoid major visitor attractions, utilities, installations, and sensitive receptors altogether or provide undergrounding in sensitive areas may reduce impacts. Adopting sensitive routeing and standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.3.30 Corridor 1 crosses Flood Zones 2 and 3 and multiple watercourses. This comes with flood risk impacts associated with construction works. Whilst the corridor is generally at low risk of surface water flooding, there are localised areas at higher risk including Calow, Upper Hackney, Mercaston, along the River Etwall, and an area south of Findern. Construction in Flood Zone 3 should be avoided where possible. Where this is not practicable, a Flood Warning and Evacuation Plan, informed by the findings of a Flood Risk Assessment, would mitigate the risk of flooding to construction work sites.

7.3.31 There are areas of natural high ground along the River Derwent, River Etwall, the Etwall Brook and to the north of Findern, but there are no other flood defences present in this section. There are also multiple WFD waterbodies within the corridor at risk of pollution,

such as from sediment laden runoff, but this may be readily mitigated through standard good practice measures such as silt fencing and settlement lagoons.

7.3.32 There are multiple authorised and historic landfill sites and numerous mine shafts and adits present in the corridor. Mine shafts are concentrated in the northern extent of the corridor, around Grassmoor and Tupton in Sections C1a and C1b. Careful consideration to routeing and siting of pylons will be required to seek to avoid these features and any adverse impacts on the works such as migration of contaminants and instability. Standard environmental controls would be put in place during construction.

7.3.33 There is one geological SSSI (Masson Hill) in Section C1c which can be avoided with careful routeing and siting of infrastructure.

7.3.34 There is a Zone 1 Source Protection Zone located to the southwest of Matlock in Section C1c. This Source Protection Zone covers the width of the corridor, extending into the National Park to the east of Wirksworth. Avoidance of this receptor would not be possible in Corridor 1; therefore, water quality protection measures and drainage systems would be implemented and maintained throughout the construction phase.

Engineering and System Appraisal Summary

7.3.35 In the close vicinity of Chesterfield Substation, within Section C1a, there are multiple challenging constraints present which would impact heavily on routeing. These include two solar farms, one existing and one that has gained planning permission (Hasland Solar Farm), the A617, South Chesterfield Golf Club, multiple existing 132kV overhead lines and the existing 275kV 4ZV overhead line.

7.3.36 Both an overhead line and underground cable solution have been appraised in this area due to the density of constraints and the impact these have on the feasibility of overhead line routeing. The technical challenges of each solution are as follows:

- Overhead Line: The solar farms impose limitations on the available swathe which can result in challenging construction, operation and maintenance activities unless a definitive route through is established. An overhead line route east of Grassmoor Country Park between Temple Normanton Business Park and Temple Normanton could be established if the two existing 132kV overhead lines are rerouted or undergrounded. To cross the A617 and to avoid the existing solar farm, the overhead line might need to oversail land ancillary to the planned solar farm. Therefore, this is considered at this stage as a feasible solution.
- Underground Cable: An underground cable route under the approved solar farm is not considered preferable due to the associated impacts on the solar farm and limitations on maintenance and access. An underground cable route closer to the junction of the A617 would hence be required; this would be in close proximity to the grade separated junction and could be impacted by the associated increase in depth. There could also be an impact on the existing solar farm in this location and on existing overhead lines infrastructure. Underground cabling within this area is made more challenging due to the existing overhead lines and buried cables. Despite these challenges, an underground cable solution is considered feasible at this stage.

7.3.37 From a ground complexity point of view, there is a widespread occurrence of artificial ground[26] from south of Cock Alley to around Grassmoor. If infrastructure is required within areas of artificial ground, there may be a requirement for ground improvement and/or deep foundations.

7.3.38 The area around Grassmoor (Section C1a) is split into two routeing options. The route to the north is likely to require a significant crossing of South Chesterfield Golf Club, whilst the route to the south would need to use existing corridors of 132kV lines between Temple Normanton and Grassmoor Country Park. A high density of coal mine entries is present around Grassmoor, which is also a region located within the Coal Authority (CA) development high-risk area. The route to the south has many mine entries that may make the routeing and location of the pylons difficult.

7.3.39 West of the A61, within Section C1b, there is an area of ancient woodland which constrains the corridor; this area forces the overhead lines to route to the southern edge of the corridor in an area of open ground with a very restricted width of approximately 110m.

7.3.40 As the route continues in a westerly direction, the presence of artificial ground reduces and becomes more localised. A linear cluster of mine entries west/southwest of Tupton has been identified which would require further investigation as these may impact the siting of overhead line pylons. In this location there is a second cluster of ancient woodland area, with two potential routes to avoid it. The route to the north is approximately 120m wide and the one to the south is approximately 75m wide; likely requiring some woodland clearance. From a technical perspective, it would be preferable to follow a northern route within this section due to requiring less angle pylons and due to the fact that artificial ground would be encountered in the southern route.

7.3.41 Around Northedge (Section C1c) there is a significant risk of non-coal mining works according to the British Geological Survey, which may affect pylon positioning in the area. Large areas north of Northedge are also noted to be within a Coal Authority development ‘high-risk area’, and further assessment would be required for pylon positioning and foundation design. West of the A632, between Hardwick and Darley (at the A6), Corridor 1 traverses in a south-easterly direction though a section of largely unconstrained land, though undulating ground and areas of woodland might impact routeing.

7.3.42 As the corridor approaches the A6 and the River Derwent Valley, it enters a highly constrained area which would have a high impact on routeing feasibility. These technical constraints include geotechnical, physically constricted sections, Flood Zones 2 and 3 and poor vehicle access for construction.

7.3.43 Where the corridor crosses the A6 it is constrained by an industrial area, Red House Stables, Darley Dale Primary School, and some residential dwellings and gardens. To avoid oversailing the school and residential gardens, the corridor was extended to the west as part of the refinement process. Whilst this served to provide a less constrained route, it would still involve the oversailing of existing industrial buildings. All options for routeing at this location would also involve crossing of the Peak Rail line, the A6 and

[26] Areas where the ground surface has been significantly modified by human activity, including: made ground, infilled ground, and worked ground. Artificial ground poses risks of ground subsidence, poor bearing capacity and contamination.

River Derwent; all of which impact constructability, cost and programme due to the associated temporary protection works required.

7.3.44 Peat has been identified to the east of Darley Dale. The area identified spans the width of the corridor and is unavoidable. Peaty soils typically include a high water content and low bearing capacity, which constrain the foundation design and temporary haul roads used for access during construction through ground subsidence and waterlogging. Other ground hazards in this location include areas that are prone to landslides and the presence of soluble rock, the latter being associated with the areas of limestone. In this location, the corridor is also in an area identified as containing a significant likelihood of non-coal mining works, which could have significant implications for the potential constructability of overhead networks in this area.

7.3.45 The Flood Zones 2 and 3 associated with the River Derwent cover the whole width of the corridor for approximately 600m. The extent of this zone would require at least one pylon to be located within the Flood Zones. The foundations, constructability and future maintenance of the pylon would be impacted as a result.

7.3.46 Where Section C1c enters the Derwent Valley, the topography steepens dramatically. In areas it is expected this will impact upon both the routeing of the overhead line and the access to the overhead line, as these slopes are widespread.

7.3.47 Vehicle access throughout the Derwent Valley is considered challenging and presents difficulties to constructability, as there are large areas south of Darley Moor that may be cut off from access. Minor roads are available between Alton and the A6; however, many are subject to 7.5t access limits and are generally unlikely to be suitable for construction traffic. Furthermore, a haul road in this area might not be possible due to areas of steep topography.

7.3.48 Moving south-westerly of the A6 and the River Derwent crossing, the route enters the Peak District National Park. Routeing through this section is extremely constrained and would be considered challenging. Furthermore, the Peak District National Park is afforded the highest protection in NPS EN-1 and in accordance with the Holford Rule 1 and NPS EN-5, the appraisal of this section has considered an underground cable solution.

7.3.49 An underground cable route spanning the National Park and associated constraints could be in the order of 10km. For the purpose of this appraisal, an interface between overhead lines and underground cables is assumed to be located in the vicinity of the A6 crossing at Darley Dale and in the area of Longcliffe, which are both located outside of the Peak District National Park.

7.3.50 Undergrounding the cables in the vicinity of Darley Dale is impacted by the same features as the overhead line, as described above, and is considered extremely constrained. Siting of an SEC north of Darley Dale would require an underground cable crossing of the A6 and Peak Rail Line. Insufficient space for trenchless techniques would imply open-cut crossings of each, requiring temporary closures and causing significant associated disruption. This option would also require careful routeing to minimise short-term impact on residential properties.

7.3.51 Siting of an SEC south of the Peak Rail Line would avoid underground cable crossings of the road and railway but would place the SEC within the River Derwent alluvial flood zone (Flood Zone 3). Constructability is likely to be impacted by poor ground conditions and flooding. Extensive civil works, including embankments, drainage systems and raised levels, may also be required to protect the permanent asset from future flooding.

7.3.52 The topography east of Darley Bridge / north of Oker is considered too steep and constrained for underground cable routeing. The underground cable route would instead need to route around to the east, following the River Derwent floodplain. Constructability in this area would be heavily impacted by the hydrology and ground conditions. Up to three crossings of the River Derwent are likely to be required.

7.3.53 Throughout the entirety of the Peak District National Park, the topography is generally steep and undulating with only minor roads, inaccessible to construction traffic. Limited highway connections would require long-haul road sections with gradients that may be unsuitable for construction traffic. Access works are likely to be extensive and are therefore considered very restricted through the Peak District National Park.

7.3.54 The corridor is within an area of significant risk of non-coal mining works according to the British Geological Survey, which could have significant implications for constructability. Towards the southern edge of the Peak District National Park around Brightgate, the corridor enters a Source Protection Zone 1. Within this area, groundwater supplies could potentially be polluted. Consequently, construction activities may be severely limited or precluded. Aquifer quality protection measures and drainage systems will need to be maintained throughout the construction phase.

7.3.55 Overall, through the Peak District National Park, constructability would be challenging due to the geology, topography, exposed nature of that land and inadequate access conditions. Opportunities for underground cable routeing remain possible, but further detailed assessments would be required to provide confidence in developing a feasible underground cable routeing solution in this area. Construction costs and duration are likely to be very high.

7.3.56 Long sections of underground cable would impose network constraints, such as increasing the likelihood of longer faults in the circuits and a capacity bottleneck under particular scenarios if two underground cables per phase were used. These network constraints would be particularly relevant within this corridor due to the amount of underground cable required.

7.3.57 Moving south within Section C1c from Longcliffe towards the A52, the corridor is largely unconstrained. There is an existing 132kV overhead line within the corridor. This presents the opportunity of close parallel alignment for a long segment (up to 25km). Access across this zone could be achieved via the B5035, A517 and A52. Roads between these are noted as being very small and therefore may not be suitable for construction traffic. Where there are no intermediate connections to the highway network, long sections of haul road will be required, linking the above roads. These are likely to be in the order of 5km to 6km per section, impacting cost and programme. Areas of steep terrain may also further impact on accessibility.

7.3.58 Moving south from the A52 crossing (Section C1d), the corridor is largely unconstrained. There is a small area of artificial ground northwest of Burnaston that should be avoidable.

7.3.59 At the A516, Corridor 1 splits into two options: one route goes to the north of Etwall (Section C1e), and one route goes to the south (Section C1f). The routes then directly lead into Willington Substation (Section C1g).

7.3.60 In the close vicinity of Willington Substation, within Sections C1e, C1f and C1g, there are multiple challenging constraints present that would impact on routeing. These include Willington village, two railway lines, the Trent and Mersey Canal, the A38, the A50, Mercia Marina, an outline planning application for commercial development under

consideration to the south-east of the Toyota Island roundabout and multiple existing 132kV overhead lines.

7.3.61 The route approaching Willington Substation from the south of Etwall (Section C1f and Section C1g) routes south to the A50. South of the A50, a site is designated for the East Midlands Intermodal Park (Section C1f) and, in addition, an outline planning is currently under consideration for 100,000sqm of commercial floorspace (Section C1g). If these were approved and constructed, they could heavily constrain the route with a high probability of not finding a route from C1f to C1g. If this development did not proceed, then open space is available for routeing with a maximum of one of the existing 132 kV lines expected to be impacted (re-routed/undergrounded).

7.3.62 The route approaching from the north of Etwall (Section C1e and Section C1g) could be routed through the narrow point west of Findern and either east or west of Mercia Marina. The west of the Marina appears to be less constrained as it routes further from multiple 132kV lines running in parallel and a car park. Either option would require the undergrounding of a 132kV line south of the Marina to establish an overhead line up to Willington Substation.

7.3.63 Minor roads around Willington Substation might be required to provide access around the constraints in the area for both options (Section C1e/Section C1f and Section C1g). Within both options, the overhead lines would be required to cross the A50 and A38, the railway and the Trent and Mersey Canal Conservation Area, which runs east to west. This would require careful coordination to ensure minimal disruptions. The ground conditions to the south (Section C1f) are slightly worse than the northern option (Section C1e) due to a larger presence of artificial ground in the southern section. The ground conditions in the vicinity of Willington Substation (Section C1g) substation also comprise moderate amounts of artificial ground.

7.3.64 A summary of the options appraisal for Corridor 1 is shown in Table 7.1 below.

Summary

Table 7.1 – Summary of Corridor 1 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Masson Hill SSSI, Wall Lands SSSI and Hulland Moss SSSI are located within the corridor in Section C1c. – A route to the west of Matlock (Section C1c) will have a potential fragmentation impact on the Peak District Dales SAC. – Corridor 1 crosses multiple areas of ancient woodland. The ancient woodland is largely concentrated to the southeast of Chesterfield (Section C1a), and to the west of Tupton (Section C1b). – Multiple areas of lowland fen irreplaceable priority habitat are present within the corridor in Section C1c.
	Landscape and Visual	– Section C1c crosses through the Peak District National Park. A route through this section has potential to significantly impact upon the Special Qualities of the National Park. – Section C1c intersects the Pennine Bridleway National Trail. There are potential visual impacts upon the users of the National Trail and the other regional / promoted long-distance paths within Corridor 1. – There are numerous scattered settlements and individual residential properties in Corridor 1. There are points within Sections C1a, C1b and C1c through which the route has no option but to pass within 100m of a residential property. There is potential for visual impacts upon residential communities located either side of these ‘pinch-point’ locations. – There is the potential for cumulative landscape and visual impacts along the corridor where the overhead line would cross and/or be located close to other existing 132kV and 275kV overhead lines (creating a potential ‘wirescape’) and/or other similar infrastructure in Sections C1a, C1c, C1d and C1g. Whilst there are opportunities for the new overhead line to close parallel with one or more of these

Theme	Topic	Summary
		(and therefore potentially reduce impacts), there is still a potential for 'wirescape' to occur due to the numeracy of existing overhead lines in these sections and their differing angled approaches to Willington.
	Historic Environment	– There are a number of scheduled monuments and listed buildings throughout Corridor 1. – Wensley, Aldwark and Hulland Conservation Areas are crossed by the corridor in Section C1c, in addition to Etwall Conservation Area in Section C1f and Trent and Mersey Canal Conservation Area is crossed by the corridor in Section C1g. There is potential for impacts to the setting of the Conservation Areas.
	Water, Soils, Geology, Noise and Vibration	– There is one geological SSSI (Masson Hill) in Section C1c. – There are multiple authorised and historic landfill sites and numerous mine shafts and adits present in the corridor. Mine shafts are concentrated in the northern extent of the corridor, around Grassmoor and Tupton in Sections C1a and C1b, respectively. – There is a Zone 1 Source Protection Zone located to the southwest of Matlock in Section C1c. Avoidance of this receptor would not be possible in Corridor 1.
Socio-Economic		– Corridor 1 includes Grassmoor Country Park and The Avenue Washlands Nature Reserve (Section C1a), Cowlishaw and Sutcliffe Woods (Section C1b), equestrian centres (e.g. in Section C1c), golf clubs (South Chesterfield, Brailsford), farms, parks, CRoW access lands (e.g. in Section C1c), office/industrial estates, aggregate sites (e.g. in Section C1c), the Mercia Marina (in Section C1g) and existing overhead lines. – There are two solar farms, one existing and one with approved planning permission, in Section C1a which represent a significant constraint directly south immediately out of Chesterfield Substation. – There are two areas of allocated land for residential development in Sections C1a and C1b. There are also two planning applications in Section C1f and Section C1g which may be a constraint into Willington Substation.

Theme	Topic	Summary
		– There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN), railway lines, National Cycle Network (NCN) routes, long-distance paths, and Public Rights of Way (PRoW). There is potential for disruption on the SRN and LRN roads from construction traffic and activity, which similarly may also lead to temporary disruption of these recreational PRoW and NCN routes. Adopting sensitive routeing and siting, and standard construction control measures may reduce impacts on the LRN and SRN.
Technical	Technically Constrained Areas	– Routeing out of Chesterfield within Section C1a, there are multiple challenging constraints present which would impact heavily on routeing. These include two solar farms, one existing and one that has gained planning permission (Hasland Solar Farm), crossing of the A617, South Chesterfield Golf Club, multiple existing 132kV overhead lines and the existing 275kV 4ZV overhead line. An overhead line and an underground cable solution have been studied through this area. A potential underground cable solution could be up to 4km. – A pinch point at Darley Dale in Section C1c, constrained by industrial buildings, Red House Stables, crossing of a railway line and the A6, Darley Dale Primary School and some residential buildings and gardens. It is highly likely that the oversailing of industrial buildings would be required. – Routeing through the Peak District National Park (Section C1c) is considered challenging due to the geology, topography, exposed nature of the land and inadequate access conditions. In accordance with NPS EN-5 and the Holford Rules, an underground cable solution has been considered. Construction costs and duration are likely to be very high. An underground cable solution would be approximately 10km. This would be considered a long underground cable section. Likelihood of longer faults in the circuits increased. Capacity would be limited if two underground cables per phase are used. – Routeing into Willington Substation can either be facilitated via Section C1e or Section C1f. The constraints in these sections include Mercia Marina, a railway, multiple 132kV lines (particularly to the east of the substation) and an active planning application for a commercial development. If the planning application were to be approved, routeing close to the Mercia Marina is likely to be required.

Theme	Topic	Summary
	Access	– Vehicle access within Section C1c is considered difficult with long haul road requirements and areas of steep terrain. There are also areas where access would be required to use minor roads and use routes through towns and villages in order to connect back to the Strategic Road Network.
	Geotechnical, Flood Risk and Topography	– Large presence of artificial ground within Sections C1a, C1f, and C1g. – Section C1a and Section C1b are within a Coal Authority development high-risk area. – Section C1c includes an area of significant non-coal mining hazard, a region with presence of peat, risk of soluble rock and potential for landslides. – Two landfill sites are located within the corridor in Section C1c and Section C1f. – One Flood Zone of note within Corridor 1 (Section C1c) which is associated with the River Derwent (Flood Zone 2 and 3) and is approximately 600m wide. Siting of a SEC within Flood Zone 3 might be necessary which would imply extensive civil works and drainage systems to protect the permanent asset from future flooding. – Sections of steep topography identified and large undulations particularly in Section C1c and localised areas in Section C1b.
	Existing NGED Assets	– A number of existing 132kV lines close to Chesterfield and Willington Substations which might need to be undergrounded and/or re-routed. – In addition to the above, a maximum of one more crossing of existing 132kV lines would be required along the route. – A long section of 132kV line extending from south of Peak District National Park to Willington Substation parallel to the corridor in Sections C1c and C1d passing through less constrained areas which might present an opportunity for close parallel alignment for approximately 20 - 25km.

7.4 Corridor 2

Introduction

7.4.1 Corridor 2 begins to the south of Tupton, using Corridor 1 (Section C1a) to connect to Chesterfield Substation. The corridor encompasses the open land between Clay Cross and the villages of Tupton, Old Tupton, North Wingfield and Henmoor, and crosses the River Rother and two railway lines. From this point, the corridor continues south to the west of Clay Cross, crossing the River Amber to the west of the Ogston Reservoir and rising up towards the Peak District National Park foothills around Milltown and Butterley. To the east of Holloway, the corridor splits into two sections at Section C2c, which provide alternative routes to cross the Derwent Valley Mills World Heritage Site, whilst avoiding the presence of larger SSSIs. The western section of the corridor (Section C2d) intersects the Derwent Valley Mills World Heritage Site in the vicinity of Holloway (also providing optionality to either side of the settlement) between the Lea Wood and the settlement of Whatsandwell, before continuing south. The eastern section (Section C2e) continues southeast, crossing the River Amber again before heading west and crossing the Derwent Valley Mills World Heritage Site between Ambergate and Belper. Both Sections C2d and C2e merge again to the northwest of Belper at Section C2f, which includes optionality to either side of the settlements of Belper Lane End and Cowers Lane.

7.4.2 The refined corridor then heads south, crossing the River Ecclesbourne. Within Section C2g, the corridor provides optionality to either side of the constrained area, including Kedleston Hall, the Kedleston Conservation Area, Kedleston SSSI, and Kirk Langley Conservation Area. The northern side of the corridor crosses Cutler Brook, and the southern side of the corridor crosses Markeaton Brook and Mackworth Brook, as well as providing optionality around Langley Common, before both sides of the corridor join with Corridor 1 at either Section C1d or Section C1e west of Derby.

7.4.3 The key constraints for this corridor include: the Derwent Valley Mills World Heritage Site and biodiversity designated sites located along the River Derwent Valley near Holloway and Whatsandwell, including several areas of ancient woodland and the Cromwell Canal SSSI; the number and proximity of residential settlements around Clay Cross and in the River Derwent Valley; major road and river crossings including the River Derwent, River Amber, River Rother and other smaller watercourses; a number of listed buildings; and two Conservation Areas (Wheatcroft, and Dethick, Lea and Holloway). Key constraints within this corridor are shown in Figure 7.3.

7.4.4 Given the presence of the Derwent Valley Mills World Heritage Site, in accordance with Holford Rule 1 and NPS EN-5, the appraisal of this refined corridor has also considered an underground cable solution through the Derwent Valley World Heritage Site.

7.4.5 As previously described, there are two locations where Corridor 2 splits into two sections or provides optionality within a single section to provide opportunities to avoid a receptor or constraint. These include:

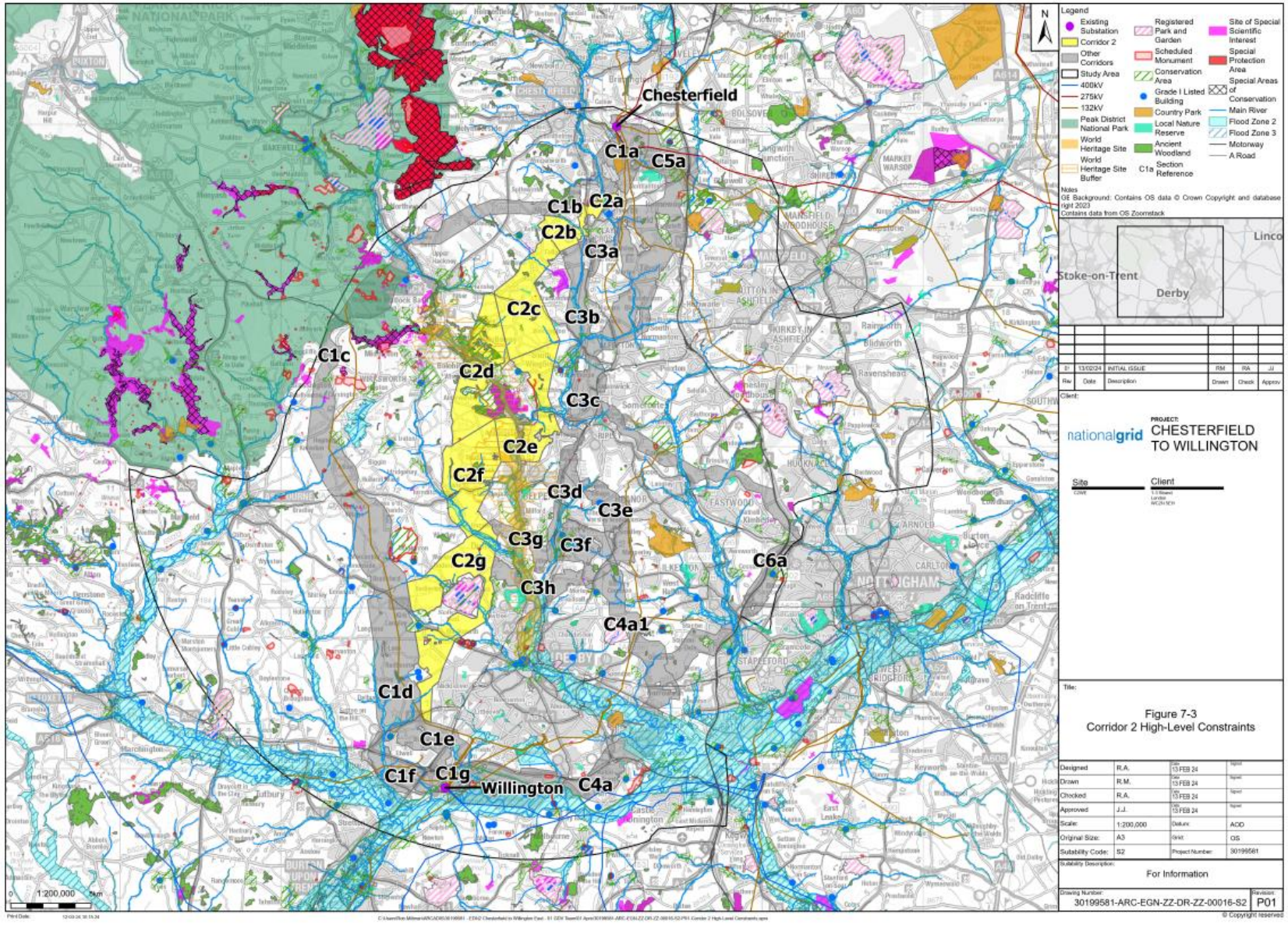
- Alternative crossings (Sections C2d and C2e) through the Derwent Valley Mills World Heritage Site to identify the least impactful crossing location; and
- Around Kedleston Hall (Section C2g) to provide alternative routes around the registered park and garden, a conservation area, SSSI, and National Trust land.

7.4.6 There are eight possible links between this corridor and other corridors to allow flexibility in the options appraisal process and the selection of the emerging preferred corridor. These include:

- Link 1, which connects Corridor 1 at Section C1a to Corridor 2 at Section C2a.
- Link 2, which connects Corridor 1 at Section C1b to Corridor 2 at Section C2b.
- Link 3, which connects Corridor 2 at Section C2a to Corridor 3 at Section C3a;
- Link 4, which connects Corridor 2 at Section C2b to Corridor 3 at Section C3b.
- Link 5, which connects Corridor 3 at Section C3g to Corridor 2 at Section C2g.
- Link 6, which connects Corridor 3 at Section C3h to Corridor 2 at Section C2g.
- Link 7, which connects Corridor 2 at Section C2g to Corridor 1 at Section C1d.
- Link 8, which connects Corridor 2 at Section C2g to Corridor 1 at Section C1e.

7.4.7 To progress Corridor 2, applicable sections from Corridor 1 will be required to link to Corridor 2 at both the northern and southern ends of the corridor to connect to Chesterfield and Willington Substations, respectively. Corridor 2 links to Corridor 1 in the northern extent near Clay Cross and Tupton and in the southern extent near Kirk Langley/Langley Common. Therefore, the appraisal of the applicable sections of those corridors should also be read in conjunction with the appraisal below.

Figure 7.3 – Corridor 2 Key Constraints



Ecology

7.4.8 Corridor 2 crosses multiple areas of ancient woodland, ancient and veteran trees, as well as areas of lowland fen irreplaceable priority habitat, three SSSIs (Shining Cliff Woods SSSI in Section C2d, Cromford Canal SSSI to the south of Holloway in Section C2d, and Ambergate and Ridgeway Quarries SSSI, to the south and east of Ridgeway in Section C2e), and two LNRs (Highoredish LNR to the north west of Brackenfield in Section C2c and Cromford Canal LNR to the south of Holloway in Section C2d).

7.4.9 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the South Pennine Moors SAC, Peak District Dales SAC, Gang Mine SAC, Birklands and Bilaugh SAC, Bee's Nest and Green Clay Pits SAC, Peak District Moors (South Pennines Moors Phase 1) SPA, numerous SSSIs, South Pennine and Peak District Moors IBA, Sherwood Forest IBA, several LNR's and numerous areas of ancient woodland.

7.4.10 Whilst outside of the corridor, Peak District Dales SAC could be hydrologically linked to the potential area of works. Many of the qualifying features of the SAC are fundamentally linked to the river network. During construction, there is the potential for indirect impacts on the qualifying habitats and associated species (white-clawed crayfish, brook lamprey and bullhead) of the SAC, through pollution of land, water and air. There is the potential to indirectly impact the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and of operation. A more detailed assessment, including consideration of potential mitigation, is required.

7.4.11 During construction, there is also the potential for disturbance of qualifying birds of the Peak District Moors (South Pennines Moors Phase 1) SPA and IBA and Sherwood Forest IBA. During operation, there is the potential for collision risks for breeding/winter bird populations within Peak District Moors SPA, South Pennine and Peak District Moors IBA, Sherwood Forest IBA, Ogston Reservoir SSSI, Shining Cliff Wood SSSI, and Cromford Canal SSSI and LNR. A Habitats Regulations Assessment would be required for the SPA and SAC designations if this option were to be taken forward.

7.4.12 With careful routeing and siting, it may be possible to avoid some of the ecological impacts on a range of designated sites, given the discrete nature of the sites and the relatively restricted development footprint associated with overhead lines. The areas of Holloway (Section C2d) and Ambergate (Section C2e) are highly constrained locations within the corridor due to the presence of several parcels of ancient woodland, SSSIs and LNRs along the Derwent Valley Mills World Heritage Site, River Derwent and Cromford Canal, as well as the presence of other environmental and socio-economic receptors. If key ecological features cannot be avoided, sensitive construction methods may be adopted, such as the use of trenchless construction techniques to minimise impact.

7.4.13 Given that the Cromwell Canal SSSI and LNR cross the centre of Corridor 2 (within Section C2d) and lie along the Derwent Valley World Heritage Site, it is likely to be difficult to avoid. In accordance with Holford Rule 1 and NPS EN-5, the appraisal of this corridor has also considered an underground cable solution through the Derwent Valley Mills World Heritage Site. A single HDD crossing may not be achievable over the distance of the World Heritage Site and adjacent ecological designations to the north

and south of the site, due to limitations of cable section lengths. Therefore, a trenched installation may be required, which has the potential to cause significant impacts on the parcels of ancient woodland, and Cromford Canal SSSI and LNR in Section C2d. Effective mitigation cannot be guaranteed at this stage and the potential still exists for significant ecological impacts on the integrity of the SSSI and ancient woodland.

7.4.14 Should this option be taken forward, further survey works will be undertaken to determine the potential impact on breeding bird populations associated with the SPA and IBAs. To avoid the potential impact of collision risks for birds, implementation of appropriate mitigation, such as that outlined in NPS EN-5, including making overhead lines more visible (e.g. bird diverters) or amending the design of crossarms, insulators and the construction of other parts of high voltage power lines, will be considered.

Landscape and Visual

7.4.15 Corridor 2 contains (or is visible from) sections of the Derwent Valley Mills World Heritage Site (and its buffer zone) and the Amber Valley Special Landscape Area, which both span the width of the corridor in Sections C2d and C2e. Corridor 2 also contains recreational routes, regional trails and promoted long-distance paths, National Cycle Network (NCN) routes (No.54), three towns (Belper, Clay Cross, and Duffield) and numerous villages. There are multiple areas of scattered individual settlements, key views, CRoW Open Access areas and outdoor recreational facilities.

7.4.16 There are potential impacts during construction and operation upon the landscape fabric of the Derwent Valley Mills World Heritage Site and the landscape-related matters contained in its Statement of Outstanding Universal Value. There are also potential impacts during construction and operation on the landscape character of the Special Landscape Area. These may occur with both underground cable and overhead line infrastructure. There is also potential for impacts to the setting of the Peak District National Park through the introduction of a discordant new element to its landscape setting. The impacts on the Derwent Valley Mills World Heritage Site, the setting of the Peak District National Park, and Special Landscape Area may be unavoidable, but may be limited through mitigation, including: minimising removal of established structural vegetation; routeing away from the most sensitive views experienced by visual receptors; sensitive routeing to maximise the ability of existing landform and vegetation to visually integrate and backcloth infrastructure so reducing their visibility; application of other sensitive routeing measuring in accordance with Holford Rules 3, 4, and 5; selection of appropriate overhead line pylons; and planting schemes.

7.4.17 There are potential impacts to visual amenity for the users of the National Cycle Network (NCN) routes, regional and promoted long-distance paths, and users of the outdoor recreational facilities. There is also potential for impacts to the visual amenity of users of the following key views: Ashover Rock (Fabrick Wood); Coldharbour (Highoredish Picnic Site); Crich Cliff; Alport Height; Middleton Top; Black Rocks. The introduction of an overhead line may be a detrimental addition to the generally unspoilt views from these locations.

7.4.18 There is also the potential for impacts on the residents of towns, villages and the scattered settlements between them. There are points through which the route may have no option but to pass within 100m of a residential property (e.g., between Clay Cross and Henmoor in Section C2a, Tupton and North Wingfield, and Egstow Park (emerging housing development) in Section C2a, and Tupton Hall School playing fields in Section C2a. There is potential for significant visual impacts upon residential communities located either side of these ‘pinch-point’ locations, and it represents a

significant constraint within this corridor. There is also potential for impacts on the visual amenity of residents in other settlements on account of overhead lines likely being within 2km of some properties. This is particularly common in the south of the corridor, to the east where the suburbs and satellite settlements of Derby are located, and to scattered properties within the gently rolling landscape, which allows occasional long views. Avoidance of such impacts may be possible where they can be separated by substantial landform or blocks of trees. Where avoidance is not possible, impacts may be reduced by positioning the overhead line and associated infrastructure away from the most sensitive views experienced by these communities, careful siting to maximise the ability of existing landform and vegetation to visually integrate backcloth-built infrastructure and selecting visually appropriate overhead line pylons. Further mitigation of impacts may be possible by using planting schemes to reduce the degree of visible overhead line infrastructure.

7.4.19 There is the potential for cumulative impacts where the overhead line crosses or is to be located close to multiple existing 132kV overhead lines along the corridor, creating a 'wirescape'. On the boundary between Sections C2g and C2e, there is an existing 132kV overhead line present which crosses at this point. This would need to be undergrounded or re-routed for either option to facilitate routeing of a new overhead line.

7.4.20 There is the potential for impacts, during construction and operation, upon the visual amenity of users of key views and CroW Open Access areas, as the introduction of an overhead line may become a detrimental addition to much of the panoramic unspoilt views from these locations and break the skyline as the route crests local ridgelines. The incised landform in this section also increases the chance that the route would have to cross over several ridges (and so not align with Holford Rule 5).

7.4.21 Routeing through the northern section of this corridor will not impact the special qualities of any landscape designation, or the visual amenity of users of any National Trails and National Cycle Network (NCN) routes. The residual adverse impact upon the users of the Chesterfield Round Walk would be moderate in significance given the line would pass near to or cross over this on multiple occasions and some of the route may run parallel to this trail.

7.4.22 Routeing through the southern section of this corridor has the potential for impacts on the special qualities of all three identified landscape designations and the visual amenity users of the National Trail, recreational routes, and key views. This includes the Derwent Valley Mills World Heritage Site and Peak District National Park, which are receptors of international and national importance afforded the highest status of protection in relation to landscape and scenic beauty in NPS EN-1, within NPS EN-5 and the Holford Rules.

Historic Environment

7.4.23 Corridor 2 includes numerous listed buildings and Conservation Areas. There are several other Conservation Areas and listed buildings outside the corridor, whose settings may also be impacted. Corridor 2 also includes scheduled monuments and a Registered Park and Garden (Belper Cemetery in Section C2e). There are other scheduled monuments and Registered Parks and Gardens near the corridor. There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated that impacts can be avoided and reduced with careful routeing and siting

to avoid significant impacts to the settings of Conservation Areas, Registered Parks and Gardens, listed buildings and scheduled monuments.

7.4.24 Corridor 2 provides two potential routes to cross the Derwent Valley Mills World Heritage Site. The most northerly option (Section C2d) crosses north of Whatsandwell, near Holloway. The Derwent Valley Mills World Heritage Site is relatively narrow in this location, following the meanders of the River Derwent, offering the potential to cross the narrower gap between the Whastandwell Conservation Area and the Dethick, Lea and Holloway Conservation Area. This is also an area containing relatively few listed buildings and no scheduled monuments. The Cromford Canal and the Manchester to Matlock and Buxton railway (both within the Derwent Valley Mills World Heritage Site) are also important heritage assets in this area (although not designated). There is an alternative crossing of the Derwent Valley Mills World Heritage Site further south between Ambergate and Belper in Section C2e, which is a relatively less sensitive part of the Derwent Valley Mills World Heritage Site than some other areas, being outside the main industrial areas. This section does not contain any Conservation Areas and has fewer listed buildings. This crossing would also likely be at one of the narrower parts of the Derwent Valley Mills World Heritage Site.

7.4.25 There is the potential for the construction of the underground cables to impact the outstanding universal values of the Derwent Valley Mills World Heritage Site. There is also potential for physical impacts to heritage assets, including undesignated below-ground archaeology and due to the requirements for SECs within the setting of the Derwent Valley Mills World Heritage Site. Careful siting and design of the SECs may ameliorate some of the effects on the setting of the identified heritage assets. Although undergrounding may ameliorate the adverse effects to its setting, this could likely not be extended across the whole of the Derwent Valley Mills World Heritage Site and its buffer and setting. Further assessment as well as ongoing design and careful routeing and siting of infrastructure may reduce, and where possible, avoid impacts to identified sensitive receptors.

7.4.26 Standard environmental control measures may be implemented during construction to reduce temporary impacts on the setting of heritage assets, such as dust and noise control. If these sections were taken forward, then engagement with Historic England would be undertaken to determine appropriate mitigation.

Socio-Economic

7.4.27 Corridor 2 crosses key features, including the Derwent Valley Mills World Heritage Site (in Sections C2d and C2e), nature reserves (e.g., Highoredish and Berridge Lane LNRs in Section C2c, Cromford Canal SSSI and LNR in Section C2d, Wyver Lane LNR in Section C2e), CroW access lands (e.g. in Section C2c, C2d, C2e) and industrial land uses (e.g. in Section C2e). It also crosses multiple roads that form part of the strategic road network (SRN) and local road network (LRN) (including A61, A615, A6, A610, A517, A52, A516). There are also railway lines (e.g. Chesterfield-Derby, Chesterfield-Loughborough, Rowsley South-Burton on Trent, Bolehill-Derby), long-distance paths, bridleways and ProWs.

7.4.28 There is the potential for this corridor to affect major / large-scale visitor attractions (e.g. the Derwent Valley Mills World Heritage Site), utilities and installations through land take.

7.4.29 There is the potential for disruption on those roads used by construction traffic on the LRN and SRN. There is the potential to impact users of the recreational routes and ProW through severance during construction.

7.4.30 Adopting appropriate alignments that either avoid major visitor attractions, utilities, installations and sensitive receptors altogether or provide undergrounding in sensitive areas may reduce impacts. Adopting sensitive routeing and siting, and standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.4.31 Corridor 2 crosses Flood Zones 2 and 3 associated with the River Rother, River Derwent, River Amber, River Ecclesbourne, Lea Brook, Mercaston Brook, Cutler Brook, Markeaton Brook, Mackworth Brook, Carr Brook, Lindway Springs Brook and Press Brook, which fully bisect the route. There are areas of naturally high ground as well as areas of high ground that have been engineered along the River Derwent, but no other flood defences are present. Construction in Flood Zone 3 should be avoided where possible. Where this is not practicable, a Flood Warning and Evacuation Plan, informed by the findings of a Flood Risk Assessment, would mitigate the risk of flooding to construction work sites.

7.4.32 There are multiple WFD waterbodies that fall within this corridor, including the River Rother (from Redleadmill Brook to Spital Brook), River Amber, River Derwent, River Ecclesbourne, Markeaton Brook, and Mackworth Brook. There is a Zone 1 Source Protection Zone located between Holloway and Whatsandwell in Section C2d, and a Zone 3 Source Protection Zone located to the north of Belper in Sections C2e and C2f. Working near or in WFD waterbodies has associated pollution risks, such as from sediment-laden runoff, but this may be readily mitigated through standard good practice measures such as silt fencing and settlement lagoons. Water quality protection measures and drainage systems would be maintained throughout the construction phase, which would reduce potential impacts on these receptors.

7.4.33 There are historical landfill sites, a geological SSSI and numerous mine shafts and adits present in the corridor. Mine shafts are concentrated in the northern extent of the corridor, around Clay Cross and Tupton, and in the centre of the corridor around Ambergate and Whatsandwell. Careful consideration of the routeing and siting of pylons will be required to avoid these features and any adverse impacts on the works, such as migration of contaminants and instability. Standard environmental controls would be implemented and maintained during construction.

Engineering and System Appraisal Summary

7.4.34 Corridor 2 (Section C2a) is constrained by a pinch point between North Wingfield and Tupton, constricted by residential properties, industrial buildings and railway lines. The approximate width at this point is 320m. It is highly likely that an isolated industrial building would need to be oversailed at this point along with railway lines, and this would likely result in taller pylons to achieve statutory clearances. Further south there is a second very constrained area between Clay Cross and Holmgate; the approximate available gap width at this point is 160m and a part of Kenning Park would need to be oversailed by the overhead lines at this point.

7.4.35 Throughout Section C2a there is a significant presence of artificial ground. There is a landfill located south of Tupton Hall School and a fault in the centre that spans the whole width of the corridor. With regards to mining in the area, according to the Coal Authority, the vast majority of the section is within a development high-risk area, there is a significant cluster of mine entries in the south, widespread occurrences in the central-south and a minor cluster in the north. There is also a significant hazard for non-coal

mining to the west of Clay Cross. All mining hazards require further surveys and mitigation to allow for an overhead line to route through this area.

7.4.36 Where Section C2b links into Section C1b the corridor would route in a southerly direction to avoid an area of replanted ancient woodland which is located on the southern edge of Section C1b. There is also a cluster of mine entries and an area of artificial ground present in Section C2b which should be avoidable by routeing design. According to the British Geological Survey, this area includes significant risk of non-coal mining works, which could cause an impact in finding suitable locations for pylons and their subsequent constructability.

7.4.37 Within Section C2c in the area of Woodhead, the corridor begins to head south-westerly towards the A6 and the River Derwent. This section of the route is deemed to be moderately complex due a handful of technical constraints present; these are mainly associated with access and geotechnical aspects. However, the corridor remains relatively wide, providing multiple possible overhead line routeing options. Around Dicklant, there is an area of significant risk to non-coal mining hazards which could impact constructability in this region. Steep slope angles and areas prone to landslides are present down the centre line of this section, with particularly steep slope angles southwest of Milltown.

7.4.38 In the region around Plaistow, the corridor splits to form an eastern option (Section C2e) and a western option (Section C2d) around the area between Whatstandwell, Crich and Ambergate. Both options are fairly similar in length, have similar ground constraints and have physically constrained areas present. Both sections would be required to cross the Derwent Valley Mills World Heritage Site and the River Derwent Valley which represent the main constraints.

7.4.39 The western option (Section C2d) has two physically constrained areas along the route, and the first and main area is identified in the vicinity of Holloway.

7.4.40 In this location, the corridor is constrained by the Derwent Valley Mills World Heritage Site, Conservation Areas, ancient woodlands, SSSIs and residential properties. A route through this area would be required to cross the River Derwent, a railway line, the A6, New Road and a small section of the SSSI.

7.4.41 This pinch point has a possible overhead line routeing corridor approximately 100m wide, which has been identified between the residential areas of Cupola Park and Merebrook. A single span crossing the railway, the river and the two roads might be possible, but the overall gradient is close to 50%, which could compromise its routeing feasibility. A second potential overhead line option is along a route north-west of Cupola Park, where there is more clear space available; however, an ancient woodland would be affected in this scenario.

7.4.42 In accordance with NPS EN-5 and the Holford Rules, an underground cable solution has also been considered to pass through the Derwent Valley Mills World Heritage Site. In the base of the valley, the Cromford Canal, River Derwent, Derwent Valley Railway and the A6 are all major crossing constraints which would require trenchless crossings. The valley contains largely uninterrupted residential and commercial developments, small steep access roads and steep tributary valleys currently offering no clear or viable path for underground cable routeing. Given the successive trenchless crossings, terrain and environmental designations, underground cable routeing perpendicular to the Derwent Valley in this area is considered extremely challenging and might not be feasible.

7.4.43 Within Section C2d, in addition to the Derwent Valley Mills World Heritage Site, a second constricted area is identified between Alderwasley and Wirksworth. At this point the corridor is reduced to a width of 280m and includes a minor road crossing.

7.4.44 A Zone 1 Source Protection Zone is also present in the area between Holloway and Whatsandwell. Within this area, groundwater supplies could potentially be polluted. Consequently, construction activities may be severely limited or precluded. Aquifer quality protection measures and drainage systems will also need to be maintained throughout the construction phase.

7.4.45 The eastern option (Section C2e) has a constrained point in the area of Ambergate. This part of the corridor is within the Derwent Valley Mills World Heritage Site and is constricted by ancient woodlands and a handful of scattered residential and nursery buildings. This route, similar to Section C2d, would require multiple crossings including a railway line, the A6 and the River Derwent, all of which are in very close proximity to each other.

7.4.46 Before entering the Derwent Valley Mills World Heritage Site, it is considered that enough space is available to route the line between Crich Lane and an industrial estate. Taking this route would likely require oversailing of a parking lot. If this route cannot be established, the designated woodland within the Derwent Valley Mills World Heritage Site, east of Derby Road, would need to be oversailed for approximately 50-100m.

7.4.47 An underground cable solution in this area would need to traverse steep topography on the western and eastern extent of the World Heritage Site but might be feasible. Crossings of the A6, railway and the River Derwent would be required. Similar to Corridor 1, the inclusion of an underground cable section would impose network constraints related to longer faults and capacity bottleneck; however, the likelihood of these would be expected to be lower as the underground section would be significantly shorter (2-3 km). Further assessments would be required to determine these.

7.4.48 The River Derwent is within a floodplain, which poses construction challenges, namely through potential waterlogging and possible access restrictions. The Midland Main Line Railway and River Derwent prevent a through route for access from the Derwent Valley (A6). Access to the valley area west of the railway is not currently considered practicable due to steep terrain and insufficient suitable connections to the highway network. Roads within this area are not considered suitable for large volumes of construction traffic due to very narrow/constrained geometry and also that they pass through residential developments. Access to this section of the segment presents a large construction constraints associated with this option. Vehicle access further south may be achieved via the A517 but would require approximately 5km of haul road to connect back to the valley area.

7.4.49 There is a Zone 3 Source Protection Zone present within the Derwent Valley Mills World Heritage Site north of Belper, along the River Derwent, which covers the majority of the width of the section. Within this area, construction activities will need to consider and mitigate the potential for groundwater contamination.

7.4.50 Both Section C2d and Section C2e have ground constraints consisting of small to medium coverage of artificial ground, localised mine clusters and large areas with a significant risk to non-coal mining hazards according to the British Geological Survey. Both options are also mostly within an area prone to landslides. Generally, for both options, the topography is varied with areas of very steep gradients which would significantly impact constructability and access overall.

7.4.51 After the Section C2d and Section C2e options converge in the vicinity of Shottle and Belper Lane End (Section C2f), Corridor 2 routes southerly past Windley. This part of the corridor is mainly constrained by limited access, and it has no spatially constricted points identified. According to the Coal Authority, there is a small development high-risk area at the northern end around Belper Lane End. There is also a small area of significant non-coal mining hazard in the area northwest of Shottle. Steep gradients occur along the eastern border of the corridor and in the area located west of Shottle, which could affect the overhead line routeing and impact construction vehicle access/haul roads within this area. Access to the south of the A517 and onwards into Section C2g would require two separate sections of haul road to facilitate access to installation works either side of the River Ecclesbourne and Midland Main Line Railway. Two separate connections would be required to the highway network, one from the B5023 for the southern installations and A517 for the northern.

7.4.52 After crossing the River Ecclesbourne and the railway, Corridor 2 routes to the south (Section C2g) and at this point it splits into two options, one to the east and one to the west of Kedleston Park, which is a Registered Park and Garden. These options are approximately the same length and converge again to the south in the area around Radbourne. Within both options the ground constraints are similar, and there are particular geotechnical hazards associated with the section's limestone occurrence, for example dissolution voids. On the boundary between Sections C2g and C1d/C1e there is an existing 132kV overhead line present which crosses at this point. This would need to be undergrounded/re-routed for either option to facilitate routeing of a new overhead line. Access for construction traffic within Section C2g is limited to three main roads, the B5023, A52 and A516 in the north, centre and south of the section, respectively. These roads do not appear to have restrictions and may provide an access connection for construction works to the SRN, subject to siting suitability. Smaller roads between these are not subject to formal restrictions but are noted as being very small/narrow and are therefore unlikely to be suitable for large volumes of construction traffic. As a consequence, haul road sections between connections to the highway network are likely to be in the order of 5-10km long, increasing cost and programme durations. Areas of potentially challenging topography are also noted throughout the segment.

7.4.53 Further west between Weston Underwood and Burnaston, Corridor 2 re-joins with Corridor 1 (Section C1d and Section C1e) where the entry into Willington Substation is as previously described in the appraisal summary for Corridor 1.

7.4.54 A summary of the options appraisal for Corridor 2 is in Table 7.2 below.

Summary

Table 7.2 – Summary of Corridor 2 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Cromford Canal SSSI and Shining Cliff Wood SSSI are located in Section C2d, and Ambergate and Ridgeway Quarries SSSI is located in Section C2e. – Corridor 2 crosses multiple areas of ancient woodland. The ancient woodland is largely concentrated around Holloway in Section C2d and Ambergate in Section C2e, along the River Derwent and the Cromford Canal. – Areas of lowland fen irreplaceable priority habitat is present in Section C2e. Corridor 2 crosses the Highoredish LNR in Section C2c and Cromford Canal LNR in Section C2d.
	Landscape and Visual	– There is potential for a route within Corridor 2 to be visible from the Peak District National Park, and therefore there is potential for impacts to the setting of the Peak District National Park through the introduction of a discordant new element to its landscape setting. – Corridor 2 crosses the Amber Valley Special Landscape Area which spans the width of Sections C2d and C2e. – There are numerous scattered settlements and individual residential properties in Corridor 2. There are several points within Section C2a through which the route has no option but to pass within 100m of a residential property. There is potential for visual impacts upon residential communities located either side of these 'pinch-point' locations.
	Historic Environment	– Corridor 2 crosses the Derwent Valley Mills World Heritage Site, either to the north of Whatsandwell near Holloway (using Section C2d) or between Ambergate and Belper to the south (using Section C2e). A route within Sections C2d or C2e in Corridor 2 has potential to impact the outstanding universal values of the Derwent Valley Mills World Heritage Site.

Theme	Topic	Summary
		– Corridor 2 crosses the Dethick, Lea and Holloway, Whatsandwell, and Alderwasley Conservation Areas in Section C2d and Fritchley Conservations Area in Section C2e. There is potential for impacts to the setting of the Conservation Areas. – Belper Cemetery Registered Park and Garden is crossed in Section C2e. – There are a number of scheduled monuments and listed buildings throughout Corridor 2.
	Water, Soils, Geology, Noise and Vibration	– Corridor 2 crosses a Zone 1 Source Protection Zone located between Whatsandwell and Holloway in Section C2d and a Zone 3 Source Protection Zone located near Belper Lane End in Sections C2e and C2f. – Ambergate and Ridgeway Quarries Geological SSSI is located in Section C2e. – There are historical landfill sites and numerous mine shafts and adits present in Corridor 2. Mine shafts are concentrated in the northern extent of the corridor, around Clay Cross and Tupton in Section C2a, and in the centre of the corridor around Ambergate and Whatsandwell in Sections C2c, C2d and C2e.
Socio-Economic		– Corridor 2 crosses key features including the Derwent Valley Mills World Heritage Site (in Sections C2d, C2e, C2f), nature reserves (e.g. Highoredish and Berridge Lane LNRs in Section C2c, Cromford Canal LNR in Section C2d, Wyver Lane LNR in Section C2e), CRoW access lands (e.g. in Section C2c, C2d, C2e), industrial land uses (e.g. in Section C2e). – Corridor 2 crosses multiple roads which form part of the strategic road network (SRN) and local road network (LRN), railway lines, long-distance paths, bridleways, and PRoWs. Corridor 2 may affect major/large scale visitor attractions (e.g. the Derwent Valley Mills World Heritage Site). There is potential for disruption on the SRN and LRN roads with construction traffic, which may also lead to temporary disruption of recreational routes. Adopting sensitive routeing and siting may reduce impacts on the LRN and SRN and other sensitive socio-economic receptors (e.g. visitor attractions, utilities, installations).

Theme	Topic	Summary
Technical	Technically Constrained Areas	– Between North Wingfield and Tupton (Section C2a), which is constrained by residential buildings, industrial buildings, and railway lines. An industrial building would likely need to be oversailed. – Between Clay Cross and Holmgate, which is approximately 160m wide and oversailing of a portion of Kenning Park would be required. – Sections C2d and C2e are highly constrained by the Derwent Valley Mills World Heritage Site, designated areas including ancient woodlands, SSSIs, Conservation Areas and residential properties. Overhead line options in both sections are available, but they would likely oversail designated woodland and would not follow Holford Rule 1. Underground cabling through the Derwent Valley Mills World Heritage Site within Section C2d is extremely challenging and might not be feasible. Cabling through the Derwent Valley Mills World Heritage Site within Section C2e is considered challenging and may not be achievable. If an underground cable section is included (assumed 2-3km), the probability of longer faults in the circuits is increased. Capacity would be limited if two underground cables per phase are used.
	Access	– Vehicle access within the Derwent Valley and in the vicinity of the A6 (Sections C2c, C2d, C2e and C2f) is considered challenging, due to steep and unfavourable topography and long-haul road requirements.
	Geotechnical, Flood Risk and Topography	– Areas of significant non-coal mining hazard located in Sections C2b, C2c, C2d and C2e. – Sections C2a and C2e include significant presence of mine entries, and most of both sections are within a Coal Authority development high-risk area, with a large presence of artificial ground. – Three landfill sites are located within Sections C2a, C2c and C2d. – Sections of steep and unfavourable topography identified particularly in Section C2d and localised areas in section C2e.
	Existing NGED Assets	– One crossing of existing 132kV line section whilst approaching either from the northwestern or eastern arm of Section C2g.

7.5 Corridor 3

Introduction

7.5.1 Corridor 3 begins at Clay Cross, using either Corridor 2 (at Section C2a) or Corridor 5 (at Section C5a) to route north towards Chesterfield Substation. The corridor extends around the east and south of Clay Cross before providing optionality within Section C3a to either traverse the northern or southern edge of Stretton. The corridor then continues south, along the River Amber Valley, providing optionality within Section C3c to route either to the west or east of Oakerthorpe, Pentrich and Lower Hartshay, crossing several brooks before reaching Ripley. To the southwest of Ripley, the corridor splits into two, providing alternative routes around the settlements of Denby Bottles, Denby Village, Rawson Green, Kilburn, and Horsley Woodhouse, either to the west (through Section C3d) or the east (through Section C3e) of the settlements. The eastern section of the corridor through Section C3e splits again to provide optionality to the west or east of Smalley.

7.5.2 The corridor then merges again at Section C3f in the vicinity of Horsley to the west or Morley to the east (also providing optionality around the edges of Morley). Two sections (Sections C3g and C3h) provide alternative routes to the west to cross the Derwent Valley Mills World Heritage Site. The northern section of the corridor (Section C3g) intersects the Derwent Valley Mills World Heritage Site to the south of Milford in the vicinity of Makeney. The southern section (Section C3h) crosses the Derwent Valley Mills World Heritage Site south of Little Eaton. The two sections of the corridor then link to Corridor 2 (at Section C2g), west of Duffield.

7.5.3 Key constraints for this corridor include: the Derwent Valley Mills World Heritage Site; the number and proximity of settlements in the southern half of the corridor; major infrastructure and river crossings including the A38, railways, River Derwent, River Amber and Bottle Brook; historic mine entries and adits which are extensive across the width of the corridor south west of Ripley; several listed buildings; five Conservation Areas (Amber Mill and Toad Hole, South Wingfield, Horsley, Coxbench, Belper and Milford); and one SSSI (Morley Brick Pits). Key constraints are shown on Figure 7.4.

7.5.4 Given the presence of the Derwent Valley Mills World Heritage Site, in accordance with Holford Rule 1 and NPS EN-5, the appraisal of this refined corridor has also considered an underground cable solution through the Derwent Valley Mills World Heritage Site.

7.5.5 As previously described, there are several locations where Corridor 3 splits into two to provide opportunities to avoid a receptor or constraint. These include:

- To the north and south of Stretton in Section C3a.
- To the east and west of Oakerthorpe to avoid the settlement and an area of ancient woodland in Section C3c.
- To the east and west of Pentrich and Lower Hartshay in Section C3c.
- To the west (Section C3d) and east (Section C3e) to avoid the settlements of Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn, and Horsley Woodhouse.
- To the west and east of Smalley in Section C3e.
- To the west and east of Morley in Section C3f.

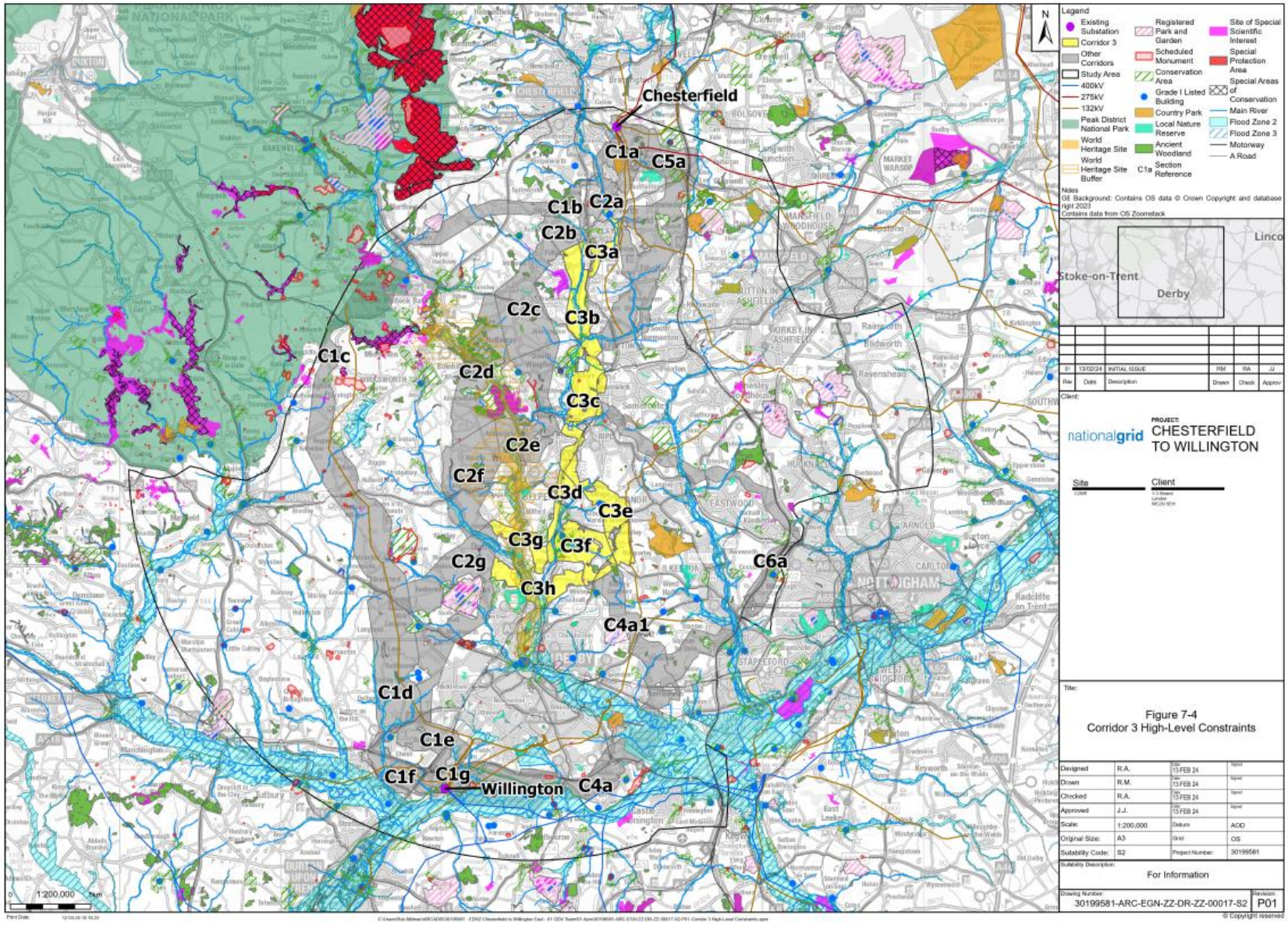
- To the north (Section C3g) and south (Section C3h) of Duffield and Little Eaton to provide alternative routes across the Derwent Valley Mills World Heritage Site.

7.5.6 There are also eight links between this corridor and other corridors to allow flexibility in the appraisal process and selection of the emerging preferred corridor. These include:

- Link 1, which connects Corridor 2 at Section C2a to Corridor 3 at Section C3a.
- Link 2, which connects Corridor 5 at Section C5a to Corridor 3 at Section C3a.
- Link 3, which connects Corridor 2 at Section C2b to Corridor 3 at Section C3b.
- Link 4, which connects Corridor 5 at Section C5a to Corridor 3 at Section C3c.
- Link 5, which connects Corridor 3 at Section C3c to Corridor 6 at Section C6a.
- Link 6, which connects Corridor 3 at Section C3f to Corridor 4 at Section C4a1.
- Link 7, which connects Corridor 3 at Section C3g to Corridor 2 at Section C2g.
- Link 8, which connects Corridor 3 at Section C3h to Corridor 2 at Section C2g.

7.5.7 If this option were progressed, sections from Corridor 1 and Corridors 2 or 5 will be required to link to Corridor 3 at its northern extent depending on the route around Clay Cross, therefore the appraisal of applicable sections of those corridors in the vicinity of Clay Cross should be read in conjunction with the appraisal below. Depending on the route around Derby, Corridor 3 would also need to link in to either sections of Corridors 2 and 1 (west of Derby), or sections of Corridors 4 and 1, and potentially Corridor 6 (east of Derby), to reach Willington Substation at its southern extent; therefore, the appraisal of applicable sections of those corridors should also be read in conjunction with the appraisal below.

Figure 7.4 – Corridor 3 Key Constraints



Environment and Socio-Economic Appraisal Summary

Ecology

7.5.8 Corridor 3 crosses Morley Brick Pits SSSI near Morley Smithy (Section C3h), Oakerthorpe LNR in Section C3c and Allestree Park LNR near Little Eaton in Section C3h. The corridor also crosses an area of irreplaceable lowland fen priority habitat in Section C3c, a wooded and parkland area, as well as areas of ancient woodland and multiple veteran trees. In accordance with Holford Rule 1 and NPS EN-5, the appraisal of this corridor has considered an underground cable solution through the Derwent Valley Mills World Heritage Site. The installation of an underground cable has the potential to cause significant impacts on Allestree Park LNR in Section C3h. Adopting careful routeing and siting may avoid direct impacts on these receptors. If receptors cannot be avoided, sensitive construction methods could be adopted such as the use of trenchless techniques. Early consultation and engagement with Natural England would be undertaken to determine appropriate mitigation. During construction, standard environmental control measures would be implemented, which may include pollution control measures, appropriate buffer zones and undertaking works at the appropriate time of year to avoid impacts on certain species or implementing pollution control measures.

7.5.9 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the South Pennine Moors SAC, Peak District Dales SAC, Gang Mine SAC, Birklands and Bilhaugh SAC, Bee's Nest and Green Clay Pits SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, SSSIs, South Pennine, Peak District Moors and Sherwood Forest IBA, LNRs, and areas of ancient woodland. There is the potential to indirectly impact the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and of operation. A Habitats Regulations Assessment would be required for the SPA and SAC designations if this option were to be taken forward.

7.5.10 With careful routeing and siting, it should be possible to avoid the majority of ecological impacts on a range of designated sites given the discrete nature of the sites and the relatively restricted development footprint associated with overhead lines. If the key ecological features cannot be avoided, sensitive construction methods may be adopted such as the use of trenchless techniques to minimise impacts.

Landscape and Visual

7.5.11 Corridor 3 contains (or is visible from) section of the Derwent Valley Mills World Heritage Site (and its buffer zone), recreational routes and promoted long-distance paths (Derwent Valley Heritage Way, Midshires Way, Centenary Way and Chesterfield Round Walk), multiple towns (including Clay Cross, Ripley, Heanor, Duffield, Alfreton, Belper), multiple villages, outdoor recreational facilities, an area of CRoW Open Access Land (between Smalley and Shipley), residential areas, an area of scattered individual settlement (Milford and Makeney), a key view (Quarndon Millennium Topograph) and a National Cycle Network (NCN) route (no.54).

7.5.12 There are potential impacts during construction and operation upon the landscape fabric of the Derwent Valley Mills World Heritage Site and the landscape-related matters contained in its Statement of Outstanding Universal Value that would occur with both underground cable and overhead lines. Potential impacts may be unavoidable but could

be limited through mitigation including: minimising removal of established structural vegetation; sensitive siting of overhead line and/or SECs away from the most sensitive views experienced by visual receptors; sensitive routeing to maximise the ability of existing landform and vegetation to visually integrate and backcloth an overhead line and/or SEC so reducing their visibility; application of other sensitive routeing measuring in accordance with Holford Rules 3, 4, and 5; selection of appropriate overhead line pylons; and planting schemes.

7.5.13 There are potential impacts to the visual amenity of the users of a National Cycle Network (NCN) route, regional and promoted long-distance paths, and users of the outdoor recreational facilities given the line would pass near to or cross over them.

7.5.14 There is also the potential for impacts on residents of towns, villages and the scattered settlements between them. There are three locations in which Corridor 3 may have no option but to pass within 100m of a residential property. These are between North Wingfield and Lower Pilsley by Parkhouse Green in Section C3a, west of Morley between Brackley Gate and Cloves Hill in Section C3f and around Makeney in Section C3g. There is potential for significant visual impacts upon residential communities located either side of these 'pinch-point' locations and so this is a significant constraint within this corridor.

7.5.15 There is also potential for impacts on the visual amenity of residents in other existing settlements on account of overhead lines likely being within 2km of some properties. This is particularly occurrent at Clay Cross, Stretton, Mickley Gate, Higham, Pentrich, Lower Hartshay, Horsley, Morley, Horsley Woodhouse, and Smalley, and to scattered properties within the gently rolling landscape, which allows occasional long views. Avoidance of such impacts may be possible where they can be separated by substantial landform or blocks of trees. Where avoidance is not possible, impacts could be reduced by positioning overhead lines and associated infrastructure away from the most sensitive views experienced by these communities, careful routeing and siting to maximise the ability of existing landform and vegetation to visually integrate and backcloth-built infrastructure and selecting visually appropriate overhead line pylons. Further mitigation of impacts may be possible by using planting schemes to reduce the degree of overhead line infrastructure visible.

7.5.16 There is the potential for cumulative impacts where the overhead line would cross and/or be located close to multiple existing 132kV overhead lines along the corridor (creating a potential 'wirescape'). Existing 132kV overhead lines within Corridor 3 are located from Chesterfield to Alfreton, and Denby Common to Stanley Common.

Historic Environment

7.5.17 There are multiple listed buildings and scheduled monuments within Corridor 3. There is a cluster of listed buildings within Amber Mill and Toad Hole Conservation Area, which may be difficult to avoid within this corridor. Some of the listed structures are bridges over the North Midland Railway. There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated that impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of listed buildings and scheduled monuments.

7.5.18 There are also further Conservation Areas within the Corridor that may need to be crossed (Higham Old Village, Hallfield Gate, South Wingfield, Horsley, Coxbench, Belper and Milford Conservation Areas). There are also a number of Conservation Areas and a Registered Park and Garden (Kedleston Hall) close to the boundary of the

corridor. There is potential for physical impacts and changes to the settings of Conservation Areas. There is potential for changes to the setting of the Registered Park and Garden, depending on the overhead line alignment. Impacts may be avoided and reduced with careful routeing and siting of pylons.

7.5.19 Corridor 3 crosses the Derwent Valley Mills World Heritage Site at two alternative locations. The northern section of the corridor (Section C3g) intersects the Derwent Valley Mills World Heritage Site to the south of Milford and Belper. The southern section (Section C3h) crosses the Derwent Valley Mills World Heritage Site south and west of Little Eaton. The section of the Derwent Valley Mills World Heritage Site and its buffer are over 1km wide in these areas. A single trenchless crossing is not considered to be achievable over this distance due to limitations of underground cable section lengths and the presence of other constraints in the area that would require a trenchless crossing, such as the A6, and a railway line. Therefore, a trenched installation would be required in some areas. There is potential for trenchless construction techniques and SECs to impact the setting of the Derwent Valley Mills World Heritage Site.

7.5.20 Further assessment, as well as ongoing design and routeing and siting of infrastructure, may reduce, and where possible avoid, impacts to identified receptors. It will be important to assess the settings of designated heritage assets and any key views. Standard environmental control measures would be implemented during construction to reduce temporary effects to the setting of heritage assets, such as dust and noise control. If these sections were taken forward, then engagement with Historic England would be undertaken to determine appropriate mitigation.

Socio-Economic

7.5.21 Corridor 3 crosses the Derwent Valley Mills World Heritage Site (in Sections C3g and C3h), angling clubs, stables, local nature reserves (Oakerthorpe LNR in Section C3c, Allestree Park LNR in Section C3h), a country park (Shipley Country Park in Section C3e), hiking areas, golf clubs (e.g. Alfreton Golf Course, Horsley Lodge, Morley Hayes, Chevin Golf Course, Padbrook Park), and CRoW access lands (in Sections C3b). It also crosses a number of roads that form part of the strategic road network (SRN) and local road network (LRN) including the A6175, A61, A615, A38, A610, A609, A608, A6. There are also railway lines (e.g. Chesterfield-Derby, Derby-Wirksworth) and PRoWs within the corridor and existing overhead lines.

7.5.22 Construction is underway for a mixed-use development on Lily Street Farm Way immediately east of the A38 within the eastern edge of the corridor in Section C3c; however, it is considered possible to avoid this through appropriate routeing. There is also a live planning application for an employment and residential development immediately north of Denby Bottles to the east of the A38 that may require further consideration if potential routeing alignments through Section C3d are developed.

7.5.23 There is the potential for this corridor to affect major / large-scale visitor attractions (e.g. the Derwent Valley Mills World Heritage Site), utilities and installations through land take. There is the potential for disruption on those roads used by construction traffic on the LRN and SRN. There is the potential for the corridor to affect users of the recreational routes and PRoW through severance during construction.

7.5.24 Adopting appropriate alignments that either avoid major visitor attractions, utilities, installations and sensitive receptors altogether or undergrounding in sensitive areas may reduce impacts. Adopting sensitive routeing and siting, and standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.5.25 Flood Zones 2 and 3 may be unavoidable within Corridor 3, particularly along the River Amber in Sections C3b and C3c and along the River Derwent near Little Eaton in Sections C3g and C3h. Construction works in Flood Zone 2 or 3 would be at medium to high risk of flooding and may also cause adverse impacts on flood risk off site. Corridor 3 is generally at very low risk of surface water flooding throughout. However, there is land at high risk of flooding along the rivers, through the centre of the corridor to the east of Stretton, west of Kilburn, to the northwest of Denby Bottles, around Coxbench along the Park Brook, along the A6, and to the south of Little Eaton along the River Derwent.

7.5.26 There are multiple WFD waterbodies within Corridor 3, including the River Rother (from Redleadmill Brook to Spital Brook), River Amber, Bottle Brook and the River Derwent. The southern section of Corridor 3 is located within a Source Protection Zone 1 near Little Eaton (Section C3h). Working near or in waterbodies has associated pollution risks, such as from sediment-laden runoff, but this may be readily mitigated through standard measures such as silt fencing and settlement lagoons. Water quality protection measures and drainage systems would need to be maintained throughout the construction phase.

7.5.27 There are historical landfill sites and numerous mine shafts and adits present in the corridor. Mine shafts are concentrated in areas of Oakerthorpe, Lower Hartshay, Street Lane, Denby Bottles, and Smalley. Careful consideration to routeing and siting of pylons will be required to seek to avoid these features and any adverse impacts on the works, such as migration of contaminants and instability. Standard environmental controls would be put in place during construction.

Engineering and System Appraisal Summary

7.5.28 In Section C3a, Corridor 3 routes around the east and south of Clay Cross, where it diverges from Section C2a to the east of Tupton Hall School. Section C5a also provides an option to link into Corridor 3 within Section C3a (south of North Wingfield). Within Section C3a, there are two railway lines present. An overhead line would be required to complete at least one crossing, but this could increase to a maximum of four crossings, depending on the selected route. This section is extremely constricted in multiple locations along the route.

7.5.29 Where the corridor diverges from Section C2a, the route turns 90 degrees and passes over a railway bifurcation and the River Rother; the width of the corridor at this point is approximately 270m. In addition to this, there is a sports playing field and St Lawrence's Church compound, which further constrain the area at this crossing. Further south, Section C3a crosses over a railway again.

7.5.30 If the corridor routes from Section C5a, the overhead line avoids crossing the aforementioned railway bifurcation but is still required to cross a railway and the River Rother further south.

7.5.31 Throughout Section C3a, there is a widespread presence of artificial ground, which spans the width of the corridor in multiple locations. According to the Coal Authority, the vast majority of the section is within a development high-risk area. In addition, significant clusters of mine entries are present, where the corridor splits north and south of Stretton. There are also a handful of mine entries in the area around the railway bifurcation and a few entries located south of Pilsley Road. These mine entries and areas of development high risk could have significant implications for the constructability

of the route and will require further investigation to determine the potential impact on the constructability of a route through this area.

7.5.32 The Erewash Valley Line essentially splits the vehicular access of this section into two halves, east and south of Clay Cross. Both zones would need separate access points to the highway network, likely off Parkhouse Road and off the A61 for the eastern and southern sections, respectively. Access throughout both zones is generally considered feasible, though the topography east of Clay Cross may present some challenges. Onward access out of the segment both north and south of Stretton is considered very challenging due to steep gradients. Access off the A61 south of Stretton into Section C3b is not considered an option at this stage due to steep embankments.

7.5.33 Section C3a splits into two options around Stretton, where the corridor would cross the A61. One option is to the north, and one is to the south of the village; both options are considered to have feasible overhead line routes.

7.5.34 After crossing the A61, Section C3a links into Section C3b. In the area west of Stretton, the corridor heads south, following parallel to the railway line in this area. The corridor follows this railway up to the point where it crosses the A615. Routeing in this area is moderately constrained due to the railway and the River Amber, which are present in the middle of the corridor. There are also many linear bands of artificial ground present; these are orientated in the same direction as the corridor. Further assessments would be required to establish the design solutions in these areas, which could include piled foundations or ground improvement. To the east of the railway and between the edge of the corridor, there are steep slopes, which would present a challenge to gaining vehicle access within this section. Access to the west of the railway is also very constrained due to the length of the section, topography, railway and the fact that the existing roads are unsuitable for construction traffic in this area.

7.5.35 At the location where the railway crosses the A615, Corridor 3 (section C3c) splits into two options: one to the east of Oakerthorpe and one to the west.

7.5.36 The western option routes through the South Wingfield Conservation Area, which would likely need to be oversailed by the overhead line. Routeing in the western option is also constrained throughout by multiple narrow areas, the aforementioned railway line and Flood Zone 3 associated with the River Amber, which is present in the majority of the option. Furthermore, in the vicinity of the A615 crossing, there is an area of significant risk to non-coal mining according to the British Geological Survey, which would potentially add an extra layer of complexity to the A615 crossing. Access along the western option is expected to be particularly inadequate due to the topography and existing constraints on the highway network. There is a requirement for the route to cross the railway again in the south, which would isolate this section, requiring a substantial length of offline haul road through challenging terrain.

7.5.37 The eastern option would require oversailing and construction of pylons within Alfreton Golf Course. The eastern option is within a Coal Authority development high-risk area and has a large cluster of mine entries present as well as a few areas of artificial ground; however, it is expected that these may be avoidable with routeing and therefore would not compromise the route feasibility. Apart from requiring access through the golf course, the eastern option has few constraints regarding access and avoids a conservation area in line with Holford Rule 2 and would be considered preferable to the western option from a technical perspective.

7.5.38 Once the options around Oakerthorpe rejoin, Section C3c continues heading due south through a mainly unconstrained area that has a small island cut out from the corridor

around Pentrich. There are a few large areas of artificial ground present on the edges, and the centre of the corridor in this section has a handful of mine entries present throughout. To the immediate south of the golf course, the corridor widens to the east of the A38. Routeing is preferred to stay to the west of the A38 to avoid crossing the highway twice in this location and encroaching on an area of land with planning approval for commercial development. Access to the west of the A38 is generally considered feasible, though it is noted that many of the roads within this area are subject to restrictions requiring further investigation. The topography is also noted to be steep in areas, which makes construction access difficult. A number of areas have been identified as prone to having compressible ground and landslides, which pose a constraint to foundations and accesses in relation to potential ground movement/subsidence.

7.5.39 In the vicinity of the A610 crossing, Lower Hartshay splits the corridor and presents an eastern and a western option, both of which are restricted with widths of approximately 220m and 180m, respectively. The western option is likely to oversail Derbyshire Archery Club to the immediate south of the A610. In this area, there is a technical preference towards the eastern option, as it is likely to require fewer angle pylons (in accordance with Holford Rule 3) and has fewer constraints present generally. Both the east and west options have a large presence of artificial ground and a fault line east to west across the corridor; however, when considering the west option, this fault line might present a larger constraint as the overhead line route is likely to be routed in parallel. There is also a significant cluster of mine entries in the western route, which could affect pylon positions. Both routes and crossings of the A610 have a large presence of ground that is potentially highly compressible, and a large presence of ground prone to landslides, which pose a constraint for foundations and accesses.

7.5.40 West of Ripley, Corridor 3 (Section C3c) follows the A38. At this point, the corridor is particularly narrow. The whole width of the corridor at the narrowest point is measured at approximately 250m. The width to the west of A38 is found to be approximately 100 m; however, it is deemed feasible to route overhead lines through both locations. Otherwise, the overhead lines may be required to cross the A38 twice within an approximate distance of 700m. In this area, there is a large amount of ground potentially highly compressible, and a large amount of ground prone to landslides. These pose a constraint for foundations and access in relation to potential ground subsidence. Throughout this whole area, there are multiple clusters of mine entries, and this area is indicated by the Coal Authority as an area of development high risk. There is a technical preference to stay to the west of the A38 at this location.

7.5.41 Corridor 3 then routes due south and splits into Section C3d and Section C3e north of Denby Bottles; these two sections then merge into Section C3f. There are four alternative corridor options to route from Section C3c to either Section C3g or Section C3h: two of them through Section C3d and another two using Section C3e.

7.5.42 Throughout Section C3d parallel to the A38, the area is highly constricted by geotechnical constraints. There is a significant presence of artificial ground as well as a system of faults in the central and southern regions with a single fault crossing the option towards the north. Furthermore, according to the Coal Authority, almost all of this section is within a development high-risk area, and there is also the presence of mine entries. These factors pose a constraint for foundations and access in relation to potential ground subsidence.

7.5.43 To connect to Section C3g and C3h, this route involves the use of Section C3d. Section C3d is constrained to a narrow corridor, following the A38 to the west of Kilburn.

Routeing on the eastern side of the A38 is restricted by residential properties. Routeing to the west of the A38 is limited to a corridor of approximately 300 to 350m, narrowing to less than 200m west of Cinderhill. A 33kV overhead line is also present within this corridor, which may need to be undergrounded or diverted to facilitate routeing of the new overhead line.

7.5.44 At the base of Section C3d, routeing can progress east into Section C3f, or west into Section C3g, avoiding the crossing of the A38 and the other constraints described below.

7.5.45 Routeing to Section C3h via Section C3d involves crossing through Section C3f, between Lower Kilburn and Coxbench. As the route enters this zone, there would be a complex crossing required, which includes multiple buildings, an SRN junction on the A38, a disused railway line and a 33kV steel lattice pylon line. The Conservation Areas of Horsley and Coxbench may also need to be oversailed at this location. Southwest of Morley, there is a further restriction in the corridor width, limiting routeing to a narrow space of approx. 120m.

7.5.46 Within Section C3f, there are multiple geological faults present in all areas surrounding Morley and a few areas of artificial ground. Further assessment would be required to establish the best location for the placement of infrastructure.

7.5.47 To link Section C3c to C3e, the route crosses the A38 to the north of Denby. Afterwards, it routes south easterly within Section C3e towards a small island in the corridor in the vicinity of Derby Road. In this area, there are a large cluster of mine entries. These entries are extremely dense on the northern edge of the corridor, with a small area to the south that is potentially clear and would be potentially favourable to route through. Furthermore, to the east of the A38, there is a widespread and significant presence of artificial ground. This continues for the majority of these options until they start to head in a westerly direction. In this area, there is also ground that is potentially highly compressible. According to the Coal Authority, the vast majority of Section C3e is a development high-risk area. These factors may severely constrain the foundations and constructability of a future overhead line in this area. Further assessments would be required to establish detailed design solutions in these areas, which could comprise ground improvement or piled foundations, for example.

7.5.48 Along the eastern edge of Section C3e, there is an existing 132kV overhead line; it is considered that routeing options without affecting this overhead line would be available.

7.5.49 In the vicinity of Smalley, the two options separate. The option linking to Section C3g begins to route westerly. It passes Smalley to the west and Morley to the north; through this area, the corridor is constrained to an approximate width of 300m. As the option approaches the A38, it routes past a few clusters of mine entries and several fault lines. West of Horsley, there is a complex crossing that includes multiple buildings, an A road bifurcation, a railway line and a 33kV steel lattice pylon line. There is also a conservation area present that would likely be required to be oversailed with an overhead line.

7.5.50 In the vicinity of Smalley, the option linking to Section C3h can either route to the northwest of Smalley, or to the east. The option to the east routes over a considerable cluster of mine entries. It is also required to oversail an area of ancient woodland and Morley Hayes Golf Club. The route to the northwest of Smalley could either route to the east or west of Morley.

7.5.51 Section C3g routes westerly where it approaches the World Heritage Site. In this location, the corridor will have to cross the River Derwent, a railway line (Derwent Valley

Railway) and the A6. Furthermore, the corridor crosses Chevin Golf Course and a conservation area.

7.5.52 In the vicinity of Duffield, there is a feasible overhead line routeing corridor of approximately 165m between a Conservation Area in Milford and a built-up area in Duffield.

7.5.53 In accordance with NPS EN-5 and the Holford Rules, an underground cable solution was also considered crossing the Derwent Valley Mills World Heritage Site. An underground cable solution through Section C3g would require multiple successive trenchless crossings; the River Derwent, the A6 and a railway line (Derwent Valley Railway). The latter two could be combined, subject to land take and routeing studies. Underground cable routeing would also need to pass through Chevin Golf Club. An underground cable solution is considered feasible in this section.

7.5.54 The land adjacent to the River Derwent is considered part of Flood Zones 2 and 3. This poses a risk to construction, delivery and maintenance of the overhead line / proposed underground cable, namely through potential waterlogging and possible access restrictions. Foundations would need to be designed to suit, as would temporary and permanent drainage.

7.5.55 Vehicle access is highly constrained across this area (Section C3g), limited by the Derwent Valley Railway and the River Derwent. Roads east of the River Derwent are unsuitable for construction traffic and limited to 7.5t vehicles. Access west of the railway would likely need to be through the golf course.

7.5.56 Section C3h routes westerly where it would oversail Breadsall Priory Golf Course, and it then begins to approach the Derwent Valley Mills World Heritage Site. It was previously identified in Preliminary Corridor 3 that there was an opportunity to extend the refined Corridor 3 to the south of Little Eaton to improve the feasibility of an overhead line route in the area. This was completed to allow a route through Section C3h. The corridor in this area was extended by approximately 1.6km south.

7.5.57 Just before the corridor enters the Derwent Valley Mills World Heritage Site, it is constrained in the vicinity of the A38/A61 roundabout. In this area, two options are identified for routeing of an overhead line either to the north or south of the roundabout. An approximate width of 60m could be achieved east and south of the roundabout, through the open areas available. Assessing the northern option, a small corridor of approximately 90m is present between the Derby Garden Centre car park and the commercial building adjacent to A38. Both options would require multiple angle pylons, which would increase the amount of construction materials required and the volume of construction traffic. An overhead line is considered feasible through this point and through Derwent Valley Mills World Heritage Site.

7.5.58 In accordance with NPS EN-5 and Holford Rule 1, an underground cable solution was also considered to cross the Derwent Valley Mills World Heritage Site. An underground cable solution would have to cross the River Derwent, the A6 and a railway line (Midland Mail Line).

7.5.59 At the location where Corridor C3h crosses the Derwent Valley Mills World Heritage Site, the A38 is on a significant embankment, approximately 10m above the land either side. A trenchless crossing would be challenging due to system constraints related to this technology. West of the A38, a trenchless crossing of the Midland Rail Line to enter the Derwent Valley Mills World Heritage Site would be required and potentially multiple crossings of the River Derwent. Constructability within the Derwent Valley Mills World Heritage Site is likely to be affected by Flood Zone 2 and 3, which fully cover this area.

Furthermore, air shafts are noted in close proximity to the river. These may be part of a historical underground water system, which may constrain routeing. Further investigation would be required to confirm the exact nature of these. Avoiding the use of an underground cable and instead using overhead lines to cross this constraint would be preferable.

7.5.60 If an underground cable section is included either in Section C3g or Section C3h, network constraints related to longer faults and capacity bottlenecks would be imposed. With an underground cable length of 2-3 km, the likelihood of these limitations would be expected to be lower than in Corridor 1 and similar to Corridor 2. Further assessments would be required to determine these.

7.5.61 Section C3g and Section C3h converge in the area west of Duffield within Section C2g, where Corridor 3 links with Corridor 2. It should be noted that routeing from Section C3g would require crossing the River Ecclesbourne and another railway line.

7.5.62 A summary of the options appraisal for Corridor 3 is provided in Table 7.3 below.

Summary

Table 7.3 – Summary of Corridor 3 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Corridor 3 crosses the Oakerthorpe LNR in Section C3c and Allestree LNR in Section C3h. – An area of irreplaceable lowland fen priority habitat near Lower Hartshay is located in Section C3c. – Morley Brick Pits SSSI is located in Corridor 3 near Morley Smithy in Section C3f. – Areas of ancient woodland are present throughout Corridor 3.
	Landscape and Visual	– There are numerous scattered settlements and individual residential properties in Corridor 3. There are several points within the corridor through which the route has no option but to pass within 100m of a residential property. These include areas within Sections C3a and C3g. There is potential for visual impacts upon residential communities located either side of these 'pinch-point' locations.
	Historic Environment	– Corridor 3 crosses the Derwent Valley Mills World Heritage Site, either to the south of Milford and Belper (using Section C3g) or to the west of Little Eaton (using Section C3h). A route within Sections C3g or C3h of Corridor 3 has potential to impact the outstanding universal values of the Derwent Valley Mills World Heritage Site. – Corridor 3 crosses Higham Old Village, and Hallfield Gate Conservation Areas in Section C3b, South Wingfield Conservation Area in Section C3c, Horsley and Coxbench Conservation Areas in Section C3e, and Belper and Milford Conservation Area in Section C3g. There is potential for impacts to the setting of the Conservation Areas.

Theme	Topic	Summary
		– The corridor boundary in Section C3h is close to Kedleston Hall Registered Park and Garden, therefore there is potential for impacts to the setting of the registered park and garden. – There are a number of scheduled monuments and listed buildings throughout Corridor 3.
	Water, Soils, Geology, Noise and Vibration	– There are historical landfill sites and numerous mine shafts and adits present in Corridor 3. Mine shafts are concentrated in areas of Oakerthorpe, Lower Hartshay Street Lane, Denby Bottles, and Smalley in Sections C3c, C3d and C3e. – The southern section of Corridor 3 is located within a Source Protection Zone 1, 2 and 3 at Little Eaton in Section C3h. The Source Protection Zones span the width of the corridor and therefore crossing the Source Protection Zones would be unavoidable in this section. – Large areas of Flood Zones 2 and 3 are present along the River Amber in Sections C3b and C3c, and along the River Derwent near to Little Eaton in Sections C3g and C3h. These areas of Flood Zone 2 and 3 are likely to be unavoidable in this section.
Socio-Economic		– Corridor 3 crosses the Derwent Valley Mills World Heritage Site (in Sections C3g and C3h), angling clubs, stables, local nature reserves (Oakerthorpe LNR in Section C3c, Allestree Park LNR in Section C3h), a Country Park (Shipley Country Park in Section C3e), hiking areas, golf clubs (e.g. Alfreton Golf Course, Horsley Lodge, Morley Hayes, Chevin Golf Course, Padbrook Park) and CRoW access lands (in Sections C3b). – Construction is underway for a mixed-use development in Section C3c; however, it is considered possible to avoid this through appropriate routeing. There is a live planning application for an employment and residential development that may require further consideration if approved and potential routeing alignments through Section C3d are developed. – Corridor 3 crosses a number of roads that form part of the strategic road network (SRN) and local road network (LRN), railway lines, PRoWs, and existing overhead

Theme	Topic	Summary
		lines. Corridor 3 may impact major/large scale visitor attractions (e.g. the Derwent Valley Mills World Heritage Site). There is potential for disruption on the SRN and LRN roads with construction traffic, which may also lead to temporary disruption of recreational routes. Adopting sensitive routeing and siting may reduce impacts on the LRN and SRN and other sensitive socio-economic receptors (e.g., visitor attractions, utilities, installations).
Technical	Technically Constrained Areas	— Section C3a is relatively narrow along the whole length, and there is also a sports playing field and St Lawrence Church, which reduce the width of the section further. Within this section there is also a railway bifurcation present, which would need to be crossed. — Two constrained areas have been identified within Section C3c. The first is where the corridor splits around Oakerthorpe, and the second is a narrow section west of Ripley where the A38 crosses the corridor parallel to the route. — Sections C3g and C3h are highly constrained by the Derwent Valley Mills World Heritage Site, designated areas including ancient woodlands, SSSIs, Conservation Areas, and residential properties. Within Section C3g an overhead line or underground cable route could be established, passing through Chevin Golf Club. With Section C3h either an overhead line or an underground cable would be feasible. If an overhead line is avoided through the Derwent Valley Mills World Heritage Site, in line with Holford Rule 1, with the inclusion of an underground cable section (assumed 2-3 km), the likelihood of longer faults in the circuits is increased. Capacity would be limited if two underground cables per phase are used.
	Access	— Vehicle access within Section C3g is generally considered challenging due to the potential requirement for long haul roads and the steep/unfavourable topography around the River Derwent. — Access within Sections C3c and C3d is generally considered challenging due to the requirement to use minor roads to avoid physical constraints in the corridor and the unfavourable topography.

Theme	Topic	Summary
	Geotechnical, Flood Risk and Topography	– Widespread abundance of artificial ground present in Sections C3a, C3c, C3d and C3e. – According to the Coal Authority, the vast majority of the corridor is indicated as a development high-risk area. This includes Sections C3a, C3c, C3d and C3e. – Large clusters of mine entries present within Sections C3a, C3c and C3e. – Areas of Flood Zones 2 and 3 associated with the River Derwent cross both Section C3g and Section C3h. The Flood Zones are more prominent in Section C3h due to the shape of the corridor, an approximate 1700m of the route would be affected. In Section C3g the Flood Zones would affect the route for approximately 500m. – Localised sections of unfavourable topography identified within Sections C3c, C3d, C3g and C3h.
	Existing NGED Assets	– An existing 33kV overhead line is present within Section C3d and is likely to require to be undergrounded or diverted to facilitate routeing of a new overhead line. – An existing 132kV line section passing parallel to the east border in Section C3e. It would not be expected to impact the route of the new line.

7.6 Corridor 4

Introduction

7.6.1 Corridor 4 is intended to provide a potential corridor to the east of Derby, therefore avoiding the presence of the Peak District National Park and Derwent Valley Mills World Heritage Site, which are significant constraints highlighted in Corridors 1, 2 and 3. It begins to the south of Morley (linking in this location to Section C3f) in Section C4a1, between the settlements of Morley Smithy and Stanley Common. The corridor continues south east, crossing the Stanley Brook and Ock Brook through a predominantly agricultural landscape of gently rolling and occasionally incised landform, with frequent tree-lined hedges and occasional tree belts and small woodlands, before heading south west at Borrowash after entering Section C4a. The corridor then crosses the River Derwent between Elvaston and Draycott, and an extensive area of Flood Zones 2 and 3 associated with the river.

7.6.2 To the north of Aston-on-Trent and then Swarkestone, the corridor heads west, broadly following to the south of the A50, through areas of low-lying floodplain containing large fields, with occasional shelterbelts between them. It intersects the River Trent and several of its tributaries, as well as the Trent and Mersey Canal, also providing optionality within Section C4a to the north or south of the settlements of Barrow upon Trent and Stenson, before approaching Willington Substation from the east.

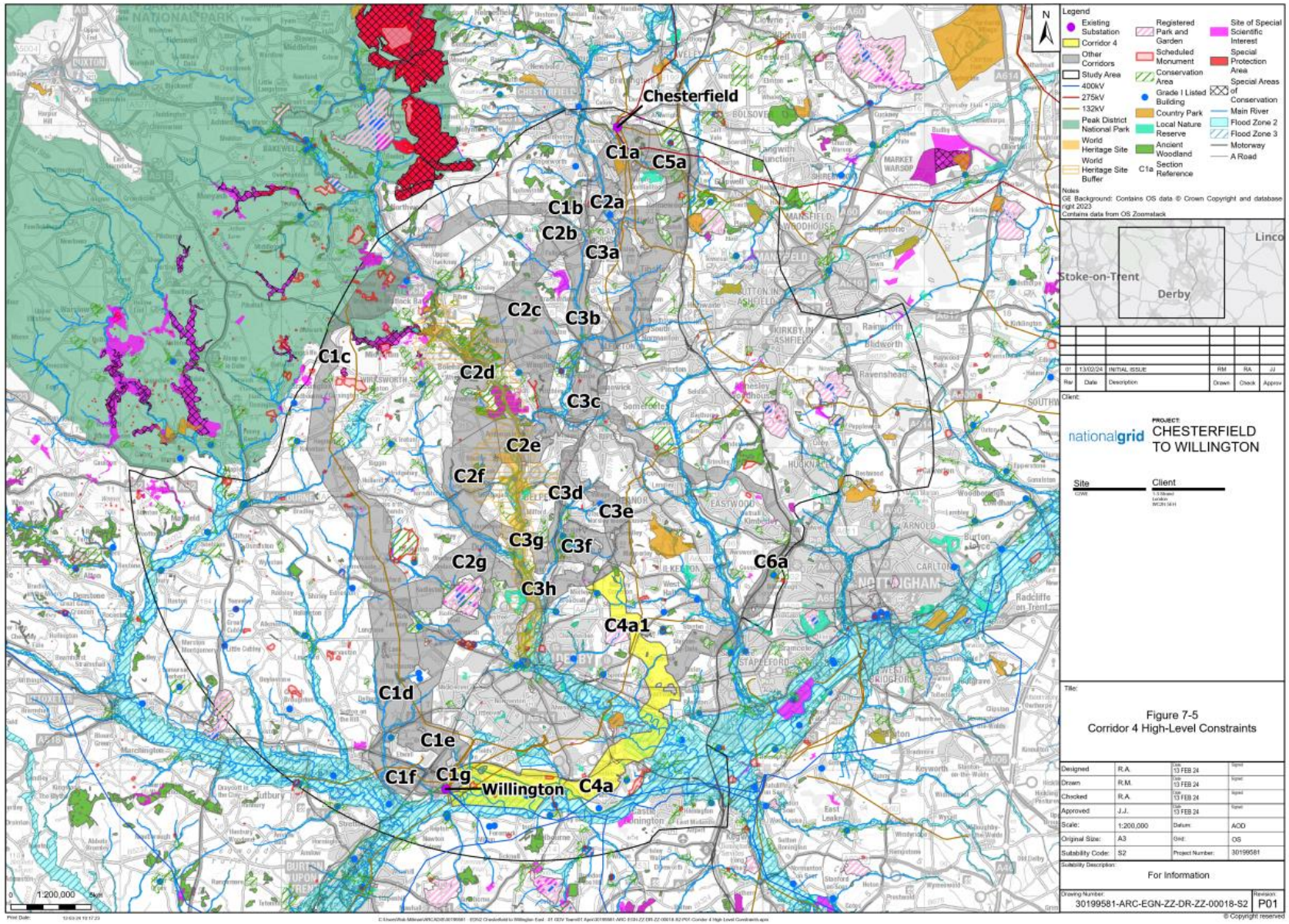
7.6.3 The key constraints in Corridor 4 include crossing the River Derwent and River Trent and the extensive areas of Flood Zones 2 and 3 associated with these rivers, major road crossings, and the recreational and heritage sensitivity of the Trent and Mersey Canal Conservation Area. There are also several listed buildings, two larger scheduled monuments between Swarkestone and Willington Substation, and an additional Conservation Area at Twyford. Key constraints are shown in Figure 7.5.

7.6.4 There are three links between this corridor and other corridors to allow flexibility in the appraisal process and selection of the emerging preferred corridor. These include:

- Link 1, which connects Corridor 3 at Section C3f to Corridor 4 at Section C4a1.
- Link 2, which connects Corridor 6 at Section C6a to Corridor 4 at Section C4a.
- Link 3, which connects Corridor 4 at Section C4a to Corridor 1 at Section C1g.

7.6.5 If this option were progressed, multiple sections from all other corridors may be utilised to link to Corridor 4 north to Chesterfield Substation, therefore the appraisal of applicable northern sections of those corridors should be read in conjunction with the appraisal below. Corridor 4 would also need to link into Corridor 1 at its southern extent to reach Willington Substation at Section 1g, which should also be considered in conjunction with the appraisal below.

Figure 7.5 – Corridor 4 Key Constraints



Environment and Socio-Economic Appraisal Summary

Ecology

7.6.6 Corridor 4 crosses Aston Brickyard Plantation LNR in Section C4a, five areas of lowland fen irreplaceable habitat in Section C4a1, predominantly along the River Trent and the Trent and Mersey Canal, areas of ancient woodland in Section C4a and an ancient tree. With careful route alignment and siting, it may be possible to avoid the majority of ecological impacts on a range of designated sites given the discrete nature of the sites and the relatively restricted development footprint associated with overhead lines.

7.6.7 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the River Mease SAC, Peak District Dales SAC, Gang Mine SAC, Bee's Nest and Green Clay Pits SAC, multiple SSSIs, 1 NNR, Sherwood Forest IBA, multiple LNRs and areas of Ancient Woodland. There is the potential to indirectly impact the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and of operation. A Habitats Regulations Assessment would be required for the SAC designations if this option were to be taken forwards.

7.6.8 With careful routeing and siting, it may be possible to avoid the majority of ecological impacts on a range of designated sites given the discrete nature of the sites and the relatively restricted development footprint associated with overhead lines. If the key ecological features cannot be avoided, sensitive construction methods could be adopted such as the use of trenchless techniques to minimise impacts.

Landscape and Visual

7.6.9 Corridor 4 contains (or is visible from) three regional trails and promoted long-distance paths (Derwent Valley Heritage Way, Midshires Way, Centenary Way (Derby)), a National Cycle Network (NCN) route (No.6), multiple villages, outdoor recreational facilities (Swarkestone Sailing Club, Hill Farm Camping and Caravanning Park, Trent and Mersey Canal, Beechwood Park), and an area of scattered individual settlements (Morley to Stanley). With careful route alignment and siting of pylons, it may be possible to avoid the majority of significant visual impacts to users of these sites.

7.6.10 There is potential for visual impact upon some residential communities as the route is likely to be located within 250m of these. There is also potential for visual impacts upon the users of the recreational routes and the National Cycle Network (NCN) route given an overhead line would pass by or cross over.

7.6.11 There is the potential for cumulative impacts where the overhead line would cross and/or be located close to multiple existing 132kV overhead lines along the corridor (creating a potential ‘wirescape’). This includes the existing 132kV overhead lines around Willington Substation, from Stanley to Spondon, and between Derby and Draycott. Rationalisation of the existing network by removing or undergrounding existing overhead lines may be considered in these areas which could serve to help alleviate visual impacts of new infrastructure in these areas.

Historic Environment

7.6.12 Corridor 4 contains three scheduled monuments (Settlement site and enclosures, Swarkestone Lows round barrow cemetery and part of an aggregate field system 300m

north west of The Lowes Farm, and Iron Age settlement and cursus, with other air photographic marks, SE of Aston-on-Trent). There are also three Conservation Areas (Barrow on Trent Conservation Area, Twyford Conservation Area and the Trent and Mersey Canal Conservation Area) and multiple listed buildings. There are also a number of Conservation Areas, listed buildings and scheduled monuments close to the boundary of the corridor. There are no Registered Parks and Gardens within the corridor; however, it passes close to Locko Park (Grade II) and Elvaston Castle (Grade II*). There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of Conservation Areas, listed buildings and scheduled monuments.

7.6.13 Further assessment as well as ongoing design and routeing and siting of infrastructure may reduce, and where possible avoid, impacts to identified receptors. It will be important to assess the settings of designated heritage assets and any key views. Standard environmental control measures would be implemented during construction to reduce temporary effects to the setting of heritage assets, such as dust and noise control. If these sections were taken forward, then engagement with Historic England would be undertaken to determine appropriate mitigation.

Socio-Economic

7.6.14 Corridor 4 crosses features including Dale Hill Natural Burial Ground (in Section 4a1), Trent Valley Crematorium (in Section 4a), Aston Brickyard Plantation LNR (in Section C4a), existing overhead lines, a golf club (Morley Hayes in Section C4a1) and the Tarmac Swarkestone Sand and Gravel Quarry (in Section C4a). Visitor attractions, utilities, installations and sensitive receptors can be avoided with careful routeing and siting. There is potential for indirect impacts to the setting of the Dale Hill Natural Burial Ground and the Trent Valley Crematorium depending on the alignment of an overhead line. Careful routeing and siting, screening of infrastructure or undergrounding in sensitive areas may reduce impacts. Part of Derby City Council's proposed Infinity Garden Village regeneration project is located along the northern edge of the corridor adjacent to the A50 to the south of Derby in Section C4a. Were this option to be taken forward, discussions with Derby City Council would be required.

7.6.15 There are a number of roads that form part of the strategic road network (SRN) and local road network (LRN) within Corridor 4 including the A608, A6096, A52, A6005, A6, A50, A514 and A5132. There are also railway lines (Loughborough-Burton on Trent, Nottingham-Burton on Trent, Derby-Burton on Trent, Derby-Loughborough), National Cycle Network (NCN) route, bridleways, long-distance paths and PRoWs within the corridor. There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and NCN routes. Adopting sensitive routeing and siting and subsequently standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.6.16 Corridor 4 is within Flood Zone 2 and 3 and crosses multiple watercourses. The largest areas of Flood Zones 2 and 3 are located in the centre of the corridor in Section C4a, along the River Derwent, and at the south western extent of the corridor along the River Trent near Willington Substation (Section C4a). There are areas of natural high ground along the River Derwent and River Trent, but there are no other flood defences present in the corridor. The corridor is generally at a low risk of surface water flooding

throughout, with localised areas at higher risk located to the west of Draycott, west of Stanley, Stanley Common and to the south of Chellaston.

7.6.17 The River Trent and River Derwent WFD waterbodies, Ock Brook, Cuttle Brook, Twyford Brook, Stanley Brook and the Trent and Mersey Canal may require river crossings and are therefore at risk of pollution, such as from sediment-laden runoff, but this may be readily mitigated through standard measures such as silt fencing and settlement lagoons.

7.6.18 There are several mining entries concentrated near Stanley. There are several historical landfills and two authorised landfill sites. Careful consideration to routeing and siting of pylons will be required to seek to avoid these features and any adverse impacts on the works such as migration of contaminants and instability. The Elvaston Quarry historical landfill records are located near Ambaston and take up the majority of the width of the corridor at this location; therefore, it may not be possible to avoid this constraint. Standard environmental controls would be put in place during construction.

Engineering and System Appraisal Summary

7.6.19 Section C4a1 can be facilitated via either Section C3d or Section C3e through Section C3f.

7.6.20 The most direct route to Section C4a1 from Section C3d (and subsequently C3f) would follow the route from Section C3d towards C3h in Corridor 3 up to the vicinity of Morley Smithy, as previously described. From this point (Section C3f), continuing south easterly, the overhead line could be routed avoiding the SSSI; however, this would require the overhead line to oversail the Morley Hayes Golf Course for a short distance. At this point, east of Morley Smithy, the route enters into Section C4a1.

7.6.21 The most direct route to Section C4a1 from Section C3e (and subsequently Section C3f) would follow the route from Section C3e towards C3h using the route east of Smalley up to A608 north of the Morley Hayes Golf Course, as previously described. From this point to Section C4a1, the route would need to oversail ancient woodland and the golf course to establish an overhead line route.

7.6.22 Routeing southerly towards the A52 from the area south of Morley Hayes Golf Course, Corridor 4 (Section C4a1) is generally unconstrained. This area would not be viewed as poor from a geotechnical perspective, with the majority of the ground constraints associated to the area around Morley Hayes Golf Course including a handful of areas of artificial ground and mine entries which are avoidable dependent on route selection. There is an existing 132kV overhead line that cuts diagonally across the corridor close to the A6096 and west of Dale Abbey; this is anticipated to either be undergrounded or modified to facilitate the 400kV line crossing.

7.6.23 To the east of Ockbrook, Section C4a1 joins Section C4a, which is also where Corridor 6 (Section C6a) links into Corridor 4.

7.6.24 After crossing the A52 in Section C4a, the corridor continues to route southerly where the corridor crosses a railway and the River Derwent. The area includes a quarry close to Ambaston that would need to be avoided, but in general routeing here is not very constrained. The main challenge is areas of Flood Zones 2 and 3 associated with the River Derwent which is approximately 2.8km wide. This poses a considerable constraint to construction, delivery, and maintenance of the overhead line, namely through soft ground conditions, potential waterlogging and possible access restrictions. Foundations would need to be designed to suit, as would temporary and permanent drainage

mitigation and access provision. In these areas of Flood Zone there is also a large presence of artificial ground, which would either need ground improvement techniques and/or complete removal if construction works are required to take place within this material. Moving further south, the corridor approaches the A50/A6. In this area, according to the British Geological Survey, there is a significant risk of non-coal-related mining activities, which would require further investigations.

7.6.25 The A6/A50 intersection can either be crossed to the east or the west of the junction. Crossing this to the east would result in a single dual carriageway crossing (A50) and to the west would be two dual carriageway crossings (A6 and A50). Shortly after this, the route begins to head due west on the approach to Willington Substation where the route would need to cross a railway line which runs parallel to the corridor. At this point, the southern side of the corridor presents Flood Zones 2 and 3 associated with the River Trent and the two 400kV routes (ZD and ZS) up to Willington Substation. As these Flood Zones are vast and completely cover the southern extent of the corridor, it would be preferable from a technical perspective to route to the north of this area. Construction within Flood Zones 2 and 3 induces considerable challenges to construction, delivery, and maintenance of the overhead line. There is also a large presence of faults spanning the entire width of the section in this location, which might increase the limitations associated with the crossing and would require further investigations. Due to the constraints described above and the preference to enter Willington Substation from the north, explained below, close parallel alignment to ZD and ZS Routes is not anticipated.

7.6.26 In the close vicinity of Willington Substation, within Sections C1g and C4a, there are multiple challenging constraints present that would impact on routeing. These include the decommissioned Willington Power Station, Willington village, a railway line, the River Trent, the Trent and Mersey Canal, the A5132, multiple existing 132kV overhead lines and two double circuit 400kV lines (ZD and ZS Routes).

7.6.27 Approximately 1-1.5km east of Willington Substation, there is one 132kV line that span across the width of the corridor. This line would need to be undergrounded if oversailing is to be avoided.

7.6.28 The area south of the 400kV substation is currently blocked by the 400kV OHL Routes ZD and ZS Routes. Entry from this side would require substantial works, outages and planning affecting the wider transmission network. Therefore, it is anticipated that a route into Willington Substation through the northern area would be preferable.

7.6.29 To enter Willington Substation from the north would require routeing around the decommissioned power plant. After this, the route to the 400kV station is highly constrained by five additional 132kV overhead lines routeing out of Willington Substation in a northerly direction. The new overhead line route would need to cross all these circuits in a tight area between the current substation boundary and a railway line further north that runs parallel to the substation boundary. If these 132kV lines are not undergrounded, the substation entry would need to be carried out via underground cables.

7.6.30 Cabling through the north side of the Willington Power Station site, parallel to the railway, to a site at Frizams Lane or as far as Twyford may be an option to avoid the overhead line crossings directly north of Willington Substation. A high likelihood of contaminated ground (subject to further review) and historical below ground structures are likely to be a constraint in this area and may prevent routeing of underground cables and siting of a cable SEC.

7.6.31 Minor roads around Willington might be required to provide access around the constraints in the area. It is assumed that access along the A5132 is covered by Abnormal Indivisible Loads (AIL) routes to Willington Substation. The ground conditions in the vicinity of Willington Substation (Section C1g) comprise moderate amounts of artificial ground. One landfill site is identified within the vicinity of Barrow upon Trent.

7.6.32 Access throughout Sections C4a1 and C4a is generally considered adequate. There are good links to the National Highways Strategic Road Network and the haul road requirements are manageable, albeit rivers and major highways may isolate some areas. South of the A50 there are a large number of existing highway restrictions in place for HGVs. However, existing construction projects are using these roads, suggesting mitigation is possible. Haul roads in the order of 5-10km would be required, with the possibility of intermediate connections.

7.6.33 A summary of the options appraisal for Corridor 4 is in Table 5.1 below

Summary

Table 7.4 – Summary of Corridor 4 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Corridor 4 crosses Aston Brickyard Plantation LNR in Section C4a. – Areas of lowland fen irreplaceable habitat are present in Section C4a, predominantly along the River Trent and the Trent and Mersey Canal. – Multiple areas of ancient woodland are present within in Section C4a1.
	Landscape and Visual	– There is potential for visual impacts upon some residential communities within the corridor as a route is likely to be located within 250m of these.
	Historic Environment	– Corridor 4 crosses Barrow on Trent Conservation Area, Twyford and the Trent Conservation Area and Mersey Canal Conservation Area in Section C4a. There is potential for impacts to the setting of the Conservation Areas. – The boundary of the corridor passes close to Locko Park (Grade II) and Elvaston Castle (Grade II*) Registered Parks and Gardens. – There are a number of scheduled monuments and listed buildings throughout Corridor 4.
	Water, Soils, Geology, Noise and Vibration	– There are large swathes of Flood Zones 2 and 3 present within the southern extent of the Corridor in Section C4a along the River Trent and River Derwent. These areas of Flood Zone 2 and 3 are likely to be unavoidable in this section and present a greater constraint to corridors that route into Willington Substation from the east of the Study Area. – There are mine shafts and adits scattered within Section C4a1 and a number of historic and authorised landfill sites present in Section C4a which are likely to be avoidable with sensitive routeing and siting.

Theme	Topic	Summary
Socio-Economic		— Corridor 4 crosses features including Dale Hill Natural Burial Ground (in Section 4a1), Trent Valley Crematorium (in Section 4a). There is potential for indirect impacts to the setting of these community assets. — Corridor 4 crosses features including the Aston Brickyard Plantation LNR (in Section C4a), existing overhead lines, a golf club (Morley Hayes in Section C4a1) and the Tarmac Swarkestone Sand and Gravel Quarry (in Section C4a). — The eastern part of the proposed Infinity Garden Village development is located in Section C4a. — There are a number of roads that form part of the strategic road network (SRN) and local road network (LRN), railway lines, National Cycle Network (NCN) route, bridleways, long-distance paths and PRoWs. There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and NCN routes. Adopting sensitive routeing and siting may reduce impacts on the LRN and SRN and other sensitive socio-economic receptors (e.g., visitor attractions, utilities, installations).
Technical	Technically Constrained Areas	— The entry into Willington Substation is constrained by the decommissioned Willington Power Station, Willington village, a railway line, the River Trent and the A5132. Two 400kV lines block the route into the substation from the south. To route into Willington Substation from the north, five 132kV lines are present; if they are not undergrounded, entry into the substation would require an underground cable solution for the new 400kV line.
	Access	— Vehicle access within Sections C4a1 and C4a requires relatively long-haul roads; however, the links back to the Strategic Road Network are good.
	Geotechnical, Flood Risk and Topography	— The northern extremity of Section C4a is indicated as a Coal Authority development high-risk area. Several mine entries are also located in this area. — Significant risk of non-coal-related mining activities and presence of artificial ground located within the central extents of section C4a.

Theme	Topic	Summary
		– One landfill site is identified within Section C4a in the vicinity of Barrow upon Trent. – Within Section C4a, there are two considerable areas of Flood Zone 2 and 3. The first is associated with the River Derwent and is unavoidable; the width of this crossing is approximately 2.8km. The second is associated with the River Trent and occupies the southern edge of the corridor between Swarkestone and Willington, this is largely avoidable when routeing to the north of the A5132. – Topography is generally flat throughout the corridor. No areas of steepness or large elevation difference to note.
	Existing NGED Assets	– Existing 132kV line section cutting diagonally across the width of Section C4a1 close to A6096 and west of Dale Abbey. This would need to be undergrounded or reconfigured. – One 132kV line across the width of the section approx. 1 – 1.5km away from Willington Substation. This line would need to be undergrounded if oversailing is to be avoided.

7.7 Corridor 5

Introduction

7.7.1 Corridor 5 is intended to provide a potential route out of Chesterfield Substation to the southeast, avoiding some of the constraints present within Corridor 1 immediately south of Chesterfield Substation. It begins to the south of Sutton Scarsdale, using a link with Corridor 1 (at Section C1a). The corridor continues south east through gently rolling agricultural land, before heading south in the vicinity of Heath onto the upper land between the valley of the River Rother and River Doe Lea, and parallel with the M1 motorway.

7.7.2 The corridor splits within Section C5a to provide optionality around the settlements of Lower Pilsley, Pilsley, Astwith and Hardstoft, including a potential link to Corridor 3 at Section C3a in the vicinity of Clay Cross, before continuing south. The land through the corridor steadily falls as it crosses the valleys formed by the Westwood Brook and Morton Brook. South of Stonebroom, the corridor splits again, providing optionality to the west and east of the settlement of Westhouses. The western section of corridor crosses Moreton Brook, and the eastern section of the corridor crosses Normanton Brook before both sections of the corridor merge again. The corridor crosses Alfreton Brook, before joining Corridor 3 (at Section C3c) to the north of Alfreton.

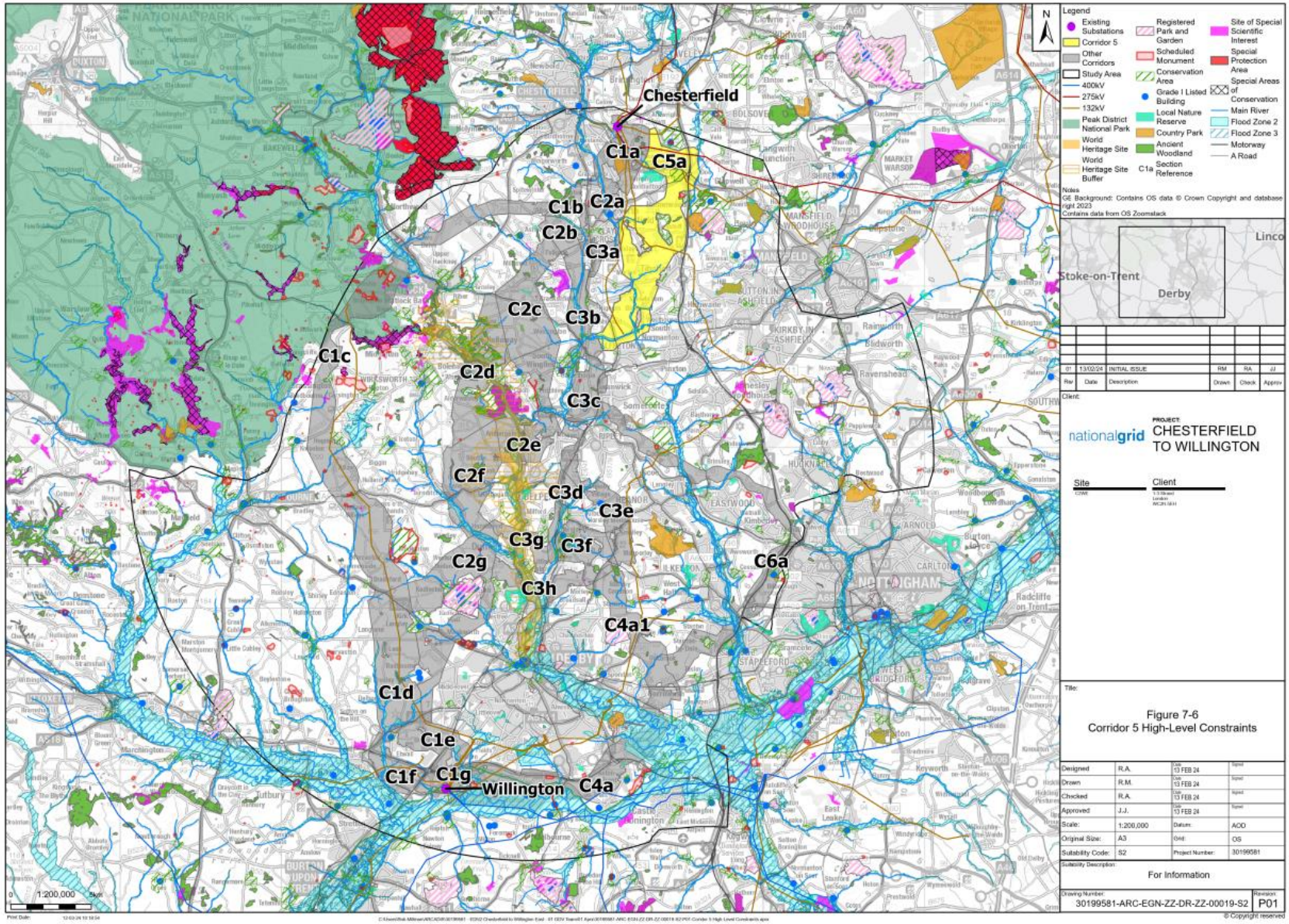
7.7.3 Key constraints in Corridor 5 include Alfreton Brook, Morton Brook and Westwood Brook crossings, the number and proximity of residential settlements through the middle section of the corridor, major road crossings, the presence of a Conservation Area (Heath Village), and the presence of mine adits and entries present in the northern extent of the corridor near Sutton Scarsdale. Key constraints are shown onFigure 7.6 .

7.7.4 There are three links between this corridor and other corridors to allow flexibility in the appraisal process and selection of the emerging preferred corridor. These include:

- Link 1, which connects Corridor 1 at Section C1a to Corridor 5 at Section C5a.
- Link 2, which connects Corridor 5 at Section C5a to Corridor 3 at Section C3a.
- Link 3, which connects Corridor 5 at Section C5a to Corridor 3 at Section C3c.

7.7.5 If this option were progressed, sections from Corridors 1 and 3 will be required to link to Corridor 5 between Chesterfield Substation and north of Derby, and therefore the appraisal of applicable sections of those corridors should be read in conjunction with the appraisal below. Corridor 5 would also need to link into the applicable sections of Corridors 1, 2, 3, 4 or 6 to reach Willington Substation. The constraints within those applicable sections should also be read in conjunction with the appraisal below.

Figure 7.6 – Corridor 5 Key Constraints



Ecology

7.7.6 Corridor 5 crosses multiple areas of ancient woodland to the south of Sutton Scarsdale, to the north east of Lower Pilsley and to the north east of Hardstoft. The corridor also crosses Williamthorpe LNR in the northern extent of the corridor, near to Heath and Williamthorpe. With careful routeing and siting, it may be possible to avoid these areas given the discrete nature of the woodland blocks and the LNR, and the relatively restricted development footprint associated with overhead lines. Sensitive construction methods may be adopted such as the use of trenchless techniques to minimise impacts.

7.7.7 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the South Pennine Moors SAC, Peak District Dales SAC, Gang Mine SAC, Birklands and Bilhaugh SAC, Bee's Nest and Green Clay Pits SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, Peak District Moors IBA, Sherwood Forest IBA, as well as multiple LNRs, SSSIs, veteran trees and areas of ancient woodland. There is the potential to indirectly impact the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and of operation. A Habitats Regulations Assessment would be required for the SPA and SAC designations if this option were to be taken forwards.

Landscape and Visual

7.7.8 Corridor 5 contains (or is visible from) two regional/promoted long-distance paths (Chesterfield Round Walk and Five Pits Trail), a National Cycle Network (NCN) route (no. 67) and multiple villages, towns and scattered individual settlements.

7.7.9 There is potential for visual impacts upon the users of the regional/promoted long-distance paths and the National Cycle Network (NCN) route, as they follow the alignment of the corridor for approximately 4-6km.

7.7.10 There is potential for impacts to the visual amenity of users of two key views – Hardwick Hall and Silverhill Country Park. Hardwick Hall is particularly sensitive given the further use of the land as a Country Park and National Trust property, and the importance of the views out from it have been subject to other studies. The introduction of an overhead line may become a detrimental addition to generally unspoilt views from these locations (albeit existing overhead lines are present in some directions).

7.7.11 There is also the potential for impacts on residents of towns, villages and the scattered settlements between them. There is one location where Corridor 5 may have no option but to pass within 100m of a residential property, between North Wingfield and Parkhouse Green. There is potential for significant visual impacts upon residential communities located either side of this 'pinch-point' location, and this is a material consideration with this corridor.

7.7.12 There is also potential for impacts on the visual amenity of residents in other existing settlements on account of overhead lines likely being within 2km of some properties. This is particularly occurrent at Heath, Holmewood, Lower Pilsley, Pilsley, Tibshelf and Stonebroom, and to scattered properties within the gently rolling landscape, which allows occasional long views. Avoidance of such impacts may be possible where they can be separated by substantial landform or blocks of trees. Where the avoidance is not

possible, impacts may be reduced by positioning overhead lines and associated infrastructure away from the most sensitive views experienced by these communities, careful routeing and siting to maximise the ability of existing landform and vegetation to visually integrate and backcloth-built infrastructure and selecting visually appropriate overhead line pylons. Further mitigation of impacts may be possible by using planting schemes to reduce the degree of overhead line infrastructure visible.

7.7.13 There is the potential for cumulative impacts where the overhead lines would cross and/or be located close to multiple existing 132kV overhead lines along the corridor (creating a potential 'wirescape'). Existing 132kV overhead lines within Corridor 5 are located between Calow and Sutton Scarsdale, Temple Normanton to Heath, North Wingfield to Tibshelf, and Lower Pilsley to Alfreton.

Historic Environment

7.7.14 There are multiple listed buildings within the corridors, as well as the Heath Village Conservation Area. There are also additional listed buildings, scheduled monuments, several Conservation Areas (Astwith, Hardstoft, Stainsby, Hardwick and Rowthorne and Sutton Scarsdale) and a Registered Park and Garden (The Grade I Hardwick Hall) within close proximity to the corridor. There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated that impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of listed buildings and scheduled monuments.

Socio-Economic

7.7.15 Within Corridor 5 there is the Williamthorpe LNR, large-scale parks (e.g. Doe Hill Community Park), a festival site (Stainsby Festival) and several smaller areas of public amenity. There are also existing utilities including a sewage treatment plant north of Alfreton. The area immediately north of Alfreton, at the southern extent of Section 5a, also includes the Meadow Lane Solar Farm, and a proposed residential development west of Chesterfield Road.

7.7.16 There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN) that fall within the corridor including the M1, A617, A6175, A61. There are also railway lines (Chesterfield-Loughborough), National Cycle Network (NCN) routes, bridleways, long-distance paths and Public Rights of Way (PRoW) within the corridor. There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and National Cycle Network (NCN) routes.

7.7.17 Adopting appropriate alignments that avoid major visitor attractions, utilities, installations, and sensitive receptors altogether may reduce impacts. Adopting sensitive routeing and siting and standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.7.18 Flood Zones 2 and 3 are present within this corridor but may be avoidable with careful routeing and siting. Whilst the corridor is generally at low risk of surface water flooding, there are localised areas at higher risk including areas to the north of Pilsley and along Locko Brook and its tributaries to the north of Lower Pilsley.

7.7.19 There are also multiple ordinary watercourses and a WFD waterbody (Locko Brook) that partially bisect the corridor and are at risk of pollution, such as from sediment-laden runoff, but this may be readily mitigated through standard measures such as silt fencing and settlement lagoons.

7.7.20 There are multiple authorised and historic landfill sites within the corridor. There are also numerous mine shafts and adits present across this section, mainly concentrated in the north of the section, close to the link to Corridor 1. Careful consideration to routeing and siting of pylons will be required to seek to avoid these features and any adverse impacts on the works such as migration of contaminants and instability. Standard environmental controls would be in place during construction which would further reduce impacts.

7.7.21 Water quality protection measures and drainage systems would be maintained throughout the construction phase.

Engineering and System Appraisal Summary

7.7.22 Chesterfield Substation sits within Section C1a. Routeing to the substation from the south-west has been previously discussed in Corridor 1. Corridor 5 instead approaches the substation from the east; most of the constraints are the same as listed for Corridor 1, but their implications in Corridor 5 are different.

7.7.23 Corridor 5, in its approach to Chesterfield Substation, encounters multiple challenging constraints which would impact heavily on the routeing. These include scattered dwellings, a planned solar farm (Hasland Solar Farm), an existing solar farm, Sutton Springs Wood, crossing of the A617, multiple existing 132kV overhead lines and the existing 275kV 4ZV overhead line.

7.7.24 Corridor 5 (Section C5a) links to Section C1a at the north-east corner of this section. Therefore, to use Section C5a, the routeing out of Chesterfield Substation needs to be predominantly in an easterly direction, as opposed to mostly in a southerly direction, which is the case for Corridors 1 and 2.

7.7.25 Most of the eastern border of Section C1a is constrained by scattered buildings. The vast majority of these buildings are residential, which makes finding a route through quite difficult and could result in a non-feasible route at this location. In addition, there is a cluster of designated ancient woodland in the area.

7.7.26 The area south of the substation and north of the A617 is heavily constrained. The planned solar farm, once implemented, presents a major constraint, and any routeing to the substation from the south-east is likely to require some of the area planned for the farm. This area is currently oversailed by two 132kV overhead lines which might need to be diverted.

7.7.27 Further south-east there is a third 132kV overhead line which would need to be undergrounded or reconfigured if the future route were to use an overhead line to approach Chesterfield Substation from the south. The existing 132kV line route passes through the solar farm and runs parallel with the A617. Using this route for the new 400kV line could be a possibility but would require the existing line to be rerouted to clear a corridor. In addition, due to the increased width of the new overhead line, oversailing of a small section of the solar farm may be required.

7.7.28 The northern area of Section C1a has small built-up areas along Calow Lane, but it is significantly less constrained than the southern part. To route up to the northern area of Section C1a, the existing 4ZV route, which will be uprated to 400kV, needs to be

crossed, and therefore either undergrounding or overhead line modification would be required.

7.7.29 Undergrounding of a future route is likely to be required in this area depending on the final configuration of the substation and the arrangements to modify the existing overhead lines in the area to facilitate the crossings.

7.7.30 In summary, the route up to Chesterfield Substation in Section C1a, coming from Section C5a, is highly constrained, particularly at the southern part (which is likely to require some underground cabling). However, as a whole, it is considered significantly less constrained than potentially routeing to the southwest as explained in the appraisal of Corridor 1. Therefore, there is a technical preference to route east out of Section C1a.

7.7.31 East of the Sutton Springs Wood, the route starts bending from east to south on approach to the A617. The corridor allows the route to cross over the M1; however, this is not the technical preference due to the extra route distance and additional angle pylons that this would require. Therefore, from a technical perspective, it would be preferable to stay west of the M1 with open land generally available, with the main potential constraint being the existing 4ZV route. In the case that the 4ZV route needs to be crossed to approach a northern route to enter the substation, it is anticipated that this crossing will happen in this area; otherwise the 4ZV route is not expected to be a major constraint.

7.7.32 After Corridor 5 crosses the A617, it continues to route south where it crosses over the A6175. Shortly after this, the corridor routes through a cluster of mine entries and artificial ground. Construction and/or ground investigation works in areas of artificial ground may require ground improvement techniques and/or complete removal of the material. The corridor continues to route south where to the west of Stainsby it widens and splits into three options: an eastern, central and western option.

7.7.33 All of these options have a moderate presence of artificial ground and a few localised mine entries. The vast majority of Section C5a is within a Coal Authority development high-risk area.

7.7.34 The eastern option routes to the east of Hardstoft parallel to the M1, and along this option there is a replanted section of ancient woodland present; this option would likely require the overhead line to oversail this woodland.

7.7.35 The central option routes between Hardstoft and Pilsley, and within this option is an area of ancient woodland. Routeing to avoid the woodland is anticipated and is considered feasible.

7.7.36 The western option routes to the north of Lower Pilsley. This option allows for continuing southerly following Corridor 5 or linking with Section C3a, as previously described in Corridor 3.

7.7.37 For each of these sub-option routes in this area, there are multiple 132kV overhead lines that are likely to need to be undergrounded or modified to allow a route through. The eastern and central options would require a 132kV overhead line east of Lower Pilsley to be rearranged or undergrounded. The western option would require the aforementioned 132kV overhead line to be reconfigured or undergrounded and, in addition, then to underground an additional second 132kV line, between Danesmoor and Lower Pilsley.

7.7.38 Within Section C5a, after the three options converge in the area west of Tibshelf, the corridor continues to route south. In this area there is a significant presence of artificial ground which would either need to be completely removed or be subjected to ground improvement techniques.

7.7.39 Continuing south from Pilsley, the corridor is largely unconstrained apart from a railway crossing in the vicinity of Doe Hill Community Park. After crossing the railway line, the section approaches the A61 where an NGED 132kV overhead line crosses the corridor (east of the A61) and terminates at an underground cable sealing end compound within the corridor (this services a treatment plant). A future route in this section would likely need to cross this overhead line, resulting in a need for it to be undergrounded/rerouted.

7.7.40 After crossing the 132kV overhead line, the section crosses both the A61 and the A615. At this location, Section C5a links back into Section C3c.

7.7.41 Access throughout Section C5a is generally considered adequate; there are good links to the National Highways Strategic Road Network and the haul road requirements are manageable. However, there are some areas of challenging topography, and intermediate roads are not considered suitable at this stage, increasing the length of potential haulage road sections; this is particularly prevalent for the section between A6175 and A61, covering a routeing distance of approximately 12km.

7.7.42 A summary of the options appraisal for Corridor 5 is in Table 7.5 below.

Summary

Table 7.5 – Summary of Corridor 5 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Corridor 5 crosses multiple areas of ancient woodland to the south of Sutton Scarsdale, to the north east of Lower Pilsley and to the north east of Hardstoft. – Corridor 5 crosses Williamthorpe LNR in the northern extent, near to Heath and Williamthorpe.
	Landscape and Visual	– There is one location where Corridor 5 may have no option but to pass within 100m of a residential property, between North Wingfield and Parkhouse Green. There is potential for significant visual impacts upon residential communities located either side of this 'pinch-point' location.
	Historic Environment	– Corridor 5 crosses the Heath Village Conservation Area in its northern extent. There is potential for impacts to the setting of the conservation area. – The boundary of the corridor passes close to Hardwick Hall Registered Park and Garden. – There are a number of listed buildings throughout Corridor 5.
	Water, Soils, Geology, Noise and Vibration	– There are numerous mine shafts and adits present in Corridor 5, mainly concentrated in the north of the section, close to the link to Corridor 1 (link between C1a and C5a). – There are scattered areas of historic landfill in the corridor which may be avoided with sensitive routeing and siting.
Socio-Economic		– Corridor 5 includes the Williamthorpe LNR, large-scale parks (e.g. Doe Hill Community Park), a festival site (Stainsby Festival) and several smaller areas of public amenity. North of Alfreton, in the southern extent of Corridor 5, also includes

Theme	Topic	Summary
		a sewage treatment plant, the Meadow Lane Solar Farm, and a proposed residential development west of Chesterfield Road. – There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN), railway lines, National Cycle Network (NCN) routes, bridleways, long-distance paths, and Public Rights of Way (PRoW). There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and National Cycle Network (NCN) routes. Adopting sensitive routeing and siting may reduce impacts on the LRN and SRN and other sensitive socio-economic receptors (e.g., visitor attractions, utilities, installations).
Technical	Technically Constrained Areas	– Routeing out of Chesterfield within Section C1a, there are multiple challenging constraints present which would impact heavily on routeing. These include scattered dwellings, a planned solar farm, an existing solar farm, Sutton Springs Wood, crossing of the A617, multiple existing 132kV overhead lines and the existing 275kV 4ZV overhead line. An overhead line and an underground cable solution have been considered through this area. Undergrounding of a future route is likely to be required in this area.
	Access	– Vehicle access throughout Section C5a is generally considered adequate, there are good links to the National Highways Strategic Road Network and the haul road requirements are manageable. However, there are some areas of challenging topography, and intermediate roads are not considered suitable at this stage, increasing the length of potential haulage road sections.
	Geotechnical, Flood Risk and Topography	– Significant presence of artificial ground throughout the entire Section C5a. – The vast majority of Section C5a is within a Coal Authority development high-risk area. There is a significant presence of mine entries in the northern region and localised areas in the centre. – Generally undulating terrain with shallow slope angles throughout the whole section. No areas of steepness or large elevation difference to note.

Theme	Topic	Summary
	Existing NGED Assets	— A 132kV line cuts across the width of the section north of Heath. The 132kV lines would require undergrounding/re-routeing at this point. — Two 132kV lines cut across the width of the section close to Pilsley. The 132kV lines would require undergrounding/re-routeing at this point. — A final 132kV line cuts through the section in the vicinity of Shirland, which might require undergrounding/re-routeing.

7.8 Corridor 6

Introduction

7.8.1 Corridor 6 begins to the north of Ripley, using a link with Corridor 3 (at Section C3c). The corridor continues south east through areas of mixed land-use and relatively undulating topography running parallel with and to the north of the A610 and the settlements of Codnor and Langley Mill. It crosses railway lines, the River Erewash and Beauvale Brook before reaching the M1 motorway to the east of Eastwood. The corridor then runs adjacent to the west side of the M1 motorway to Nuthall, before heading south west in the vicinity of Junction 26. The corridor continues south west, including the M1 motorway, through more open and gently undulating land, crossing the River Erewash again until it reaches the more built-up area between Stapleford and Trowell. The corridor breaks from the M1 motorway to the north of Junction 25 and splits to provide optionality around the north and south of the settlement of Stanton-by-Dale. As the corridor moves south west from Stanton-by-Dale it crosses a more incised landscape before joining Corridor 4 to the east of Ockbrook at Section C4a.

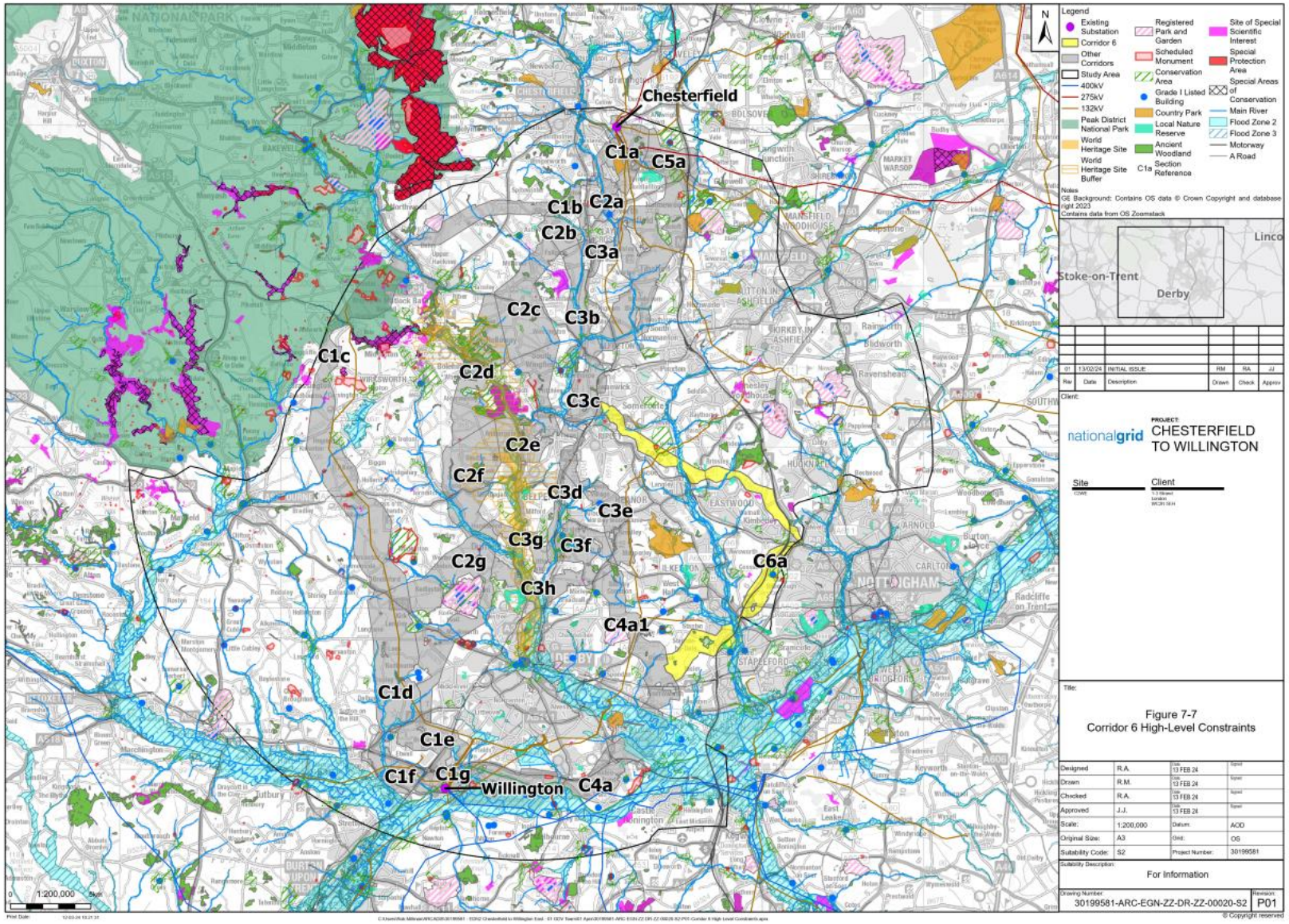
7.8.2 Key constraints in Corridor 6 include: historic mine entries and adits which cover extensive sections of the corridor; the number and proximity of residential settlements on both sides of the corridor; crossings of the River Erewash and Beauvale Brook, including areas of Flood Zones 2 and 3 associated with these watercourses; major road crossings, including the M1 motorway; multiple railway crossings, several listed buildings; and three Conservation Areas (Codnor Park, Strelley and Sandiacre Cloud Side). Key constraints are shown in Figure 7.7.

7.8.3 There are two links between this corridor and other corridors to allow flexibility in the appraisal process and selection of the preferred corridor. These include:

- Link 1, which connects Corridor 3 at Section C3c to Corridor 6 at Section C6a.
- Link 2, which connects Corridor 6 at Section C6a to Corridor 4 at Section C4a.

7.8.4 If this option were progressed, multiple sections from Corridors 1, 2, 3 or 5 will be required to link to Corridor 6 to the north of Ripley; therefore, the appraisal of northern sections of those corridors should be read in conjunction with the appraisal below. Corridor 6 would also need to link into Corridor 4 to reach Willington Substation. The constraints within Corridor 4, specifically within Section C4a, should also be read in conjunction with the appraisal below.

Figure 7.7 – Corridor 6 Key Constraints



Environment and Socio-Economic Appraisal Summary

Ecology

7.8.5 Corridor 6 crosses five LNRs (Brinsley Headstocks, Colliers Wood, Nottingham Canal, Stoney Clouds and Stanton Gate, Stanton-by-Dale). The corridor also crosses multiple areas of lowland fen irreplaceable habitat along the River Erewash near Woodlinkin and Eastwood, ancient woodland, and ancient and veteran trees. With careful routeing and siting, however, it may be possible to avoid these areas given the discrete nature of the ecological sites and features, and the relatively restricted development footprint associated with overhead lines. Sensitive construction methods may be adopted, such as the use of trenchless techniques to minimise impacts.

7.8.6 There are also a number of statutory and non-statutory designations outside of the corridor that have the potential to be indirectly impacted. These include the South Pennine Moors SAC, Peak District Dales SAC, Gang Mine SAC, Bee's Nest and Green Clay Pits SAC, Peak District Moors (South Pennine Moors Phase 1) SPA, Peak District Moors IBA, Sherwood Forest IBA, as well as multiple LNRs, SSSIs, ancient and veteran trees and areas of ancient woodland. There is the potential to indirectly affect the qualifying features and species of these statutory and non-statutory designations through noise and vibration, pollution of land and water and general disturbance as a result of construction works and of operation. A more detailed assessment and/or mitigation is required. A Habitats Regulations Assessment would be required for the SPA and SAC designations if this option were to be taken forwards.

Landscape and Visual

7.8.7 Corridor 6 contains (or is visible from) three regional/promoted long-distance paths (Midshires Way, Nutbrook Trail and Robin Hood Way), a National Cycle Network (NCN) route (no.67), multiple villages, towns and scattered individual settlements, and multiple outdoor recreational sites.

7.8.8 There is potential for visual impacts upon the users of the Robin Hood Way as this follows the alignment of the corridor for approximately 4km.

7.8.9 There are multiple outdoor recreational facilities within Corridor 6 including parks, railways, campsites and a marina. With careful routeing and siting, it may be possible to avoid the majority of significant visual impacts to users of these sites.

7.8.10 There is the potential for adverse impacts on the landscape and visual amenity of residents in existing settlements on account of overhead lines likely to be within 2km of some properties and so being potentially dominant in views. This is particularly occurrent at Ripley, Colliers Wood, Moorgreen, Nuthall, Hempshill, Trowell, Stanton Gate and Stanton-by-Dale. Avoidance of such impacts may be possible where they can be separated by substantial landform or blocks of trees. Where avoidance is not possible, impacts may be reduced by positioning overhead lines and associated infrastructure away from the most sensitive views experienced by these communities, careful routeing and siting to maximise the ability of existing landform and vegetation to visually integrate and backcloth-built infrastructure and selecting visually appropriate overhead line pylons. Further mitigation of impacts may be possible by using planting schemes to reduce the degree of overhead lines infrastructure visible.

7.8.11 There is the potential for cumulative impacts where the overhead line would cross and/or be located close to multiple existing 132kV overhead lines along the corridor

(creating a potential ‘wirescape’). Existing 132kV overhead lines within Corridor 6 are located between Brinsley and Woodlinkin.

Historic Environment

7.8.12 There are multiple listed buildings, two scheduled monuments (Codnor Castle and Moat and the fishpond at Strelley) and three Conservation Areas (Codnor Park, Strelley and Sandiacre Cloud Side) within the corridor that should be avoided. There are also additional listed buildings, scheduled monuments and several Conservation Areas (Brinsley, Stanton-by-Dale, Nuthall, Risley, Dale Abbey and Golden Valley) within close proximity to the corridor. There is potential for direct and indirect impacts to these heritage assets and their setting depending on the overhead line alignment. Further assessment would be required, but it is anticipated impacts can be avoided and reduced with careful routeing and siting to avoid significant impacts to the settings of Conservation Areas, listed buildings and scheduled monuments.

Socio-Economic

7.8.13 Within Corridor 6 there are multiple LNRs (Brinsley Headstocks, Colliers Wood, Nottingham Canal, Stanton Gate Stanton-by-Dale, Stoney Clouds), golf clubs (Ormonde Fields, Erewash Valley), and other smaller areas of public amenity. There are also existing utilities including existing overhead lines, Butterley Reservoir, a motorway service station (Trowell), a sewage treatment plant and an industrial estate. Ripley civil airfield is also located in Corridor 6.

7.8.14 There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN) that fall within the corridor including the M1 motorway, A608, A610, A609 and A6007. There are also railway lines (Chesterfield-Loughborough), National Cycle Network (NCN) routes, bridleways, long-distance paths and Public Rights of Way (PRoW) within the corridor. There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and National Cycle Network.

7.8.15 Adopting appropriate alignments that avoid major visitor attractions, utilities, installations and sensitive receptors altogether may reduce impacts. Adopting sensitive routeing and siting and standard construction control measures may reduce impacts on the LRN and SRN.

Water, Soils, Geology, Noise and Vibration

7.8.16 The River Erewash WFD waterbody fully bisects the corridor in two locations, to the north of Eastwood and to the north of Stapleford. Several other ordinary watercourses also fully or partially bisect this corridor. A route within this corridor may require river crossings. An area of Source Protection Zone 3 is located near Stanton-by-Dale which spans across most of the width of the corridor. There is a potential risk of pollution to these waterbodies, such as from sediment-laden runoff, but this may be readily mitigated through avoidance where possible during the routeing and siting stage and standard mitigation measures such as silt fencing and settlement lagoons.

7.8.17 Flood Zones 2 and 3 associated with the River Erewash to the north of Eastwood and to the north of Stapleford, and the Beauvale Brook to the north of Eastwood may be unavoidable within Corridor 6. There are areas of natural high ground along the River Erewash, but no other flood defences are present in this section. Whilst the corridor is generally at low risk of surface water flooding, there are localised areas at higher risk

including areas along the River Erewash, to the east of Nuthall and to the north of Stapleford.

7.8.18 There are multiple historic landfill sites within the corridor. There are also numerous mine shafts and adits present across this section, mainly concentrated in Golden Valley, to the south of Nuthall and to the north of Trowell. In these locations, mine entries and adits cover large extents of the corridor. Careful consideration to routeing and siting of pylons will be required to seek to avoid these features and any adverse impacts on the works such as migration of contaminants and instability. However, due to the number of constraints which span the width of the corridor, such as the mine entries and adits, further assessment will be required to determine if avoidance is possible.

7.8.19 Water quality protection measures and drainage systems would be maintained throughout the construction phase.

Engineering and System Appraisal Summary

7.8.20 Corridor 6 begins to the north of Ripley, using a link with Corridor 3 (at Section C3c).

7.8.21 East of Pentrich, Corridor 6 (Section C6a) crosses the A38 and routes to the south-east towards Nottingham and the M1.

7.8.22 This part of the corridor is bisected by a number of constraints, notably railways and watercourses, which may segregate areas of the corridor and restrict access. If sufficient access points cannot be established, long sections of haul road or more extensive works (i.e. bridge crossings) may be required. These restrictions may cause significant cost and programme implications should they be realised. Furthermore, the majority of this section is highly constrained from a geotechnical perspective and presents multiple pinch points that would all add technical complexity and impact the constructability of an overhead line.

7.8.23 Along this section there are multiple large clusters of mine entries and significant areas of artificial ground. Also, the Coal Authority has indicated this as a development high-risk area, all of which may impact pylon positioning.

7.8.24 Immediately after crossing the A38, there is a section of the corridor constrained with Butterley Reservoir waterside stables, a water/sewage treatment plant, a sports field, a residential building and a large fitness centre compound. The total width of section at this point is approximately 580m, with almost half of the width occupied by the reservoir, and the remaining by stables, treatment plant, sports field and residential building and garden. For the overhead lines to pass through this point, either the reservoir and treatment plant or the stables compound would need to be oversailed.

7.8.25 Continuing easterly, the corridor then approaches another constrained area including a railway station, The West Shed Museum, Butterley Miniature railway and some industrial compounds. The only open area is approximately 100m width to the west of the industrial building compound.

7.8.26 Further east, another section is identified between Woodlinkin and Ironville, where the corridor passes through Ormonde Fields Golf Course and Codnor Park Conservation Area. The total width of section at this point is approximately 810m wide, which is completely bisected with Ormonde Fields Golf Course and the conservation area. In this area, the route also crosses a 132kV overhead line which may need to be undergrounded/re-routed to facilitate the new 400kV overhead line.

7.8.27 After crossing the M1, where the corridor begins to route south westerly, a narrow section of the corridor is constrained between Nuthall and Bulwell. The width of section is approximately 120m with a major highway crossing and residential areas on both sides of the section. The only feasible option found to route through this area is by oversailing the roundabout on the A610, which would require an approximate total span of 450m; this would result in construction challenges and potentially special design considerations. Shortly after this crossing, the corridor enters multiple extremely dense areas of mine entries that would require further investigation as these may impact siting of overhead line pylons and have implications for the constructability of the route. The Coal Authority has indicated this as a development high-risk area.

7.8.28 As Corridor 6 (Section C6a) routes south-westerly, it approaches another constrained area, between Trowell and Stapleford, where there is a road and a railway crossing and a 20- to 60m-wide local nature reserve associated with the Nottingham Canal which would introduce additional technical complexity. At this location, the corridor is approximately 220m wide with the M1 crossing diagonally and the A6007 and a railway crossing perpendicular. At this location, the local nature reserve crosses the width of the corridor and would also require oversailing. The River Erewash in this location is a potential blocker, and a bridge would be required if access was required on both sides of the river. The associated Flood Zones 2 and 3 also span the width of the corridor adding further risk to the construction, delivery and maintenance of an overhead line.

7.8.29 As Corridor 6 approaches Stanton-by-Dale, another constrained area has been identified. The area between Stanton-by-Dale and Sandiacre is constricted by Erewash Valley Golf Course, commercial/factory buildings, Sandiacre Cloud Side Conservation Area and Stoney Clouds local nature reserve. In order to avoid impacting the golf course and the Conservation Area, an overhead line route would need to oversail the industrial buildings, which would require an approximate 400m span.

7.8.30 After navigating past Stanton-by-Dale, Section C6a continues to route south westerly towards Section C4a, and this section is generally unconstrained. However, vehicle access within this section of the corridor is considered challenging with limited options available, due to 7.5t weight restrictions on many of the existing roads. If a connection to the highway network cannot be established via minor roads in this area, a long section of haul road would be required. Further investigation would be required to confirm available links at either end of the section.

7.8.31 Section C6a links to Section C4a in the vicinity of Ockbrook.

7.8.32 A summary of the options appraisal for Corridor 6 is in Table 7-6 below.

Summary

Table 7.6 – Summary of Corridor 6 Options Appraisal

Theme	Topic	Summary
Environmental	Ecology	– Corridor 6 crosses five LNRs (Brinsley Headstocks, Colliers Wood, Nottingham Canal, Stoney Clouds and Stanton Gate, Stanton-by-Dale). – The corridor crosses multiple areas of lowland fen irreplaceable habitat along the River Erewash near Woodlinkin and Eastwood. – There are several areas of ancient woodland within Corridor 6.
	Landscape and Visual	– There is potential for visual impacts upon the users of the Robin Hood Way regional trail / long-distance path as this follows the alignment of the corridor for approximately 4km.
	Historic Environment	– Corridor 6 crosses Codnor Park, Strelley, and Sandiacre Cloud Side Conservation Areas. There is potential for impacts to the setting of the Conservation Areas. – There are a number of scheduled monuments and listed buildings throughout Corridor 6.
	Water, Soils, Geology, Noise and Vibration	– There are numerous mine shafts and adits present in Corridor 6, mainly concentrated in Golden Valley, to the south of Nuthall and to the north of Trowell. In these locations, mine entries and adits cover large extents and avoidance may not be possible. – Zone 3 Source Protection Zone present in the south around Stanton-by-Dale, which spans the width of the section.
Socio-Economic		– Corridor 6 includes multiple LNRs (Brinsley Headstocks, Colliers Wood, Nottingham Canal, Stanton Gate Stanton-by-Dale, Stoney Clouds), golf clubs (Ormonde Fields, Erewash Valley), other areas of public amenity, existing

Theme	Topic	Summary
		overhead lines, Butterley Reservoir, a motorway service station (Trowell), a sewage treatment plant, and an industrial estate. – Corridor 6 crosses Ripley civil airfield. – There are a number of roads that form part of the Strategic Road Network (SRN) and local road network (LRN), railway lines (Chesterfield-Loughborough), National Cycle Network (NCN) routes, bridleways, long-distance paths, and Public Rights of Way (PRoW). There is potential for disruption on the SRN and LRN roads with construction traffic. Construction works could lead to temporary disruption of these recreational PRoW and National Cycle Network. Adopting sensitive routeing and siting may reduce impacts on the LRN and SRN and other sensitive socio-economic receptors (e.g., visitor attractions, utilities, installations).
Technical	Technically Constrained Areas	– Multiple areas along the corridor have been identified as technically very constrained. – The highest risk within the corridor is a narrow section identified between Nuthall and Bulwell, where the width of section is approximately 120m with major road crossings present and residential areas on both side of the section.
	Access	– Vehicle access within Section C6a is considered challenging due to a few isolated areas located at the beginning and the end of the corridor where access would be blocked by physical constraints. In these areas, access is likely to not be possible and will therefore necessitate longer haul road sections for construction or substantial temporary works for crossing over physical constraints.
	Geotechnical, Flood Risk and Topography	– Significant presence of artificial ground in the northern and central regions of Section C6a. The deposits span the width of the corridor in multiple areas. – The majority of Section C6a is within a Coal Authority development high-risk area. There is also a very significant presence of mine entries throughout this section.

Theme	Topic	Summary
		– Flood Zone 2 and 3 associated with the River Erewash also spans the width of the corridor adding further risk to construction, delivery and maintenance of an overhead line. – Zone 3 Source Protection Zone present in the south around Stanton-by-Dale, which spans the width of the section. – Generally undulating terrain with shallow slope angles throughout the whole section. No areas of steepness or large elevation difference to note.
	Existing NGED Assets	– An existing 132kV line section crosses perpendicular to the width of the section close to Ormonde Fields Golf Course. The 132kV lines would require undergrounding/re-routeing at this point.

8. Cost and Programme Performance

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8. Cost and Programme Performance

8.1 Introduction

8.1.1 As detailed in Chapter 3, 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.

8.1.2 In line with the methodology identified in Chapter 5, following the appraisal of the refined corridors, cost estimates were developed. An estimate of the earliest operational date (in-service date) was also considered, taking into account factors that may significantly affect the Project programme.

8.1.3 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 and survey work and are also highly influenced by market forces such as resource availability and external market rates.

8.2 Costing

8.2.1 A model has been built to determine the cost and programme estimates associated with potential connection lines between Chesterfield and Willington Substations. The resulting route lengths are then costed using the National Grid cost tool based on historic project outturn data.

8.2.2 Table 8-1 outlines the indicative cost of technology. In line with the SOR, an overhead line solution is assumed with additional cost factored in to reflect the likely requirement for sections of underground cabling within the Peak District National Park (applicable to Option 1, which is primarily based on sections within preliminary Corridor 1) and the Derwent Valley Mills World Heritage Site (applicable to Options 2 and 3, which are primarily based on sections that could form within preliminary Corridors 2 and 3). Technical appraisal of routeing through these locations yielded estimates of between 7-10km undergrounding through the Peak District National Park and 2-3km through the Derwent Valley Mills World Heritage Site for crossing the designations. Therefore, to inform cost projections for the underground cabling, a ‘best case scenario’ of 7km and 2km respectively were used within the calculation for these options.

8.2.3 Furthermore, pylon type and conductor configuration are assumed to define a unit cost per kilometre of overhead line.

Table 8.1 – Indicative Cost of Technology

Technology Configuration		Capital Costs	
Overhead Line (OHL)	AC Underground Cable (AC Cable)	Overhead Line (OHL)	AC Underground Cable (AC Cable)
No. of conductor sets "bundles" on each arm/circuit of a pylon	No. of cables per phase	Cost for a two-circuit pylon route	Cost for a two-circuit AC cable route
3 conductors per phase (9 conductors per circuit)	3 cables per phase (9 cables per circuit)	£3.98m/km	£39.89m/km

Notes: -
1. Capital costs for all technologies are based upon rural/arable land installation with no major obstacles (examples of major obstacles would be roads, rivers, railways, etc.)
2. All underground cable technology costs are for direct buried installations only.
3. For the costing exercise, it has been assumed that there are nine conductors/cables per circuit.

8.2.4 A number of options were developed using an indicative route through combinations of different sections (detailed in Chapter 7) that could form end-to-end solutions between the Chesterfield and Willington Substations. Recognising that there is potential variance in the specific sectional make-up of refined corridor options, for the purposes of developing cost estimates, an assumption was made for each of the refined corridors that the route would follow the most technically feasible path, whilst considering key routeing constraints and professional expertise pertaining to overhead line and/or underground cable system design.

8.2.5 Where the refined corridors have necessary interdependence with sections from other refined corridors, the same routeing assumptions have been applied where applicable to ensure that only the differences brought about by the sectional divergences between the refined corridors are reflected in the indicative results.

8.2.6 Refined corridor options appraised do not include capital costs associated with any substation connection works. It is considered that all routes would require similar modifications at substations and as such have not been included in the below comparative figures, which are therefore not representative of total Project costs.

8.3 Indicative Results

8.3.1 A model has been built to determine the cost and programme estimates associated with potential connection lines between Chesterfield and Willington Substations. The resulting route lengths are then costed using the National Grid cost tool as based on historic project outturn data.

8.3.2 Table 8-2 provides the indicative cost and programme details for potential end-to-end refined corridor options between the Chesterfield and Willington Substations during the construction period.

Table 8.2 – Indicative Cost and Programme Summary

Refined Corridor Options	Indicative Route Length (km)	Indicative Underground Cable (km)	Indicative Cost (£m)	Indicative Construction Duration
Option 1	59	7	486	4 years, 3 months
Option 2	49	2	267	4 years
Option 3	57	2	299	4 years
Option 4	58	0	231	3 years
Option 5	61	0	243	3 years
Option 6	66.5	0	265	3 years, 3 months

8.3.3 As shown in Table 10-2, the indicative costs range from £231m to £486m.

8.3.4 The lowest indicative cost is Option 4 whilst the highest indicative cost is Option 1.

8.3.5 Options 1, 2 and 3 assume undergrounding will likely be required as these pass through the Peak District National Park (in Option 1) or Derwent Valley Mills World Heritage Site (in Options 2 and 3), resulting in higher capital costs and longer programme durations.

8.3.6 Option 1 demonstrated the highest cost at £486m due to the extensive undergrounding likely required through the Peak District National Park. The undergrounding requirements also result in a forecast in a construction duration of approximately 4 years, 3 months.

8.3.7 Option 2 has the shortest overall length and less significant undergrounding requirements compared to Option 1. However, undergrounding is likely to be required as a result of the need to cross the Derwent Valley Mills World Heritage Site. As a result, the estimated expenditure is £267m with a forecast construction duration of approximately 4 years.

8.3.8 Option 3 also passes through the Derwent Valley Mills World Heritage Site but takes a less direct indicative route than Option 2 and therefore results in higher capital costs at £299m but a similar forecast construction duration of approximately 4 years.

8.3.9 Options 4 and 5 are likely to comprise overhead line technology throughout and show relatively similar indicative route lengths, and therefore estimated costs are relatively comparable (approximately £231m and £243m, respectively). Both construction durations are estimated at approximately 3 years.

8.3.10 Option 6 shares areas of commonality with Options 4 and 5 and would likely also comprise an overhead line throughout; however, it has the longest indicative route length spanning further eastwards, resulting in the highest estimated cost of these three options at £265m together with a longer anticipated programme with an indicative construction duration of 3 years, 3 months.

8.4 Conclusion

8.4.1 Several end-to-end-connection refined corridor options were analysed on cost and programme alongside and following the technical and environmental appraisals as part of the decision-making process.

8.4.2 From end to end, the cost variance across all refined corridor options was estimated at approximately £231m to £486m. The cost variance was primarily driven by the use of underground cables for end-to-end options and by the overall route length of each end-to-end connection. The variance of the indicative construction duration (and ultimately 'in-service date') was also primarily driven by the construction of underground cables. The activity duration (per km) of an underground cable installation is far greater than that of an overhead line.

8.4.3 Option 4 presents the lowest indicative cost and quicker delivery timescales, as it follows a largely direct route whilst avoiding major engineering constraints and the use of underground cables.

8.4.4 The reduction in delivery timescales results in:

- Opportunity for earlier connection of renewable generation and reinforcement of the electricity network.
- Reduction in constraint charges due to an earlier increase in boundary (B8) transfer capability. (This is where power generators are compensated for not being able to physically transfer power from one region to another because of physical constraints on the network.)
- Reduction in the carbon impact of UK energy generation, based on facilitating earlier connections of renewable generation.
- Reduction in the duration that the environment and communities would be impacted.

9. Option Selection

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9. Option Selection

9.1 Introduction

9.1.1 Following the Options Appraisal phases (presented in Chapter 6 and Chapter 7), the appraisal findings for the refined corridors and their individual sections were reviewed by the Project Team considering environmental and socio-economic aspects, as well as cost and technical aspects (presented in Chapter 8).

9.1.2 The refined corridors were not considered as whole end-to-end corridors for the purposes of the comparative evaluation of options. Some of the refined corridors have constraints which are unavoidable, such as the Peak District National Park present in Corridor 1, and the Derwent Valley Mills World Heritage site present in Corridors 2 and 3, whilst some of the refined corridors have localised constraints which may be avoided through alternative routeing opportunities (i.e. linking sections of different refined corridors). The presence of certain localised constraints within specific sections of some of the refined corridors also resulted in a need to perform a comparative analysis of areas within those sections, in order to determine which onward sections remained feasible options after avoiding key constraints. Therefore, a combination of sections of refined corridors, rather than a single refined corridor, was used to identify the emerging preferred corridor to route between Chesterfield Substation and Willington Substation. The sections and their key constraints were broadly appraised from north to south within the Study Area and considered in a logical stepwise manner at key decision points, as described below:

- Step 1 – Determining the Viability of Western Options and Routeing out of Chesterfield Substation.
- Step 2 – Determining the Routeing South to Oakerthorpe.
- Step 3 – Determining the Routeing around Ripley and Other Settlements.
- Step 4 – Determining the Routeing around Denby Bottles and Other Settlements.
- Step 5 – Determining the Routeing around Derby to Willington Substation.
- Step 6 – End-to-End Solution.

9.1.3 This chapter presents the factors considered to influence the decision-making process for determining the emerging preferred corridor. The emerging preferred corridor was ultimately identified having regard to relevant National Planning Policy and NGET's statutory duties. On balance, the emerging preferred corridor was considered to provide the most appropriate overall solution in light of the environmental, socio-economic, engineering, cost and technical constraints present within the refined corridors and their sections.

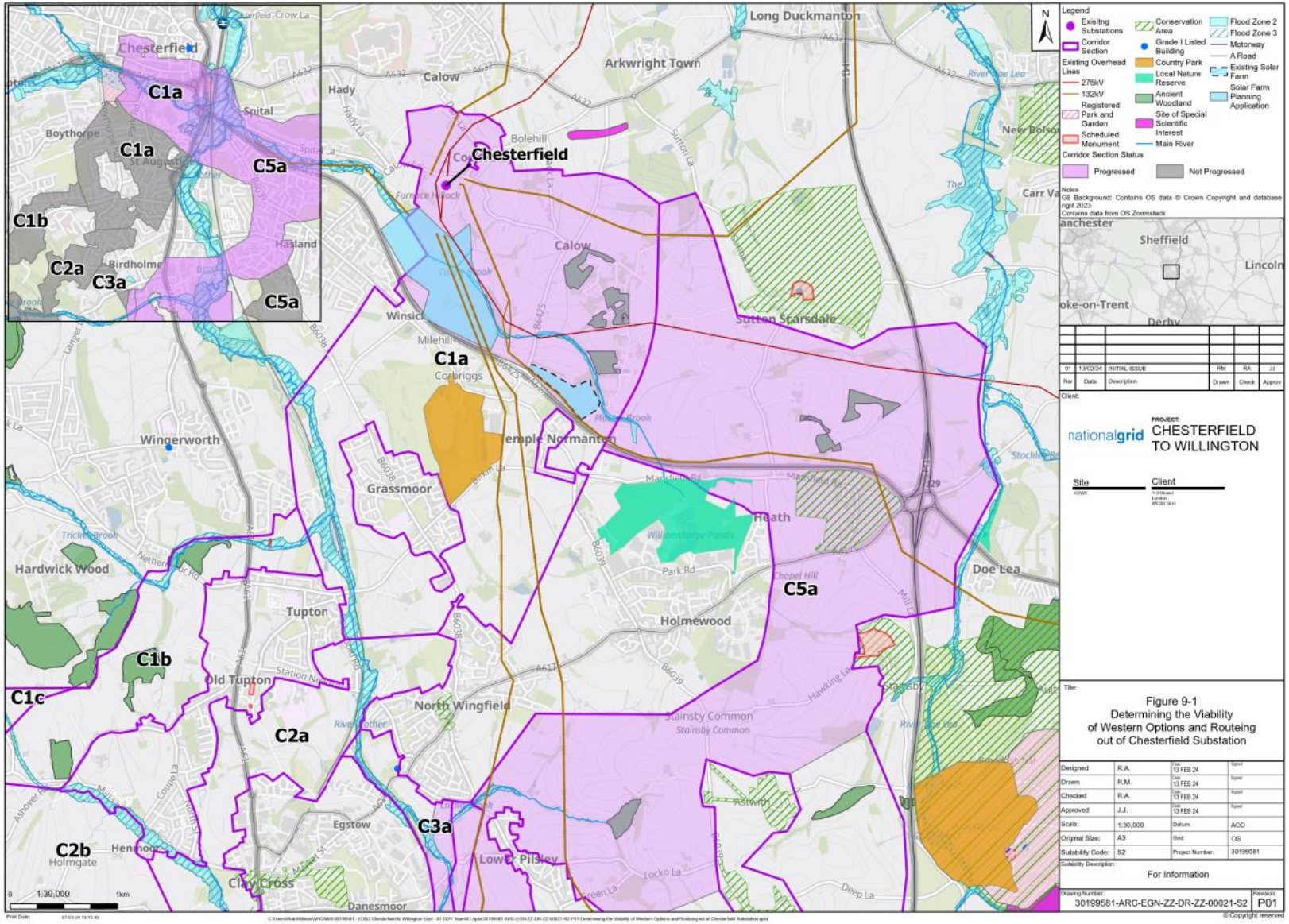
9.1.4 As the design progresses, regular reviews will be undertaken to ensure the emerging preferred corridor taken forward at this stage is still the optimum corridor when all applicable aspects are considered.

9.2 Step 1 – Determining the Viability of Western Options and Routeing Out of Chesterfield Substation

9.2.1 Step 1 considered the viability of selecting an option in the western side of the Study Area for routeing south towards Derby, and in doing so also considered the preferred option for routeing out of Chesterfield Substation. The analysis focused on the major areas of highest amenity value present in Corridors 1 and 2 in particular, and the presence of immediate constraints within Section C1a, which is a pre-requisite section of any emerging preferred corridor.

9.2.2 The key constraints considered in Step 1 are shown in Figure 9-1. Larger format versions of the figures presented in Chapter 9 are found in Appendix A.

Figure 9.1 – Step 1 – Determining the Viability of Western Options and Routeing Out of Chesterfield Substation



Comparative Appraisal

9.2.3 The analysis undertaken in Step 1 initially focused on the overarching principle of whether an option utilising the majority of Corridors 1 and 2 (i.e. to the western side of the Study Area) was preferred for routeing south towards Derby, or alternatively if an option utilising the majority of Corridors 3, 4, 5 or 6 was preferred (i.e. within the central and/or eastern side of the Study Area).

9.2.4 The primary consideration in determining this preference was founded on an assessment of the key constraints present in Corridors 1 and 2 between Chesterfield and Derby, namely the major areas of highest amenity value identified in the options appraisal phases. With respect to Corridor 1, the presence of the Peak District National Park as an area of national importance was ultimately determined to be a feature which should be avoided (in alignment with Holford Rule 1), with other options available that provided a viable alternative end-to-end solution. Further, the indirect nature of Corridor 1 and additional route length was considered to offer relatively poor alignment with Holford Rule 3 in comparison to other options. Corridor 2 contains a significantly environmentally constrained swathe extending from Holloway in a south-easterly direction towards Belper, including several areas of ancient woodland, Conservation Areas, clusters of listed buildings, and – most notably as a major area of highest amenity value and international importance – potential crossings of the Derwent Valley Mills World Heritage Site. Based on this, and in alignment with Holford Rules 1 and 2, it was determined that these constraints should be avoided, given the availability of other viable alternatives.

9.2.5 As a result of this initial analysis, it was determined that Section C1c of Corridor 1 should not be progressed, representing the relatively long section which also crosses the Peak District National Park. Furthermore, Sections C2c, C2d, C2e and C2f were also discounted from further consideration, given their interaction with the significantly environmentally constrained swathe previously identified, including the Derwent Valley Mills World Heritage Site.

9.2.6 At this point, Sections C1b, C2a and C2b remained in consideration, as despite the majority of Corridors 1 and 2 being discounted, these sections offered potential links from Section C1a (containing Chesterfield Substation) south towards Corridor 3. Similarly, Sections C1d, C1e, C1f and C1g (containing Willington Substation), as well as Section C2g, remained in consideration as these sections could potentially form part of an emerging preferred corridor around the west side of Derby connecting from Corridor 3. Whilst it was acknowledged at this stage that Corridor 3 also contained the Derwent Valley Mills World Heritage Site in Sections C3g and C3h (providing connectivity to the remaining southern sections of Corridors 1 and 2), it was decided this would be considered in a comparative evaluation in a future step (Step 5 below) so as not to preclude the possibility of routeing for the emerging preferred corridor to the west immediately around Derby.

9.2.7 The analysis in Step 1 then focused on the preferred route out of Chesterfield Substation, with two potential options. The first option was to route south west out of Chesterfield Substation to reach Corridor 3, either via Sections C1b/C2a and C2b to Section C3b, or via Section C2a to Section C3a. The second option was to route south east out of Chesterfield Substation to reach Corridor 5 (Section C5a).

9.2.8 Section C1a is more populated to the south of the A617, as it includes the settlements of Grassmoor (which represents a constraint across a large portion of the section in this location) and Temple Normanton, whilst the settlements of Wingerworth, Tupton, North

Wingfield and Holmewood all encroach upon the edges of this section. There is also an area of land, 'The Avenue', allocated as a strategic site for mixed use development (North East Derbyshire Local Plan, 2014-2034) to the immediate east of Wingerworth that extends into Section C1a. The presence of Grassmoor Country Park and South Chesterfield Golf Club between Grassmoor and Temple Normanton also represent large constraints within the middle of the section in this location. Furthermore, there is a large solar farm which has been granted planning permission (Hasland Solar Farm) adjacent to Hasland and Winsick. This solar farm would represent a constraint to options seeking to extend south immediately out of Chesterfield Substation. In addition, any options seeking to utilise either Sections C1b or C2a from Section C1a would require routeing through a more built-up area from Wingerworth south to Clay Cross.

9.2.9 Section C1a is less constrained moving east and to the north of the A617 with a notable absence of larger settlements, recognising there is a cluster of residences to the east of Hassocky Lane near Sutton Springs Wood. Existing linear infrastructure including overhead lines extends southeast from Chesterfield Substation, which may potentially be followed by a new overhead line, and the A617 extends out to the east towards Corridor 5 (via Section C5a). There are areas of ancient woodland clustered within the middle of the section in this location, which may be avoided through appropriate routeing, whilst there is also an existing solar farm adjacent to the A617 north of Temple Normanton, where further assessment is required.

9.2.10 Overall, it was considered that an option which seeks to extend south east out of Chesterfield Substation to the north of the A617 would comprise part of the emerging preferred corridor. This avoids the significantly constrained southern part of Section C1a and any potential link through Sections C1b and C2a which contain several residential areas and pinch points, whilst it traverses an area where there is also existing linear infrastructure including overhead lines and the A617. It is considered that the amount of underground cabling required for the 400kV route would be limited in comparison to an option to the southwest of Chesterfield Substation, whilst it may also be possible to avoid existing constraints such as the areas of ancient woodland through appropriate routeing in this section. The development of the Hasland Solar Farm will be monitored and assessed as the Project progresses through further design phases.

9.2.11 As a result of selecting the northern portion of Section C1a out to the south east of Chesterfield Substation, Corridor 5 (via Section C5a) was also progressed. Therefore, Sections C1b, C2a and C2b were not progressed.

Summary of Decision

Sections Progressed

Section C1a

9.2.12 Section C1a is a pre-requisite section of the emerging preferred corridor as it includes Chesterfield Substation. Specifically, an eastern corridor out of Section C1a was progressed through the northern portion of this section.

Section C5a

9.2.13 Corridor 5 (via Section C5a) was progressed as the next available section that can be linked to from the eastern part of Section C1a.

Sections Not Progressed

Section C1b; C1c; C2a; C2b; C2c; C2d; C2e; C2f

9.2.14 Sections C1c, C2c, C2d, C2e and C2f were not progressed in order to avoid the major areas of the highest amenity value present in those corridors (i.e. the Peak District National Park in Section C1c and Derwent Valley Mills World Heritage Site in Sections C2c to C2f).

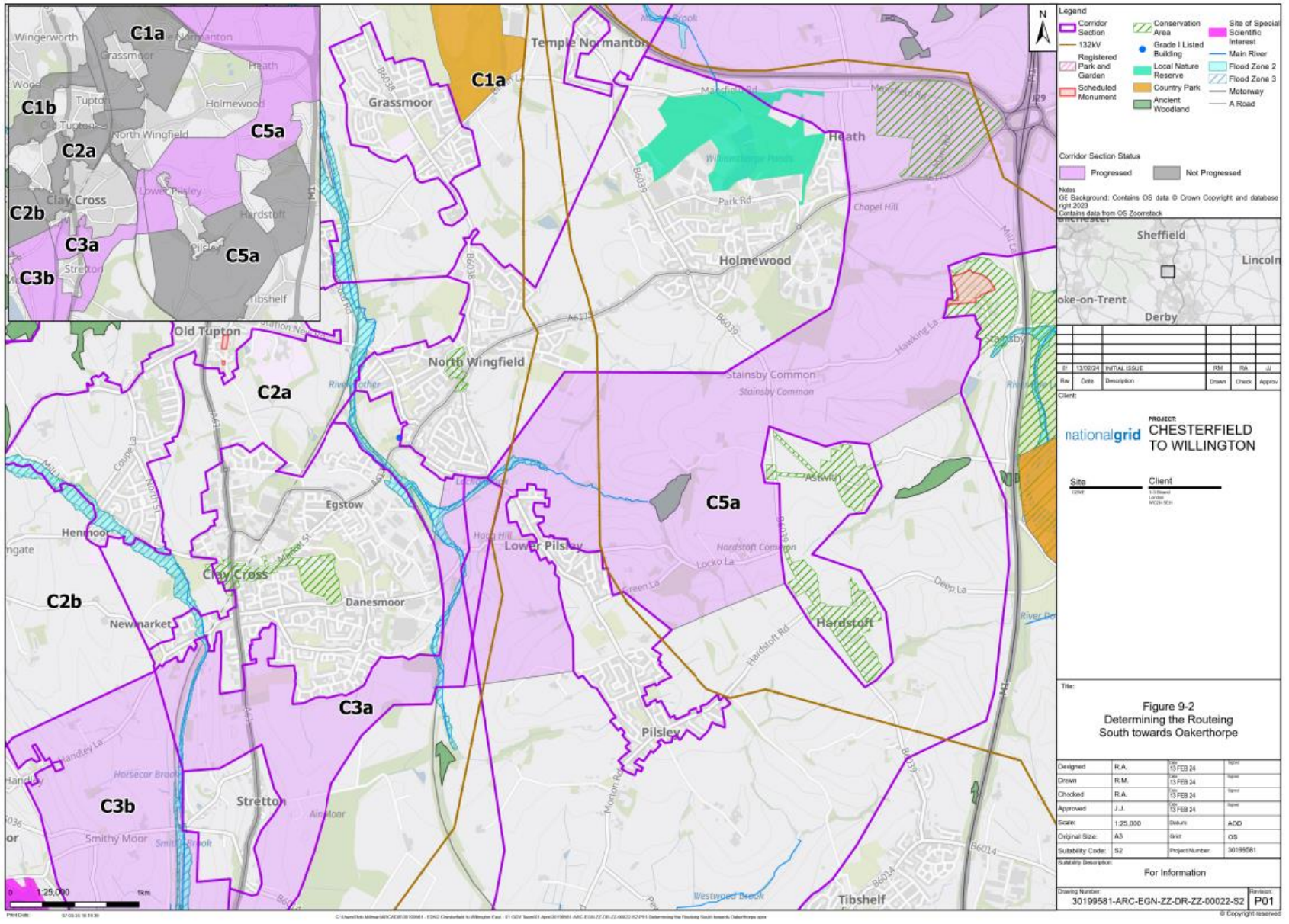
9.2.15 The southern portion of Section C1a was not progressed owing to the immediate constraints present in this portion of the section, and the need to route through more built-up areas in Sections C1b and C2a in particular. Sections C1b and C2a, and therefore also Section C2b, were not progressed.

9.3 Step 2 – Determining the Routeing South Towards Oakerthorpe

9.3.1 Step 2 considered the preferred option for a path south towards Oakerthorpe, given this settlement is in the northern part of Section C3c, which represents the confluence of the two possible options linking to it. The two possible options are either to utilise the full extent of Corridor 5 (Section C5a) in a south-westerly direction directly towards Oakerthorpe, or to traverse in a westerly direction south of Clay Cross to link to Corridor 3 at Section C3a and then onward to Section C3b. The analysis of Corridor 5 (Section C5a) therefore broadly focused on a comparative appraisal of the areas broadly north and south of the settlements of Hardstoft and Pilsley, as this represents a defining point at which the two options diverge.

9.3.2 The key constraints considered in Step 2 are shown in Figure 9.2

Figure 9.2 – Step 2 – Determining the Routeing South Towards Oakerthorpe



Comparative Appraisal

9.3.3 The northern part of Corridor 5 (Section C5a) around the settlement of Heath contains areas of ancient woodland, several listed buildings and the Heath Village Conservation Area, all of which may be avoided with appropriate routeing. Other linear infrastructure including roads and existing overhead line infrastructure would need to be crossed in this location, with the M1 motorway representing a defining feature at the eastern extent of the section.

9.3.4 Moving in a southerly direction from this point around Holmewood, from a landscape and visual perspective it was determined that turning in a westerly direction towards Clay Cross and Section C3a would be preferred to continuing in a southerly direction, owing to the area around the east of Astwith and Hardstoft being situated on a more exposed upland ridge, with the potential for visual impacts associated with an overhead line. Ultimately, this was determined to be a key factor in remaining north of Hardstoft and Pilsley within Corridor 5 (Section C5a). It was considered that avoiding the potential visual impacts associated with crossing the exposed upland ridge on balance outweighed the technical challenges associated with finding a path between the settlements of North Wingfield and Lower Pilsley, or Lower Pilsley and Pilsley, where it is considered that an appropriate path can be found. Traversing to the west at this point within Corridor 5 (Section C5a) instead of due south past Astwith and Hardstoft may also facilitate a path which is located further away from Stainsby, including the fields used for Stainsby Festival at the eastern edge of the corridor, the Stainsby-defended manorial complex including site of chapel and Stainsby Conservation Area adjacent to the eastern boundary of the section, as well as Hardwick Hall Registered Park and Garden, and Hardwick and Rowthorne Conservation Area further to the east.

9.3.5 In addition, by maintaining a path that traverses towards Section C3a, the southernmost extent of Corridor 5 (Section C5a) immediately north of Alfreton is avoided. This general area contains potential constraints including a sewage treatment plant, the Meadow Lane Solar Farm, and a proposed residential development west of Chesterfield Road. An existing NGED substation north of the Alfreton sewage treatment plant and potential wirescape associated with the presence of several existing overhead lines is also avoided.

9.3.6 As a result of the appraisal and preference to find a path in a westerly direction towards Clay Cross, Corridor 3 (via Section C3a) was progressed as the only available section that can be linked to in this way from Corridor 5 (Section C5a). As described in more detail in Step 3 below, the onward opportunities of utilising the River Amber Valley through Section C3b was also considered to be an advantage of choosing a path that includes Section C3a, as it affords the possibility of following existing linear infrastructure and vegetation which may mitigate potential visual impacts of an overhead line.

9.3.7 The result of the appraisal therefore meant that in addition to Section C3a, Sections C3b and C3c were progressed as the only available sections that can be linked to within Corridor 3 moving south from Section C3a.

Summary of Decision

Sections Progressed

Sections C3a, C3b and C3c

9.3.8 Section C3a was progressed as the available direct link in a westerly direction from the northern portion of Corridor 5 (Section C5a). As such, Sections C3b and C3c must also be progressed as the only available links south within Corridor 3 from Section C3a.

Sections Not Progressed

None Additional

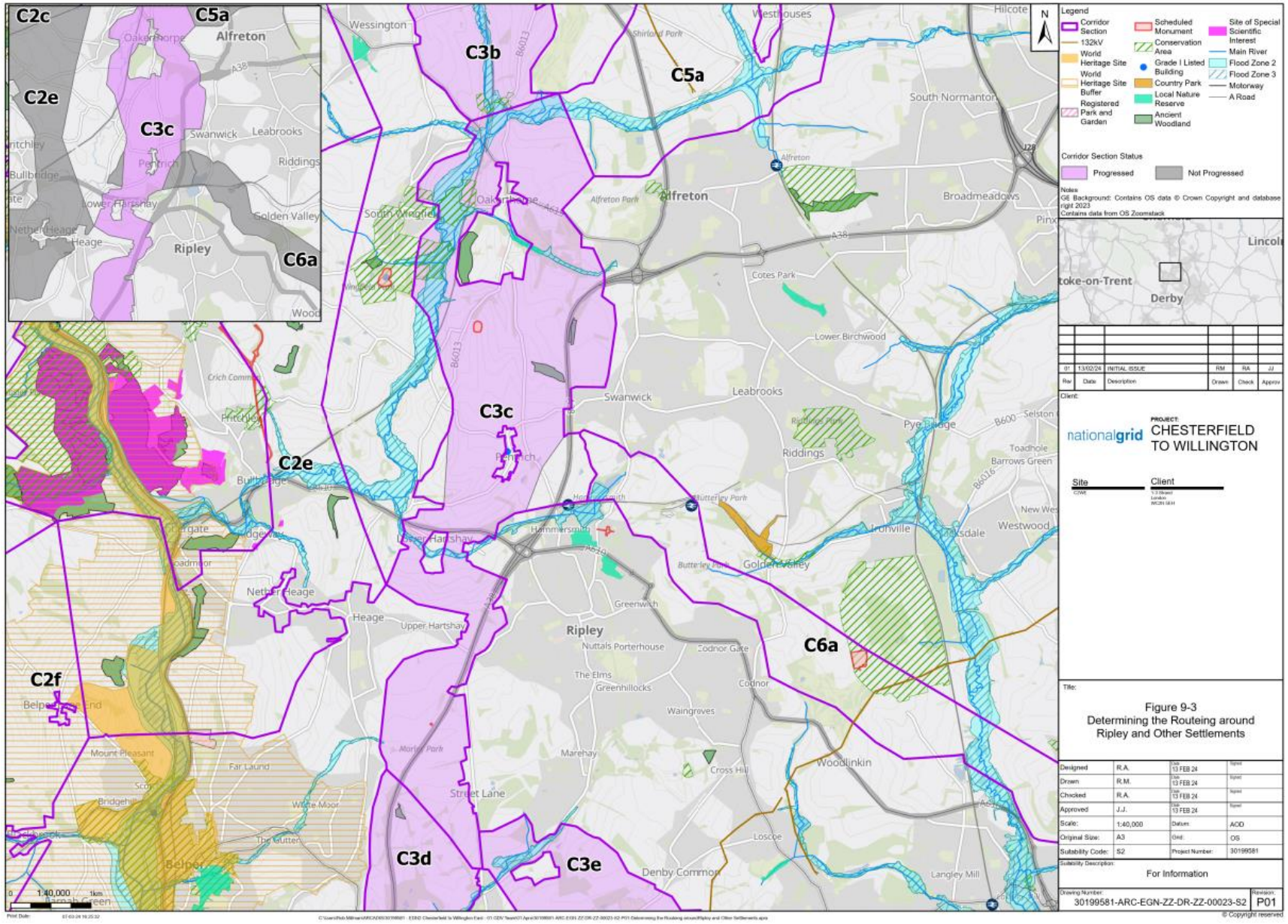
9.3.9 The southern portion of Section C5a was not progressed based on the aforementioned appraisal. No additional sections were removed from consideration at this step.

9.4 Step 3 – Determining the Routeing Around Ripley and Other Settlements

9.4.1 Step 3 considered the preferred option for a path around Ripley, given this represents the point at which two possible options extend around Ripley and other settlements including Heanor, Eastwood, Kimberley and Ilkeston further south. The two possible options are either to utilise further sections within Corridor 3 (via the remainder of Section C3c onward) in a southerly direction between Ripley and Belper, or to traverse in a southeasterly direction towards Nottingham and the eastern extent of the Study Area via the longer Corridor 6 (Section C6a). The analysis in Step 3 therefore focused on a comparative appraisal of the remainder of Section C3c and Section C6a.

9.4.2 The key constraints considered in Step 3 are shown on Figure 9.3.

Figure 9.3 – Step 3 – Determining the Routeing Around Ripley and Other Settlements



Comparative Appraisal

9.4.3 The northern part of Corridor 3 (Section C3a) traverses around the south of Clay Cross and allows for optionality to the north or south of Stretton as it turns south to enter Section C3b. There may be a need for multiple crossings of road and rail infrastructure through the transition between Section C3a and C3b, but Section C3a is otherwise lacking many other environmental and socio-economic constraints, avoiding the existing solar farm to the south. Section C3a is close to residential properties at the southern edge of Clay Cross but is considered to allow a sufficient distance to minimise potential impacts. The northern option around Stretton sits on a less pronounced ridge than the southern option but would require routeing within closer proximity to the Ogston Reservoir SSSI (located outside the corridor to the west) upon its entry to Section C3b. The southern option represents a shorter option in length and is a more direct route southward to Section C3b.

9.4.4 Moving in a southerly direction through Section C3b, the corridor broadly follows the Amber River valley, which is sparsely populated and where the presence of the railway, tree groups and field boundary vegetation may mitigate the potential visual impacts of overhead lines in alignment with Holford Rule 4. Section C3b avoids several constraints outside its eastern boundary, including the Higham Old Village Conservation Area and cluster of listed buildings in this location, Hallfield Gate Conservation Area, Shirland Golf and Country Club and future residential development in Higham and Shirland. Around the transition to Section C3c, the section is more constrained by a cluster of listed buildings in the corridor, as well as the Amber Mill and Toad Hole Conservation Area to the north of Oakerthorpe, which may be avoided through appropriate routeing. Flood Zones 2 and 3 associated with the River Amber are present in this area, and potential impacts may be mitigated through standard measures.

9.4.5 As the corridor enters Section C3c, it splits to provide optionality to the west and east of Oakerthorpe. To the west, the corridor is more constrained from an environmental perspective owing to the presence of the South Wingfield Conservation Area and the River Amber and associated Flood Zones 2 and 3 across the entire width, where crossings of these features would be unavoidable. There is also a cluster of listed buildings that may be avoided through appropriate routeing. To the east of Oakerthorpe, the corridor is less constrained from an environmental and socio-economic perspective, although it includes Alfreton Golf Club which would be unavoidable to cross, as well as the Oakerthorpe LNR and an area of ancient woodland which may be avoided through appropriate routeing. Construction is underway for a mixed-use development on Lily Street Farm Way, immediately east of the A38 within the eastern edge of the corridor; however, it is considered possible to avoid this through appropriate routeing. Section C3c is relatively sparsely populated; and optionality is also provided through Section C3c to route either to the west or east of both Pentrich and Lower Hartshay as the corridor passes west of Ripley.

9.4.6 The key decision point impacting the identification of an emerging preferred corridor from Section C3c is whether to continue through Corridor 3 in a southerly direction between Ripley and Belper to Section C3d and C3e, or to utilise Corridor 6 (Section C6a) as an alternative path around this constrained area and back again to ultimately reach the eastern side of Derby at Corridor 4 (Section C4a). Both options avoid settlements including Ripley, Heanor, Eastwood, Kimberley and Ilkeston, with Corridor 6 (Section C6a) representing a less direct option.

9.4.7 Through the remainder of Section C3c south of Lower Hartshay, there is the potential to route adjacent to the A38 towards Denby Bottles, whilst the section is also relatively sparsely populated and less constrained by areas of higher amenity value, also offering a more direct route south towards Derby in line with the Holford Rules 2 and 3.

9.4.8 In comparison, whilst Corridor 6 (Section C6a) is also relatively sparsely populated and provides some potential advantages such as the potential to route adjacent to the M1 motorway along its southern extent, it represents a longer extension out towards Nottingham and the eastern edge of the Study Area and back again towards Derby in a much more indirect manner than following Corridor 3. In addition, pinch-points considered extremely technically constrained were also identified in multiple areas (including between Woodlinkin and Ironville, Nuthall and Bulwell, Trowell and Stapleford, and Stanton-by-Dale and Sandiacre), which would have significant socio-economic impacts should a routeing option be progressed via Corridor 6 (Section C6a). Based on the above factors, consideration of its associated cost and relatively poor alignment with Holford Rule 3, it was determined not to progress Corridor 6 (Section C6a).

9.4.9 As a result, a continuation of Section C3c further south was progressed, meaning that Corridor 6 (Section C6a) was not progressed. Two areas of Section C3c were removed from the emerging preferred corridor at this stage: at its western edge to the west of Pentrich, and at its eastern edge to the east of Pentrich, where it links to Section C6a. Neither of these areas was considered to be required as part of an emerging preferred corridor that continued directly south through Section C3c towards Lower Hartshay, as utilising these areas would require indirect routeing.

Summary of Decision

Sections Progressed

None Additional

9.4.10 A continuation of Section C3c, which already comprised part of the emerging preferred corridor, was primarily progressed owing to the more direct route it offers south towards Derby in alignment with Holford Rule 3.

Sections Not Progressed

Section C6a

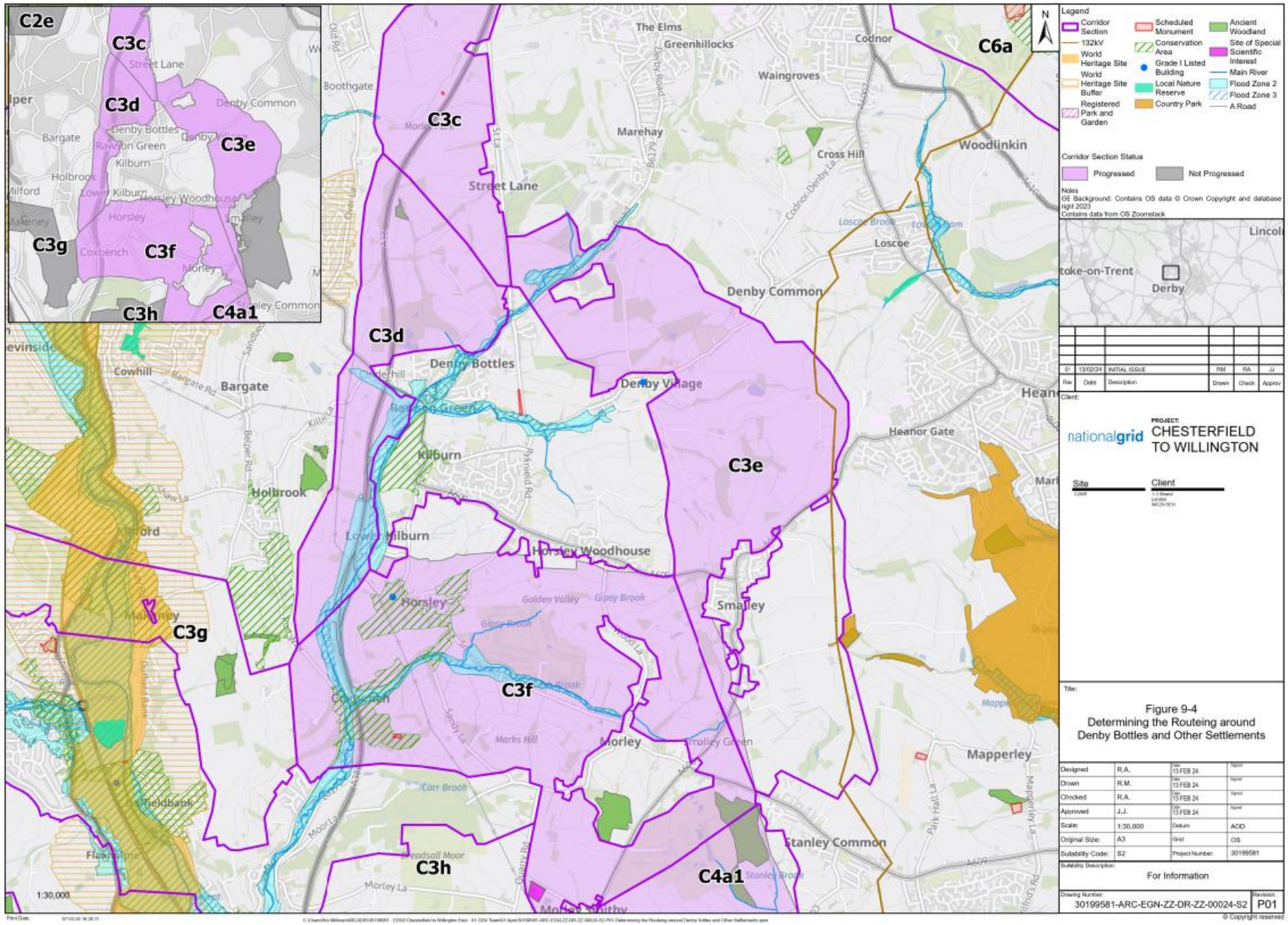
9.4.11 Section C6a was removed from consideration at this step, primarily owing to its more indirect routeing out towards Nottingham and back towards Derby, which is less aligned with Holford Rule 3.

9.5 Step 4 – Determining the Routeing Around Denby Bottles and Other Settlements

9.5.1 Step 4 considered the preferred option for a path around Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse. The two possible options are either to utilise Section C3d to the west of these settlements, or to traverse to the east of these settlements utilising Section C3e. The analysis in Step 4 therefore focused on a comparative appraisal of Sections C3d and C3e.

9.5.2 The key constraints considered in Step 4 are shown on Figure 9.4.

Figure 9.4 – Step 4 – Determining the Routeing Around Denby Bottles and Other Settlements



Comparative Appraisal

9.5.3 The eastern option (Section C3e) includes a high concentration of mine entrances representing a potential ground risk requiring further detailed assessment. From a landscape and visual perspective, the eastern option also rises onto higher land and is therefore more exposed, crossing a number of ridges. Section C3e provides optionality to route either to the west or east of Smalley. The narrower gap between Horsley Woodhouse and Smalley also represents a constraint where it meets Section C3f as it is within close proximity to residences at the edges of both settlements, whilst it may be similarly constrained around the eastern edge of Smalley between Heanor. The potential selection of Section C3e as part of the emerging preferred corridor would seek to avoid the portion of the section to the east of Smalley, given it may be unavoidable to cross the cluster of residences in this area along the A608. Section C3e is otherwise relatively wide and unconstrained in comparison to other sections.

9.5.4 The western option (Section C3d) represents a lesser potential ground risk and from a landscape and visual perspective affords the potential to route adjacent to the A38 and tree groups running through the valley, as well as the presence of existing overhead lines. Section C3d also provides a potentially more direct route south from Section C3c in line with Holford Rule 3. Flood Zones 2 and 3 are present through a large portion of Section C3d but may be largely avoided through appropriate routeing and/or standard mitigation measures. It should be noted that at the time of writing, there is an outline planning application submitted for an employment and residential development on land immediately north of Denby Bottles to the east of the A38 that may require further consideration if potential routeing alignments through Section C3d are developed. Section C3d avoids the Kilburn Conservation Area (located outside the eastern boundary of the section) and Holbrook Conservation Area (located outside the western boundary).

9.5.5 Overall, it was determined that further detailed assessment of Sections C3d and C3e is warranted to select a preferred option around this settlement cluster, given both sections have constraints and opportunities. In either scenario, a link to Section C3f is a requirement to either continuing in a westerly direction along the remainder of Corridor 3 via Sections C3g or C3h, or to traverse in a southerly direction along Corridor 4 via Section C4a1, which are the options appraised in the next step (Step 5). In addition to the aforementioned removal of the portion of Section C3e to the east of Smalley, an area of Section C3f was removed from the emerging preferred corridor at this stage, at its northern edge immediately south of Kilburn and east of Lower Kilburn. This area was not considered to be required as part of an emerging preferred corridor that entered Section C3f from either Section C3d or C3e and continued further south towards Morley, as utilising this area would require indirect routeing.

Summary of Decision

Sections Progressed

Sections C3d, C3e and C3f

9.5.6 Sections C3d and C3e were both progressed for further assessment as both present constraints and opportunities for routeing. As such, Section C3f must also be progressed as the only available section that can be linked to from both sections.

Sections Not Progressed

None Additional

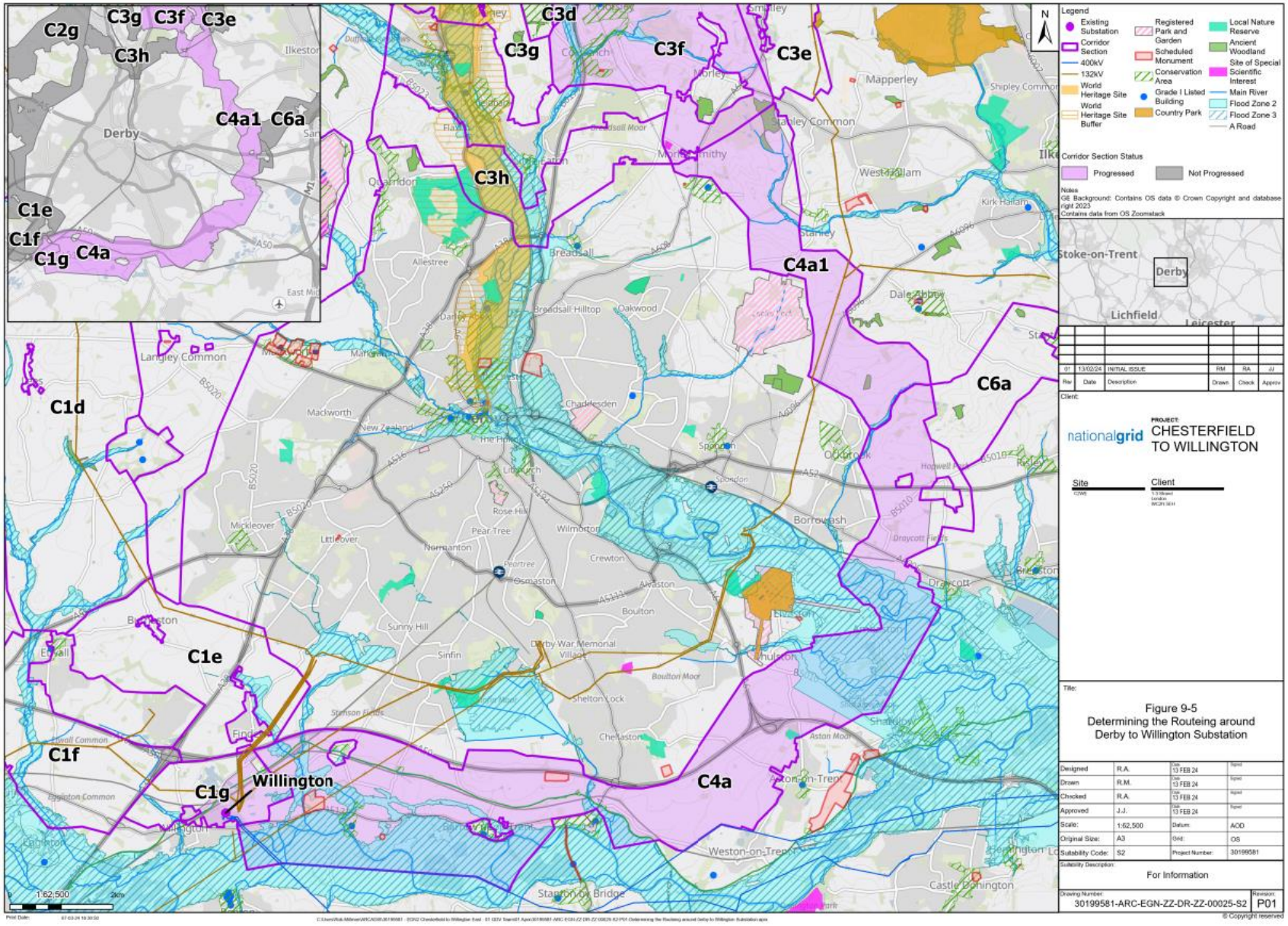
9.5.7 No additional sections were removed from consideration at this step.

9.6 Step 5 – Determining the Routeing Around Derby to Willington Substation

9.6.1 Step 5 was the final step in the option selection process and considered the preferred path for routeing around Derby from Section C3f. This is a key decision point in identifying an emerging preferred corridor, given it fundamentally determines whether southern sections of Corridors 1, 2 and 3 are to be utilised around the west of Derby, or if Corridor 4 is to be utilised around the east of Derby. The analysis during Step 5 therefore focused on a comparative appraisal of the remaining sections offering paths to either the west or east of Derby into Willington Substation.

9.6.2 The key constraints considered in Step 5 are shown in Figure 9.5.

Figure 9.5 – Step 5 – Determining the Routeing Around Derby to Willington Substation



Comparative Appraisal

9.6.3 Section C3f provides links to the remainder of Corridor 3 via either Sections C3g or C3h. Section C3g is the more northerly of the two options and traverses in a relatively acute north-westerly direction away from Section C3f, notably crossing the Derwent Valley Mills World Heritage Site, Belper and Milford Conservation Area, an area of ancient woodland, Chevin Golf Course, and a cluster of listed buildings around Makeney. Section C3h is the more southerly of the two options and traverses initially in a south-westerly direction away from Section C3f, before turning north west again in a similarly acute manner through the gap between Little Eaton and the northern edge of Derby. Section C3h also crosses the Derwent Valley Mills World Heritage Site to the west of Little Eaton and Allestree Park LNR. Both sections largely avoid the settlements of Duffield and Duffield Bank located between the sections; however, the settlements of Makeney and Little Eaton extend into the corridor at Sections C3g and C3h respectively in narrower parts of those sections. The settlements of Horsley and Coxbench, including their respective Conservation Areas, also represent constraints on the western side of Section C3f, but may be avoided through appropriate routeing, as well as Horsley Lodge golf course in the middle of the section.

9.6.4 At its southern extent, Section C3f also provides a link to Corridor 4 via Section C4a1. The approach to Section C4a1 is relatively constrained by the settlement of Morley, where Section C3f provides optionality to either the west or east of the settlement. There is a relatively large area of ancient woodland located on the boundary of Section C3f and Section C4a1 on the eastern side which may be unavoidable. This area is also constrained by the presence of Morley Hayes Golf Club, where a crossing may be unavoidable if a route were to enter this area from Section C3e and the eastern side of Section C3f. It is possible to avoid the Morley Brick Pits SSSI and settlement of Morley Smithy near the boundary of Section C3h and Section C4a1 on the western side through appropriate routeing.

9.6.5 At this stage of Step 5, a provisional decision was made to avoid crossings of the Derwent Valley Mills World Heritage Site owing to its international level of significance, and in view of the provisional viable alternative route offered through Corridor 4 (in accordance with Holford Rule 1 and consistent with the rationale adopted in Step 1, when considering the emerging preferred corridor out of Chesterfield Substation). If carried forward, this decision would require discounting Sections C3g and C3h from further consideration, which would also eliminate the remaining feasible sections providing a path to the west of Derby and into Willington Substation from the west (i.e. Sections C2g, C1d, C1e and C1f). In order to confirm this decision, the suitability of Corridor 4 (via Sections C4a1 and C4a) as a viable alternative path to the east of Derby was further considered.

9.6.6 Section C4a1 is an otherwise relatively long, straight and sparsely populated section lacking many other environmental and socio-economic constraints, with the exception of the aforementioned area of ancient woodland at its entry from Section C3f, and a further area of ancient woodland at its southern end which may be avoided with appropriate routeing. Section C4a1 avoids the presence of several key constraints located outside its boundaries, including Morley Conservation Area, Locko Park Registered Park and Garden and several listed buildings to the west, and Stanley Conservation Area to the east.

9.6.7 Section C4a contains several listed buildings, some larger registered monuments (such as the Swarkestone Lows around barrow cemetery and part of an aggregate field

system), the Twyford Conservation Area and other constraints such as the Tarmac Swarkestone Sand and Gravel Quarry west of Barrow-upon-Trent, and part of the proposed Infinity Garden Village regeneration masterplan site adjacent to the A50, all of which may be avoided through appropriate routeing. Crossings of roads, rail, and the Trent and Mersey Canal Conservation Area may be unavoidable, whilst the presence of Flood Zones 2 and 3 covers a large portion of Section C4a between Draycott and Thulston, as well as in the southern portion of the section approaching Willington Substation. Notably, Section C4a avoids Elvaston Castle Registered Park and Garden, which is located north of the section boundary, as well as multiple Conservation Areas outside its eastern and southern boundaries, whilst also avoiding the Barrow-on-Trent Conservation Area by providing optionality to the north or south of this feature.

9.6.8 Further assessment will be required to determine the preferred routeing through Section C1g from the east to Willington Substation. By entering Section C1g from the east, potential impacts to the Mercia Marina are likely avoided, as well as plans for a future East Midlands Intermodal Park adjacent to the Toyota manufacturing plant; however, a route past the former Willington Power Station site would need to be considered. Section C1g is a pre-requisite section for any emerging preferred corridor given it includes Willington Substation.

9.6.9 Based on the preceding assessment of Corridor 4 (Sections C4a1 and C4a), it was determined that a path to the east of Derby and into Willington Substation from the east presented a viable alternative to utilising Sections C3g and C3h to find an onward path around the west of Derby and into Willington Substation from the west. The provisional decision to remove Sections C3g and C3h from further consideration was therefore confirmed, in line with the rationale previously used in developing the emerging preferred corridor in Step 1. As a result, Sections C2g, C1d, C1e and C1f were also not progressed.

9.6.10 Within Section c4a1, it was identified that refinements could be made to its eastern edge to remove two areas between Stanley Common and Stanley, which would remove a number of properties associated with these villages that would otherwise have required oversailing were a route to go through this area. To facilitate these removals, the middle component of the western boundary of c4a1 was extended minorly to the west. This slight westerly extension did not introduce any new, or change the analysis of the existing, environmental, socio-economic or technical constraints from the options appraisal for this section. In addition, the western portion of Section C1g to the west of Findern Lane/Willington Road was removed owing to the emerging preferred corridor entering Willington Substation from the east.

Summary of Decision

Sections Progressed

Sections C4a1, C4a and C1g

9.6.11 Section C4a1 was progressed as the preferred section to be linked to from Corridor 3 (Section C3f). As such, Sections C4a and C1g must also be progressed as the only available sections from Section C4a1 around the eastern and southern edge of Derby through to Willington Substation. Section C1g would be a pre-requisite section for any preferred emerging corridor given it contains Willington Substation, and in the emerging preferred corridor a route into Section C1g from the east is required.

Sections Not Progressed

Sections C3g, C3h, C2g, C1d, C1e and C1f

9.6.12 Sections C3g and C3h were discounted from further consideration, primarily owing to their crossings of the Derwent Valley Mills World Heritage Site, and the viability of an alternative route around the east of Derby using Corridor 4. As a result, any remaining available sections offering a western route around the edge of Derby were also not progressed, including Sections C2g, C1d, C1e and C1f as they would not be viable without utilising either Sections C3g or C3h, or previously discounted sections from Corridors 1 and 2. The western portion of Section C1g was not progressed, owing to the emerging preferred corridor entering Willington Substation from the east.

9.7 Step 6 – End-to-end Solution

9.7.1 Six refined corridors were previously identified (in Chapter 7) and divided into sections for appraisal to facilitate the identification of an emerging preferred corridor. Following the appraisal of the sections and links in isolation, an end-to-end solution review was then undertaken between Chesterfield and Willington Substations. This review considered each progressed section in the context of the wider end-to-end solution and ensured that the reasoning and justification for progressing one part of the emerging preferred corridor did not incorrectly impact on the decision made for the next section of the corridor. The wider end-to-end solution review also incorporated cost performance, as reported in Chapter 8.

9.7.2 To summarise, the emerging preferred corridor consists of the following sections:

- From Corridor 1: Section C1a, C1g.
- From Corridor 3: Section C3a, C3b, C3c, C3d, C3e, C3f.
- From Corridor 4: Section C4a1, C4a.
- From Corridor 5: Section C5a.

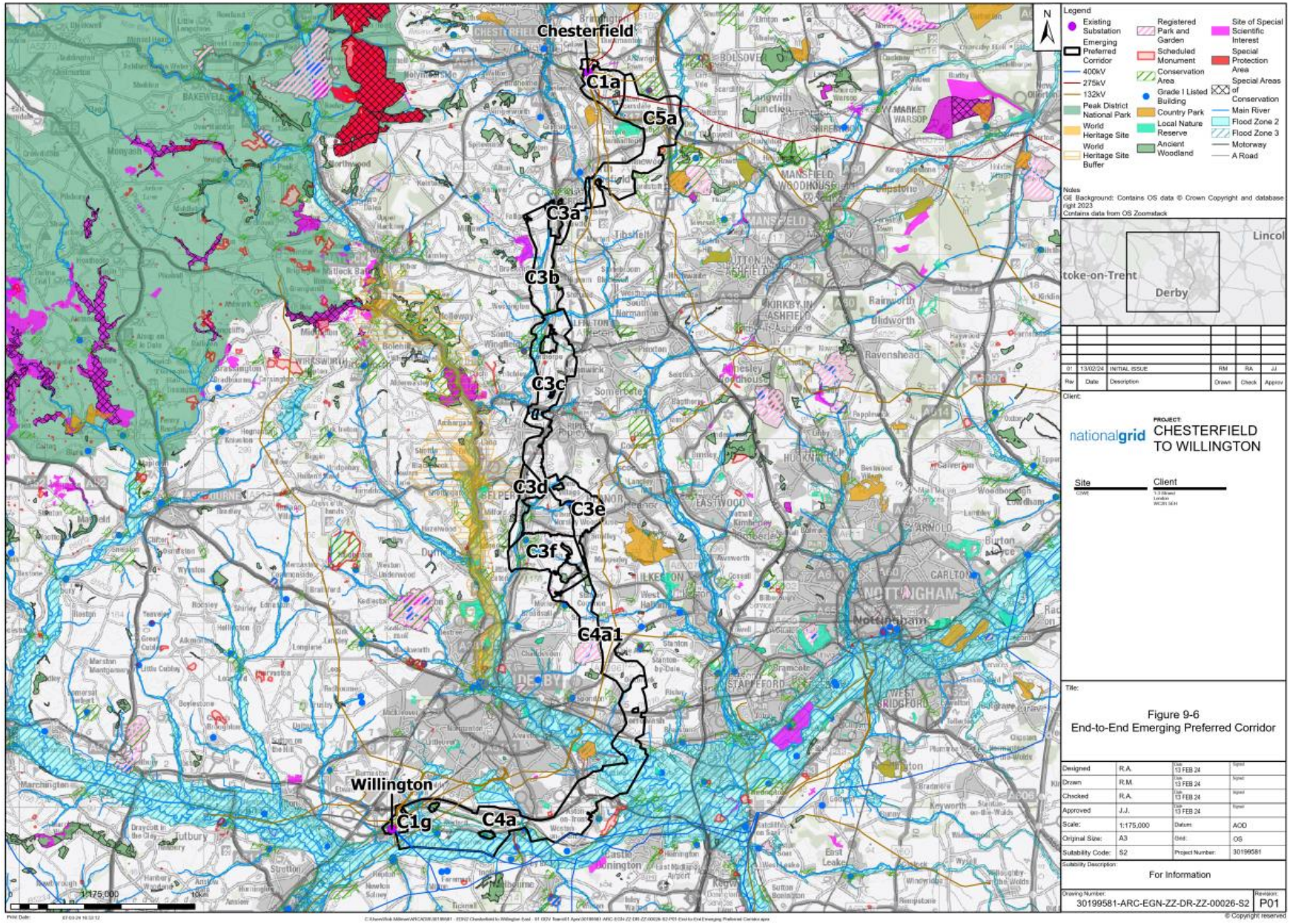
9.7.3 In sequential order from north to south, the emerging preferred corridor is as follows:

- Section C1a – from Chesterfield Substation east towards Section C5a.
- Section C5a – towards Heath and around the southern edges of Holmewood and North Wingfield to Section C3a.

- Section C3a – around the southern edge of Clay Cross to Section C3b towards Stretton.
- Sections C3b and C3c – south towards Denby Bottles.
- Sections C3d and C3e – around the cluster of settlements including Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse to Section C3f.
- Section C3f – south towards Morley to Section C4a1.
- Section C4a1 – towards Ockbrook around the north east of Derby to Section C4a.
- Section C4a – around the southern edge of Derby towards Willington Substation at Section C1g.
- Section C1g – connecting into Willington Substation from the east.

9.7.4 The end-to-end emerging preferred corridor is shown in Figure 9.6.

Figure 9.6 – End-to-End Emerging Preferred Corridor



10. Development of the Graduated Swathe

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10. Development of the Graduated Swathe

10.1 Introduction

10.1.1 Following the selection of the emerging preferred corridor, a preliminary design exercise was undertaken to identify where it may be more appropriate to locate the required infrastructure within the corridor (based on the information understood about the emerging preferred corridor at the time of writing this report). This exercise considered the Holford Rules and local sites and features to the extent feasible. This included features such as larger settlement areas, environmental and socio-economic constraints, and other technical and cost considerations. The outcome of this exercise is shown by 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 presented in this chapter, with larger format versions included in Appendix B.

10.1.2 The 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 design development of the Project. The development of the graduated swathe is a key component of the Options identification and selection phase prescribed in National Grid's Approach to Consenting, and allows for more meaningful engagement and consultation, prompting more beneficial feedback.

10.1.3 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 (lesser flexibility).

10.1.4 In some sections the graduated swathe forms two or more distinct paths, defined by local sites and features that may constrain the routeing of a new overhead line. In other places the graduated swathe follows a single path with the width varying dependent upon local sites and features and design principles, such as the preference to follow more direct routes where opportunities exist.

10.1.5 The outcomes of the analysis, as depicted in the graduated swathe, may be subject to change as the design and consenting process continues, more information becomes available, surveys are undertaken and the views of stakeholders and communities are considered. It does not rule out development within other parts of the emerging preferred corridor, or indeed outside of the emerging preferred corridor, if necessary, after considering these inputs.

10.1.6 As discussed in Chapter 3, detailed localised routeing of the new overhead line will follow the guidelines set out in the Holford Rules and other principles of good design. In order 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, cost, and socio-economic considerations and will seek to follow the holistic principles of good design.

10.2 Developing the Graduated Swathe

10.2.1 The development of the graduated swathe was informed by the location of sites and features within and beyond the emerging preferred corridor, which were identified from mapping and site visits to the emerging preferred corridor. The emerging preferred corridor was appraised to identify areas that may be more, or less, sensitive to the introduction of new infrastructure, then preliminary designs were developed to identify where a new overhead line may most appropriately be routed, designing in accordance with the Holford Rules whilst considering environmental and socio-economic features, and cost and technical requirements. Where the options appraisal identified potential opportunities for close parallel routes, this opportunity was considered in the development of the graduated swathe. As the Project design evolves, mitigation measures will be developed and assessed on a case-by-case basis.

Substations

10.2.2 The graduated swathe does not cover the Chesterfield Substation because the development of this is not within the scope of this Project, as explained in Chapter 2. However, it is shown for reference along with the existing Willington Substation because together they will form the start and end points of the Project. An indicative location for the existing Chesterfield Substation and the emerging location preference for the new substation is shown; however, the exact alignment and entry into Chesterfield Substation cannot be determined until the design and consent for the Brinsworth to High Marnham Project is further developed. This will be an iterative process whereby the location and design of the substation will influence the positions of the end-of-the-line connections, whilst in parallel the potential impacts of different options for the final section of line will be taken into account in the process of determining the substation configuration.

Avoidance of Properties

10.2.3 The removal of larger settlements from the corridors to the extent practicable was a key consideration of the refinement process from preliminary corridors to refined corridors (as detailed in Chapters 6 and 7). As a result, it is considered that potential impacts to many larger settlements and residential properties within such settlements have been avoided and/or minimised through this iterative process.

10.2.4 Despite this, there are some locations within the graduated swathe where smaller settlements remain. In such instances, these are included within the lighter shading of the graduated swathe to the extent practicable, indicating that they are less likely to be in areas where Project infrastructure is located.

10.2.5 Individual residential properties and their curtilages have not been removed from the graduated swathe at this stage of the Project, but their locations within the graduated swathe are known. As a guiding principle, the routeing of Project infrastructure will be designed to avoid potential impacts to residential properties and their curtilages wherever practicable. At this stage of the Project, the presence of individual residential properties within darker areas of shading in the graduated swathe is not a definitive indication that properties in these areas would be impacted by Project infrastructure.

10.2.6 There may be locations where a potential route could oversail the curtilage of a residential property. This would only be considered where such a route would result in a

better overall design outcome against other receptors or constraints, and through discussion with the potentially affected resident and landowner.

10.2.7 Further analysis regarding potential impacts to residential properties and appropriate mitigation measures will be undertaken as the Project progresses. However, as previously stated, it is anticipated that potential impacts to residential properties may be avoided through the appropriate routeing of Project infrastructure.

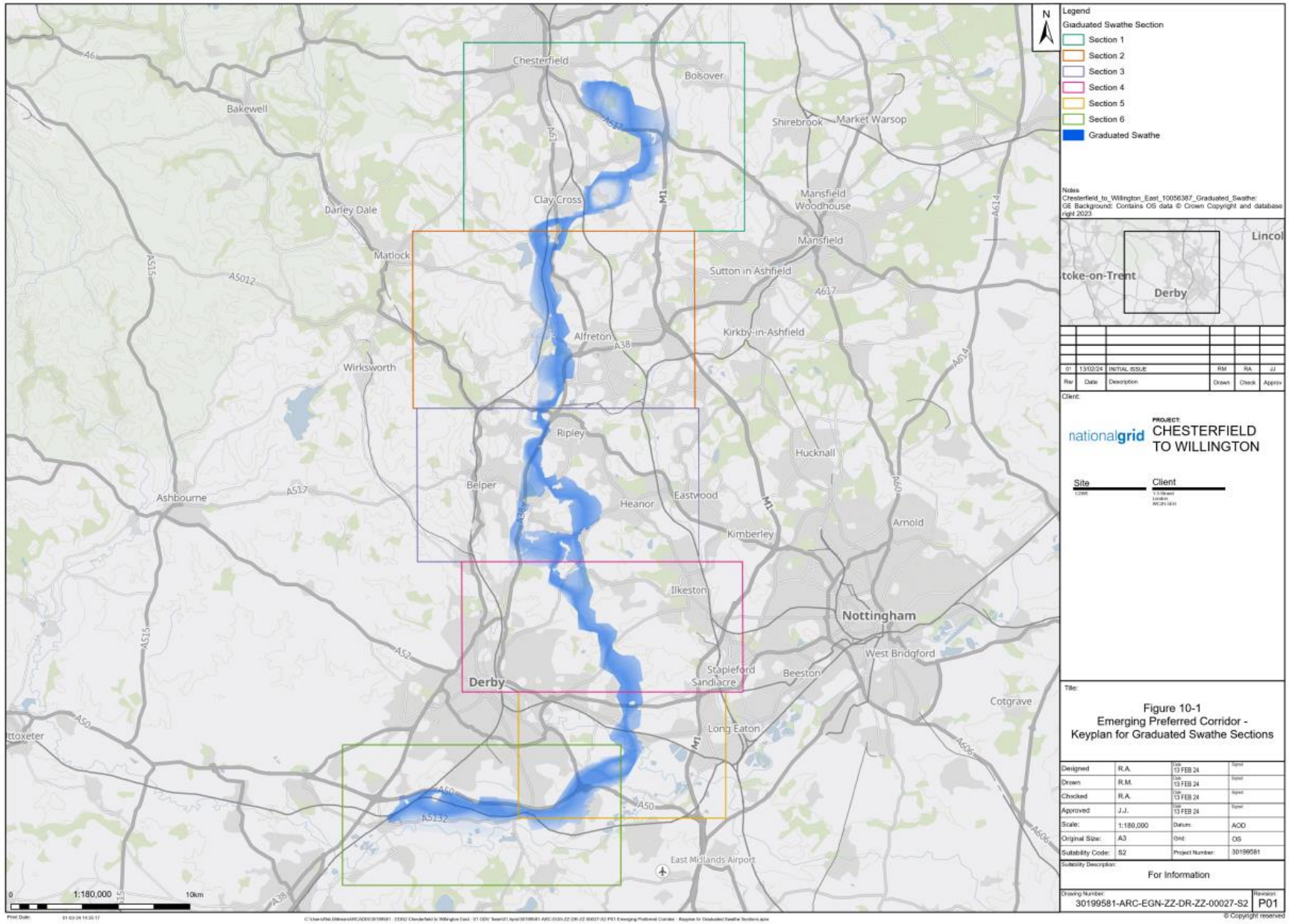
10.3 Description of the Graduated Swathe

10.3.1 For the purposes of non-statutory consultation, the graduated swathe has been split into six sections for analysis. The six sections are listed below and shown on Figure 10.1.

- Section 1: Chesterfield Substation to Stretton.
- Section 2: Stretton to Ripley.
- Section 3: Ripley to Morley.
- Section 4: Morley to Ockbrook.
- Section 5: Ockbrook to Aston-on-Trent.
- Section 6: Aston-on-Trent to Willington Substation.

10.3.2 A description of the graduated swathe by sections is provided below, and more detailed plans are included in **Appendix B**.

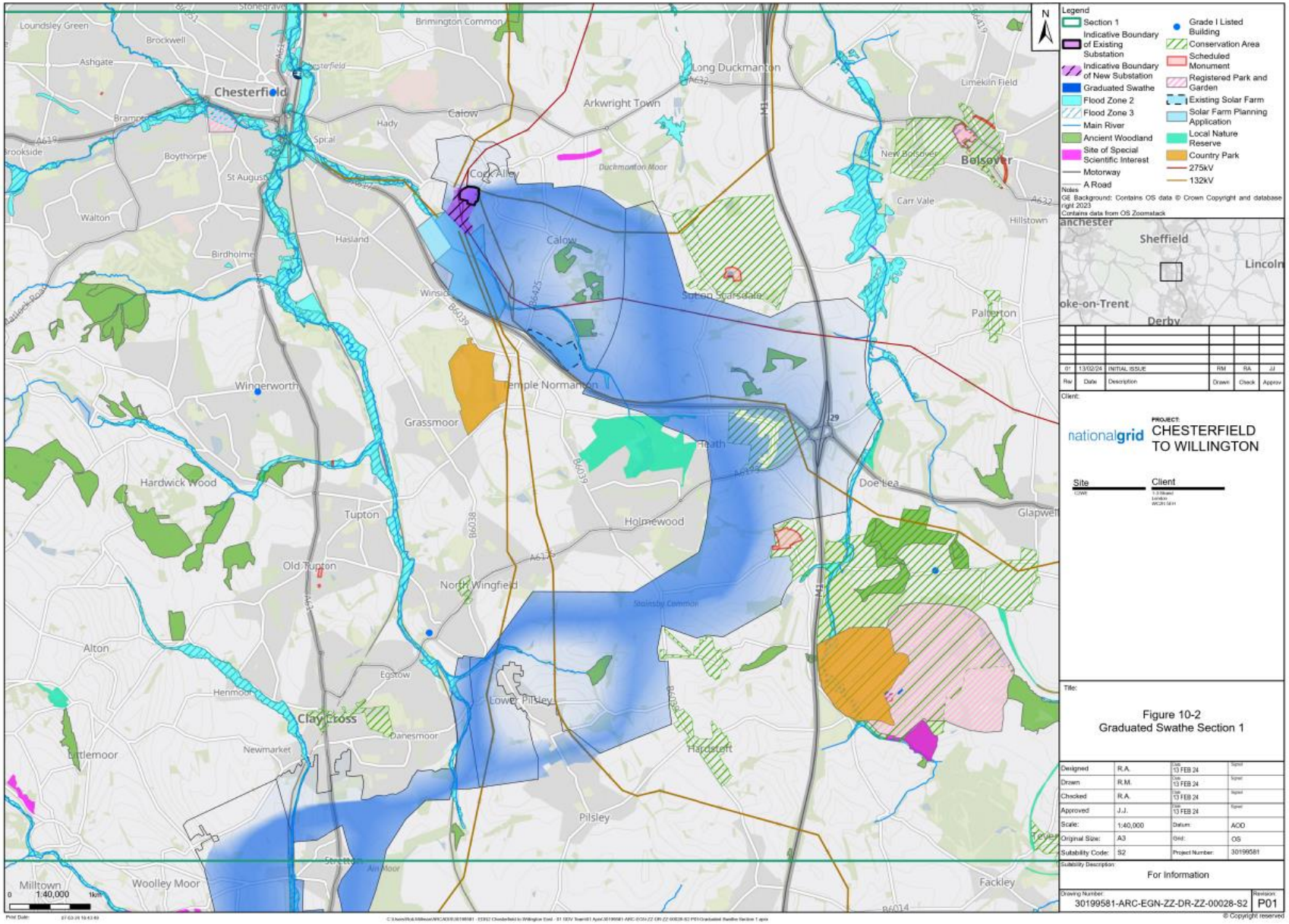
Figure 10.1 – Graduated Swathe Sections



Section 1: Chesterfield Substation to Stretton

10.3.3 This section of the graduated swathe covers the area from Chesterfield Substation in a south-easterly direction towards Heath, before curving around to the south west below the settlements of Holmewood, North Wingfield and Clay Cross as it approaches Stretton. This is shown in Figure 10.2 and on Sheet 1 of Appendix B.

Figure 10.2 – Section 1 (Chesterfield Substation to Stretton)



10.3.4 The immediate constraints when leaving Chesterfield Substation are the cluster of residences found east of Hassocky Lane near Sutton Springs Wood, existing and proposed solar farms, multiple overhead lines and areas of ancient woodland in this vicinity, indicated by the lighter shading within the graduated swathe. Potential paths are available around the north or south of these constraints as indicated by the two darker shaded areas. To the north, it may be possible to broadly follow the existing 132kV overhead line corridor towards Sutton Scarsdale, before traversing in a southern direction towards Heath. To the south, it may also be possible to broadly use or parallel with the existing overhead line corridor towards the A617, around the edge of the future Hasland solar farm development, and then traverse in a south-easterly direction towards Heath, through a relatively narrow gap between the A617 and existing solar farm north of Temple Normanton.

10.3.5 Routeing out of Chesterfield Substation via overhead line will require the rearrangement of multiple existing 132kV overhead lines and potentially the 4ZV Route (a 275kV line planned to be uprated to 400kV).

10.3.6 To the west of Heath where the two potential paths converge, it may be possible to avoid a number of listed buildings, areas of ancient woodland and the Heath Village Conservation Area by routeing through the gap between Holmewood and Heath. These constraints are located in the area of lighter shading shown from Heath out towards the eastern edge of the graduated swathe. To the east of Heath, the M1 motorway would potentially provide an existing linear corridor for an overhead line to follow through this section of the graduated swathe; however, it is a more indirect path than to the west of Heath and therefore not as strongly aligned with Holford Rule 3.

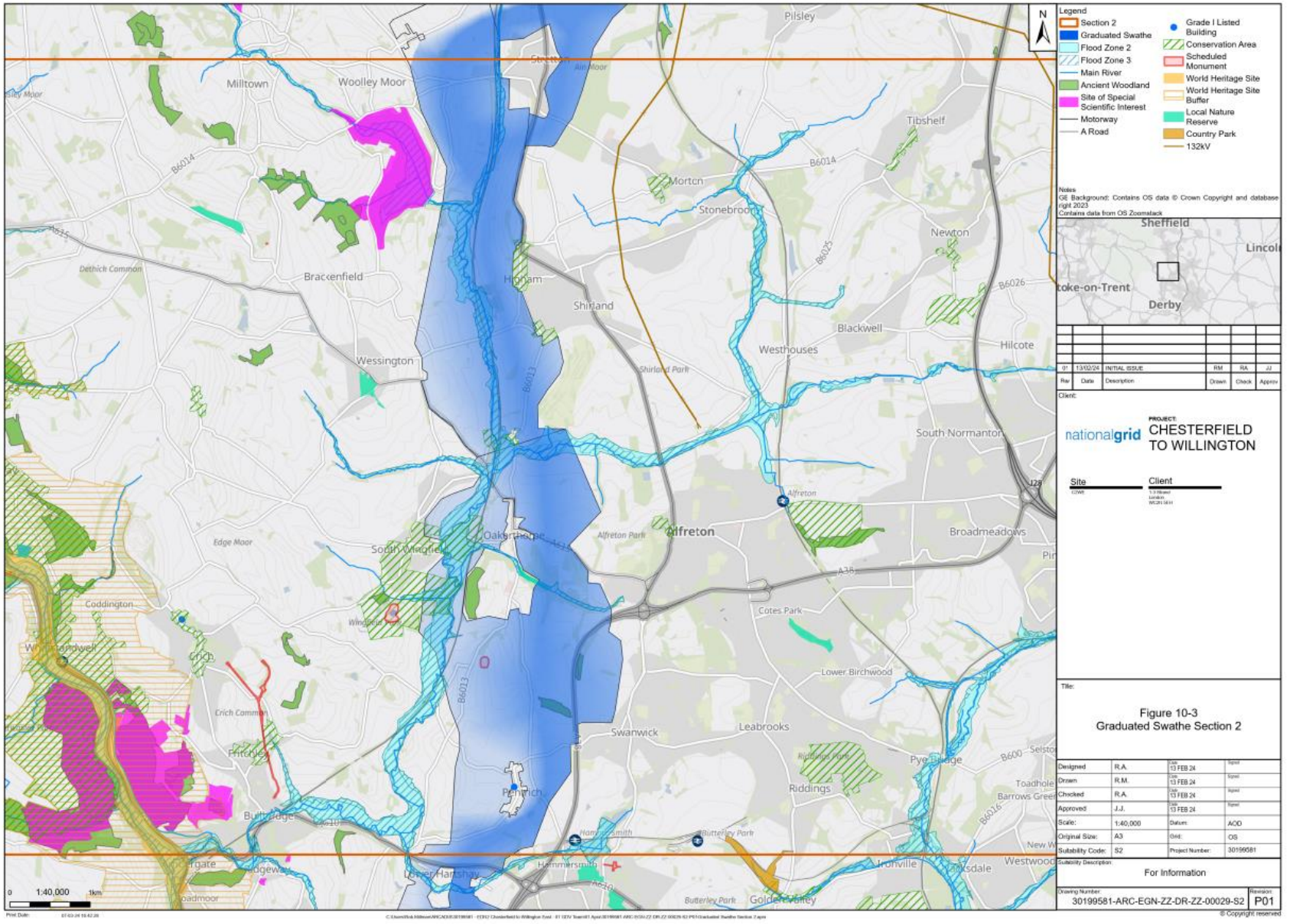
10.3.7 Around the southern edge of Holmewood, the graduated swathe allows for a degree of flexibility, offering the potential to avoid Stainsby on the eastern edge, including the lands used for Stainsby Festival, Stainsby Plantation, as well as Stainsby Conservation Area and a scheduled monument (Stainsby-defended manorial complex including site of chapel), which are both located adjacent to the lighter shaded areas of the graduated swathe. Moving further west, potential paths are available to the north and south of Lower Pilsley, traversing through gaps between either North Wingfield and Lower Pilsley to the north, and Lower Pilsley and Pilsley to the south, and therefore include potential paths within relatively close proximity to adjacent residential areas. The size of the lighter shaded area within the graduated swathe including Lower Pilsley reflects the presence of ancient woodland and community amenities, which may be avoided through appropriate routeing. Close to Lower Pilsley, there are also two existing 132kV overhead lines which would need to be reconfigured or undergrounded to establish the new line.

10.3.8 The graduated swathe then traverses around the southern edge of Clay Cross towards Stretton, within relatively close proximity to adjacent residential areas to the north and an existing solar farm development to the south, both outside the edges of the graduated swathe. Overall, there are limited paths within this relatively narrow gap.

Section 2: Stretton to Ripley

10.3.9 This section of the graduated swathe broadly runs from Stretton in a southerly direction towards Ripley, following the River Amber Valley for a large section. This is shown in Figure 10.3 and on Sheet 2 of Appendix B.

Figure 10.3 – Section 1 (Chesterfield Substation to Stretton)



10.3.10 Potential paths are available around Stretton, as indicated by the darker shaded areas within the graduated swathe. A potential path to the east and south of Stretton offers a more direct route in alignment with Holford Rule 3 and avoids a need to cross the River Amber and railway line in this location, staying to the east as it traverses south towards Oakerthorpe. A potential path to the north and west of Stretton may also avoid crossing over the River Amber by traversing back over to the east between Stretton Plantation and Ogston Lane, as indicated by the darker shaded area through this gap, but would require crossing the railway line twice. The larger area of lighter shading in the graduated swathe around Handley Lane can likely be avoided in any path to the north of Stretton. The railway line, tree groups and field boundary vegetation patterns are considered to mitigate potential visual impacts of the overhead line through this section of the graduated swathe moving south. The darker area of shading to the east of the River Amber indicates it is more likely that Project infrastructure would remain on this side as the corridor heads south to Oakerthorpe rather than west of the River Amber. The areas of lighter shading adjacent to the settlements of Higham and Shirland, as well as around Toadhole Furnace, indicate the potential to remain an appropriate distance from residences in this area.

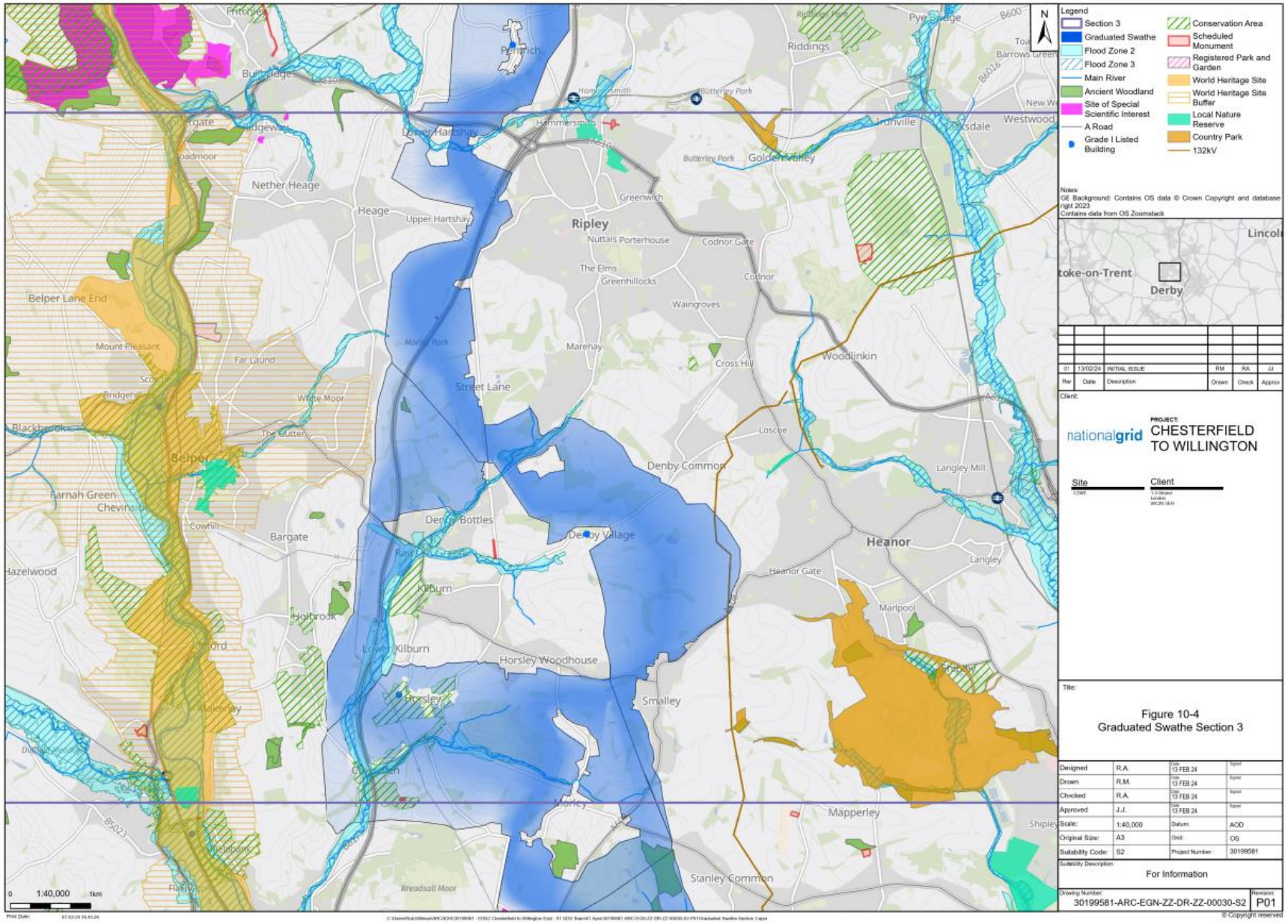
10.3.11 Around Oakerthorpe, the graduated swathe becomes more constrained. Potential paths to the west of Oakerthorpe include the presence of Flood Zones 2 and 3 associated with the River Amber across a large part of the graduated swathe, as well as the South Wingfield Conservation Area, a cluster of listed buildings, Castle Hill camp scheduled monument and the existing railway line, all of which are included in the lighter shaded area of the graduated swathe and would likely need to be crossed. To the east of Oakerthorpe, the darker shaded part of the graduated swathe indicates a preference for a potential path to continue south in a more direct manner through a less constrained section of the graduated swathe, again in alignment with Holford Rules 2 and 3. This also provides the potential to remain an appropriate distance from the adjacent settlements of Alfreton and Swanwick, without crossing the A38 corridor or impacting the construction of a mixed-use development on Lily Street Farm Way and bypassing an area of ancient woodland through appropriate routeing. Routeing to the east of Oakerthorpe though would require crossing Alfreton Golf Club, but with the potential to avoid the Oakerthorpe LNR through appropriate routeing.

10.3.12 Around Pentrich and Lower Hartshay, the graduated swathe begins to taper, where maintaining a path along the east side swathe offers the most direct path south in alignment with Holford Rule 3, and as indicated by the darker shaded area.

Section 3: Ripley to Morley

10.3.13 This section of the graduated swathe broadly runs from Ripley in a southerly direction towards Morley. Through this relatively constrained section, the graduated swathe allows for two potential paths to either the west or east of the cluster of settlements around Denby Bottles, Denby Village, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse. This is shown in Figure 10.4 and on Sheet 3 of Appendix B.

Figure 10.4 – Section 3 (Ripley to Morley)



10.3.14 Immediately adjacent to Ripley, the graduated swathe is quite narrow in order to pass between Ripley and Upper Hartshay to the west and offers the opportunity to follow the A38 corridor. As the graduated swathe widens towards Denby Bottles, it offers the opportunity to traverse to the west or east of settlements in this area.

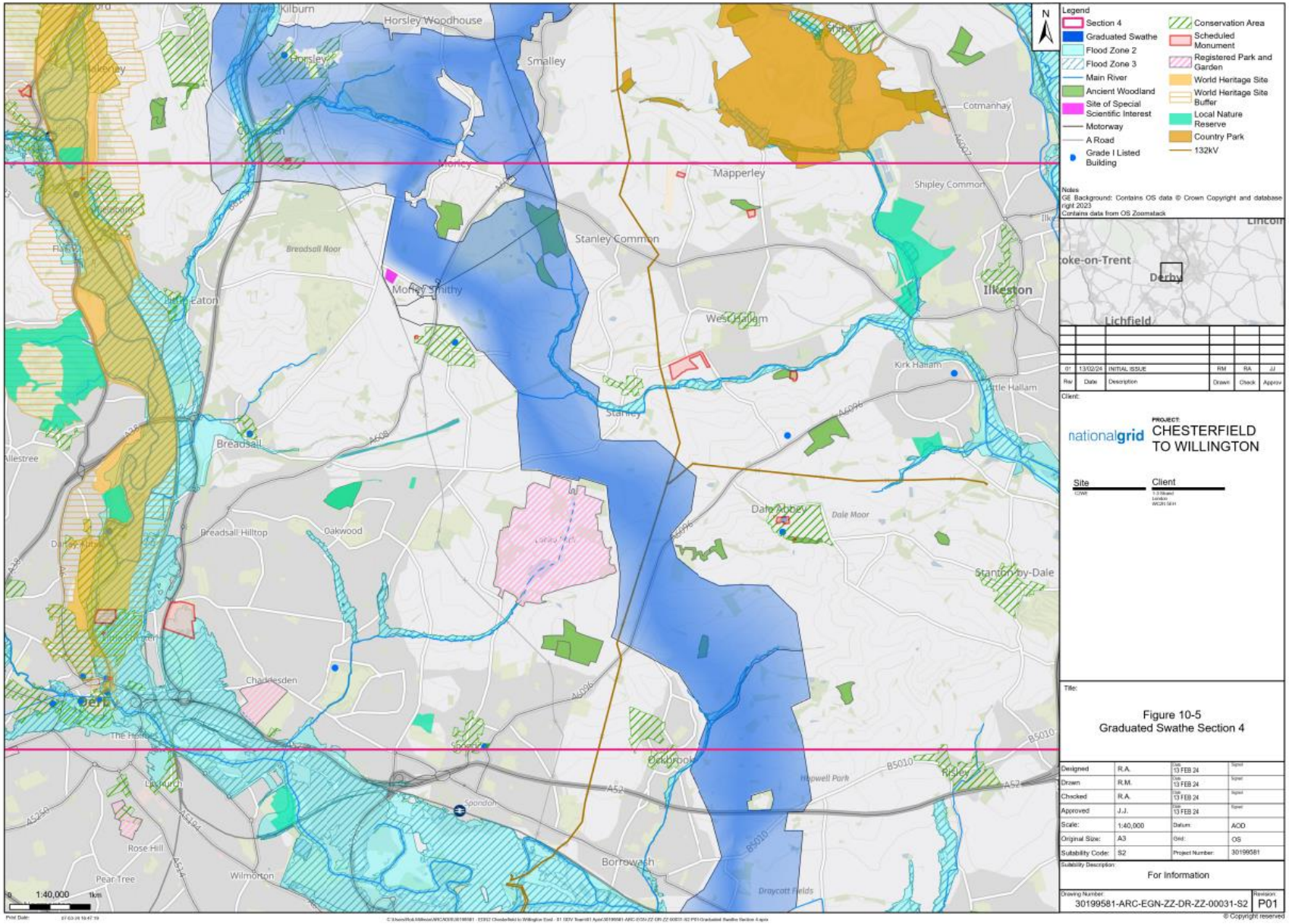
10.3.15 To the east of Denby Bottles, the darker area of shading to the west of the Denby Pottery Factory indicates there is a preference to locate Project infrastructure through this gap rather than to the east of the Denby Pottery Factory to reduce the risk of mine entries and compressible ground. Subsequently, the darker areas of the graduated swathe traverse around the north of Denby Village and maintain an appropriate distance from the settlement. Through the wider portion of the graduated swathe, there is considered to be greater flexibility within its central areas, also reflecting the need for further assessment of mine entrances in this area to find an optimal path. On the approach to Morley from the east, the graduated swathe must traverse through a narrower gap between Horsley Woodhouse and Smalley but provides potential paths to the west or east of Morley in order to continue south towards Derby. The darker shaded area to the west of Morley indicates the potential to avoid Horsley Lodge Golf Course and thread through a narrower gap by Morley before traversing around the northern edge of Morley Smithy and also avoiding the Morley Brick Pits SSSI, in alignment with Holford Rule 2. To the east of Morley, the relatively lighter shaded area of the graduated swathe reflects the presence of the ancient woodland and Morley Hayes Golf Club across a large part of the graduated swathe in this location.

10.3.16 To the west of Denby Bottles, the graduated swathe is darker towards its western edge, reflecting the large section of Flood Zones 2 and 3 and linear infrastructure including the A38 and a disused railway line, requiring potential crossing through the eastern part of this area. On the approach to Morley from the west, the graduated swathe is darker in the area between Horsley and Coxbench, indicating the potential avoidance of these two settlements to the north and south respectively and their associated Conservation Areas and clusters of listed buildings, as well as the Horsley Castle tower keep scheduled monument. Again, it is considered possible to avoid Horsley Lodge Golf Course in the middle of the graduated swathe in this area by maintaining a path to the south of this feature.

Section 4: Morley to Ockbrook

10.3.17 This section of the graduated swathe broadly runs from Morley in a southerly direction towards Ockbrook around the eastern edge of Derby. This is shown in Figure 10.5 and on Sheet 4 of Appendix B.

Figure 10.5 – Section 4 (Morley to Ockbrook)

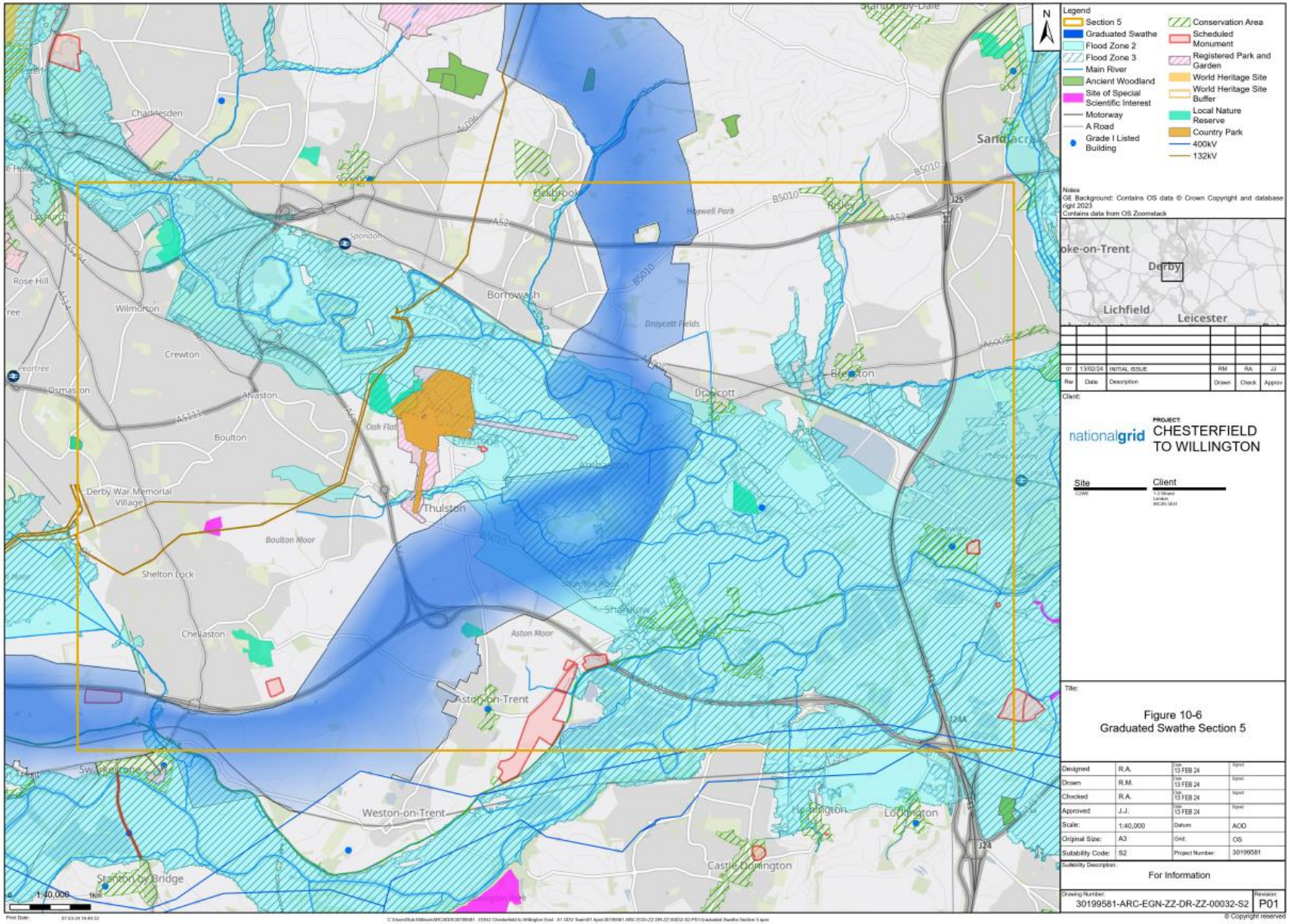


10.3.18 This section of the graduated swathe traverses south through a relatively unconstrained area which provides greater flexibility in locating Project infrastructure, as indicated by the relatively wider and overall greater amount of darker shading. The lighter shaded areas of the graduated swathe indicate that it is considered less likely to locate Project infrastructure through some of its outer edges, therefore maintaining a path which is more direct in accordance with Holford Rule 3, but also avoiding the area of ancient woodland immediately north of Ockbrook through appropriate routeing. The narrowest part of the graduated swathe is between Locko Park Registered Park and Garden to the west, which is outside of the graduated swathe and would be considered to have low visibility due to vegetative screening, and Dale Hill Natural Burial Ground to the east, which may be avoided through appropriate routeing. In this area, an existing 132kV overhead line crosses the whole width of the corridor and its modification will be required.

Section 5: Ockbrook to Aston-on-Trent

10.3.19 This section of the graduated swathe broadly runs from Ockbrook in a southerly and then south-westerly direction towards Aston-on-Trent around the eastern edge of Derby. This is shown in Figure 10.6 and on Sheet 5 of Appendix B.

Figure 10.6 – Section 5 (Ockbrook to Aston-on-Trent)



10.3.20 To the east of Ockbrook, the darker areas of shading are found between this settlement and Manor Farm, as this would result in a more direct path in alignment with Holford Rule 3, whilst seeking to maintain an appropriate distance from the settlement. Lighter shading remains to the east of Manor Farm, indicating that the potential still remains for a path through this area of the graduated swathe.

10.3.21 Moving further south past Draycott, the lighter area of shading within the western part of the graduated swathe covers a meandering section of the River Derwent. Owing to the presence of the River Derwent, Flood Zones 2 and 3 are unavoidable in this area; however, darker shading is shown within the eastern part of the graduated swathe where the Project infrastructure may be able to avoid potential multiple crossings of this feature. The lighter shading adjacent to Draycott indicates the potential to maintain an appropriate distance from the settlement.

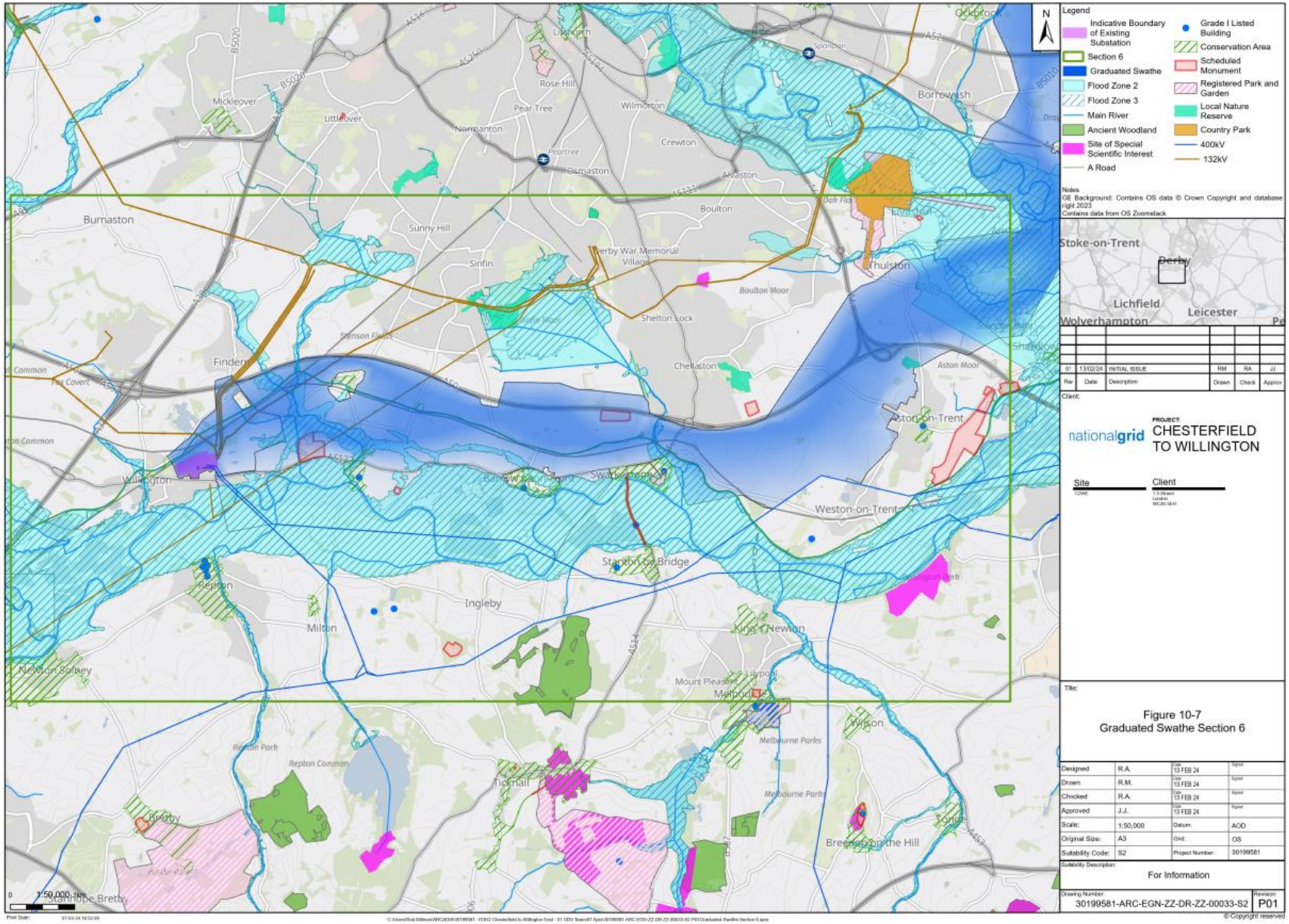
10.3.22 The relatively large lighter shaded area south of Ambaston indicates the presence of larger constraints including the Tarmac quarry and mortar plant within the graduated swathe, with the darker shade either side of this area indicating potential paths to the north or south.

10.3.23 Further assessment is required to determine the optimal path for crossing the A50/A6 SRN junction north of Aston-on-Trent; however, the graduated swathe indicates a relatively wide area in which this may be considered, whilst also avoiding proximity to Elvaston Castle Registered Park and Garden (located outside the northern edge of the graduated swathe and considered to have low visibility due to vegetative screening), the Trent Valley Crematorium (located near the A50/A6 junction), and the Aston Brickyard Plantation LNR and edges of Aston-on-Trent, which are also within the lighter shaded area. A path to the north would require two crossings of road infrastructure, whereas a path to the south would only require one crossing but is also constrained by the Derby Road bridge over the A50 and a fly-over between A50 and A6.

Section 6: Aston-on-Trent to Willington Substation

10.3.24 This section of the graduated swathe broadly runs from Aston-on-Trent in a westerly direction towards its termination at Willington Substation. This is shown in Figure 10.7 and on Sheet 6 of Appendix B.

Figure 10.7 – Section 5 (Ockbrook to Aston-on-Trent)



10.3.25 Due west from Aston-on-Trent towards Swarkestone, the graduated swathe must traverse through a relatively narrow gap between Chellaston and Swarkestone to remain north of the railway line and Trent and Mersey Canal. The darker shaded area through this section offers a more direct potential path in line with Holford Rule 3, as opposed to utilising the outer area of the graduated swathe towards Weston-on-Trent, which is shown in a lighter shading. The graduated swathe remains darker through the northern portion of this section from Swarkestone towards Willington Substation, which reflects greater opportunities for locating Project infrastructure in the northern portion of the graduated swathe relative to the southern portion, where there are significant constraints, as described below. The northern portion of the graduated swathe may utilise the presence of existing linear infrastructure corridors to guide a potential path, bounded to the north by the A50, and to the south by the A5132 and the railway line. It is also considered that there are fewer technical constraints to entering Willington Substation from the north than the south.

10.3.26 The slightly lighter shaded areas in the northern portion of the graduated swathe reflect the presence of constraints which may potentially be avoided by Project infrastructure, including larger scheduled monuments (Swarkestone Lows round barrow cemetery and part of an aggregated field system; and the Settlement site and enclosure adjacent to Frizams Lane/Twyford Road) and the settlement of Stenson. It will also be important to minimise crossings over the railway as well as the Trent and Mersey Canal and its associated Conservation Area, and the graduated swathe indicates a relatively wide area in which an appropriate crossing may be found.

10.3.27 The southern portion of this section of the graduated swathe to the south of the A5132 is notably lighter shaded to indicate the presence of significant constraints and therefore lower likelihood of locating Project infrastructure in this area. Firstly, the presence of the meandering River Trent through this section and its associated Flood Zones 2 and 3 are unavoidable, likely also requiring more than one river crossing in this location. In addition, the settlement of Barrow-upon-Trent and its Conservation Area and cluster of listed buildings represent constraints, as does the Twyford Conservation Area, Twyford henge and Round Hill bowl barrow scheduled monument, and a cluster of other listed buildings in this area. Around Barrow-upon-Trent, there are also areas of historic landfill and the Tarmac Swarkestone Sand and Gravel Quarry which present constraints to locating Project infrastructure.

10.3.28 An entry into Willington from the south is currently constrained by two 400kV overhead lines, and to establish a route from here would require substantial works. The area north of the substation is also severely constrained by Willington Power Station, a railway line, and five 132kV overhead lines. If the existing lines are not undergrounded, the new line will likely need to enter into Willington Substation by underground cables.

10.4 Summary of the Graduated Swathe

- The graduated swathe is presented for non-statutory consultation. As shown in the figures presented in this chapter and Appendix B, it depicts the graduated swathe itself, existing infrastructure and key environmental, socio-economic and technical features that directly inform the development of the overall graduated swathe.

10.5 Conclusion

10.5.1 The graduated swathe represents the current thinking on where the Project infrastructure is more likely to be located based on the current appraisal of constraints

that have been identified. This will be further informed by feedback received during consultation, so there is potential for the current indicated preference to move within the graduated swathe. In some instances, feedback may indicate that the preference should be to find a pathway through areas currently being shown as less preferable. This will be addressed at the next stage of the Project. Feedback received during non-statutory consultation will also be summarised within a consultation report during the next stage of the Project. This feedback will be fully considered through the development of the Project, whilst maintaining the principles used to develop the current graduated swathe, such as the avoidance, where practicable, of areas of highest constraint and amenity.

11. Summary and Next Steps

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11. Summary and Next Steps

11.1 Summary of Options Identification and Selection Process (Stage 2)

11.1.1 A detailed Options Identification and Selection Process (Stage 2) (see Chapter 4) has been undertaken to identify the emerging preferred corridor and graduated swathe for a new 400kV electricity transmission connection between Chesterfield Substation and Willington Substation. The connection is expected to wholly or largely comprise of a new double-circuit overhead line.

11.1.2 Eight preliminary corridors were identified, appraised and subsequently refined to create six refined corridors for appraisal (documented in Chapters 6 and 7). The six refined corridors were divided into sections for appraisal and the identification of an emerging preferred corridor (Chapter 9). Following this, an end-to-end solution review of the emerging preferred corridor was then undertaken between Chesterfield Substation and Willington Substation. This review considered each progressed section and ensured that the reasoning and justification for progressing one part of the emerging preferred corridor did not incorrectly impact on the decision made for the next section of the emerging preferred corridor. The review did not result in any amendments to the emerging preferred corridor.

11.1.3 To summarise, the emerging preferred corridor comprises of the following (as shown in Chapter 9, Figure 9.6):

- Section C1a: Extends in a south-easterly direction out of Chesterfield Substation to avoid the more constrained and built-up area to the south between Chesterfield and Clay Cross.
- Section C5a: Turns south west in the vicinity of Heath between the M1 motorway and the edges of several settlements including Holmewood, North Wingfield and Clay Cross, allowing for potential options to the north or south of Lower Pilsley.
- Section C3a: Continues to the south of Clay Cross, allowing for potential options to the north or south of Stretton.
- Sections C3b and C3c: Broadly follows the Amber River Valley south to Ripley between South Wingfield and Alfreton, allowing for potential options to the west or east of Oakerthorpe, Pentrich and Lower Hartshay.
- Sections C3c, C3d and C3e: Continues to extend south between Belper and Ripley, allowing for potential options around the west or east of a cluster of settlements including Denby Bottles, Denby, Rawson Green, Kilburn, Lower Kilburn and Horsley Woodhouse. The western option traverses between Holbrook and Lower Kilburn, whilst the eastern option traverses between Horsley Woodhouse and Smalley.
- Sections C3f, C4a1 and C4a: Allows for potential options to the west or east of Morley before extending south between Morley Smithy and Stanley Common and around the eastern edge of Derby between Borrowash and Draycott.

- Sections C4a and C1g: Broadly follows the corridor containing the A50 and River Trent valley from north of Aston-on-Trent through to Willington Substation, allowing for potential options around the north and south of Barrow-upon-Trent and Stenson.

11.1.4 The emerging preferred corridor was ultimately selected to avoid, where possible, potential impacts to areas with the highest amenity value in alignment with Holford Rules 1 and 2, as well as finding a direct path in alignment with Holford Rule 3. After assessing viable alternative paths at each of the key steps outlined in Chapter 9, this was achieved by ruling out potential options that crossed the Peak District National Park (i.e., Corridor 1, except for its most northerly and southerly sections including each substation) and the Derwent Valley Mills World Heritage Site (i.e., Corridor 2, and the southern sections of Corridor 3 which crossed this feature).

11.1.5 Following the identification of the emerging preferred corridor, a graduated swathe was identified. The graduated swathe is a way of showing the areas within the emerging preferred corridor where the required Project infrastructure is considered more or less likely to be located. The graduated swathe is 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, whilst lighter shading indicates less likely locations.

11.1.6 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. 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 and amenity.

11.2 Non-statutory Consultation

11.2.1 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 Summer 2024.

11.2.2 During the non-statutory consultation, feedback will be gathered from consultation events and feedback forms on the preferences identified in this report and on the graduated swathe, which highlights where Project infrastructure is more likely to be located.

11.2.3 The emerging preferred corridor 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.

11.3 Analysing Non-statutory Consultation Feedback

11.3.1 The feedback from non-statutory consultation will inform the further development of the Project.

11.3.2 Information from surveys undertaken to obtain baseline data and ongoing design studies will also inform the development of the Project.

11.4 Defined Proposal and Statutory Consultation (Stage 3)

11.4.1 Following the completion of non-statutory consultation, including the analysis of the consultation feedback, NGET will progress 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 integrative design development prior to submission of the application for a DCO.

Appendix A

Option Selection Process

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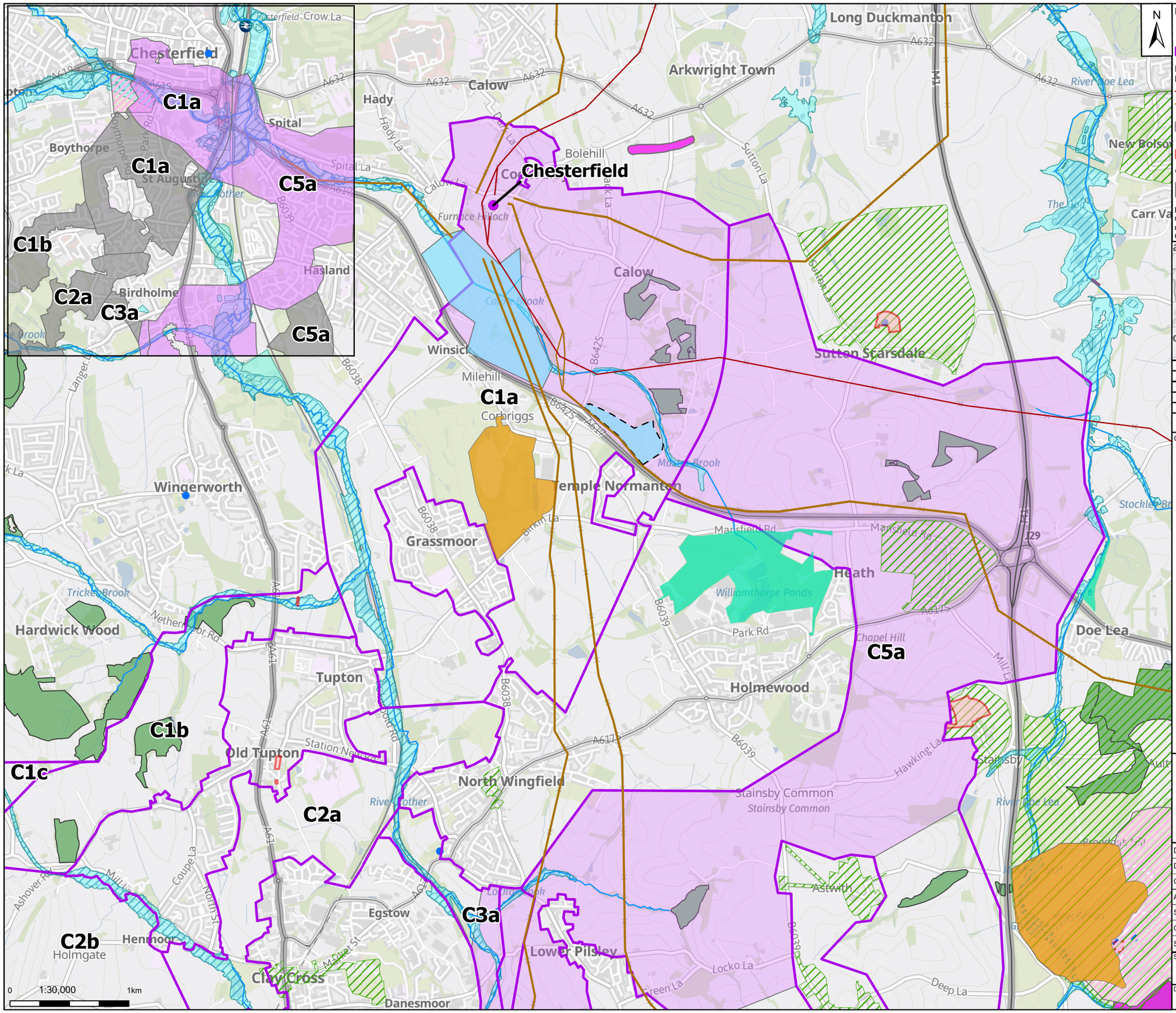

Legend

- Exisitng Substations
- Corridor Section
- Existing Overhead Lines
  - 275kV
  - 132kV
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Country Park
- Local Nature Reserve
- Ancient Woodland
- Site of Special Scientific Interest
- Main River
- Flood Zone 2
- Flood Zone 3
- Motorway
- A Road
- Existing Solar Farm
- Solar Farm Planning Application

Corridor Section Status

- Progressed
- Not Progressed

Notes

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Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client: nationalgrid

PROJECT: CHESTERFIELD TO WILLINGTON

Site: C2WE

Client: 1-3 Strand, London, WC2N 5EH

Title:

Figure 9-1
Determining the Viability of Western Options and Routeing out of Chesterfield Substation

Designed	R.A.	Date: 13 FEB 24	Signed:
Drawn	R.M.	Date: 13 FEB 24	Signed:
Checked	R.A.	Date: 13 FEB 24	Signed:
Approved	J.J.	Date: 13 FEB 24	Signed:
Scale:	1:30,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description: For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00021-S2

Revision: P01

Print Date: 07-03-24 16:15:46

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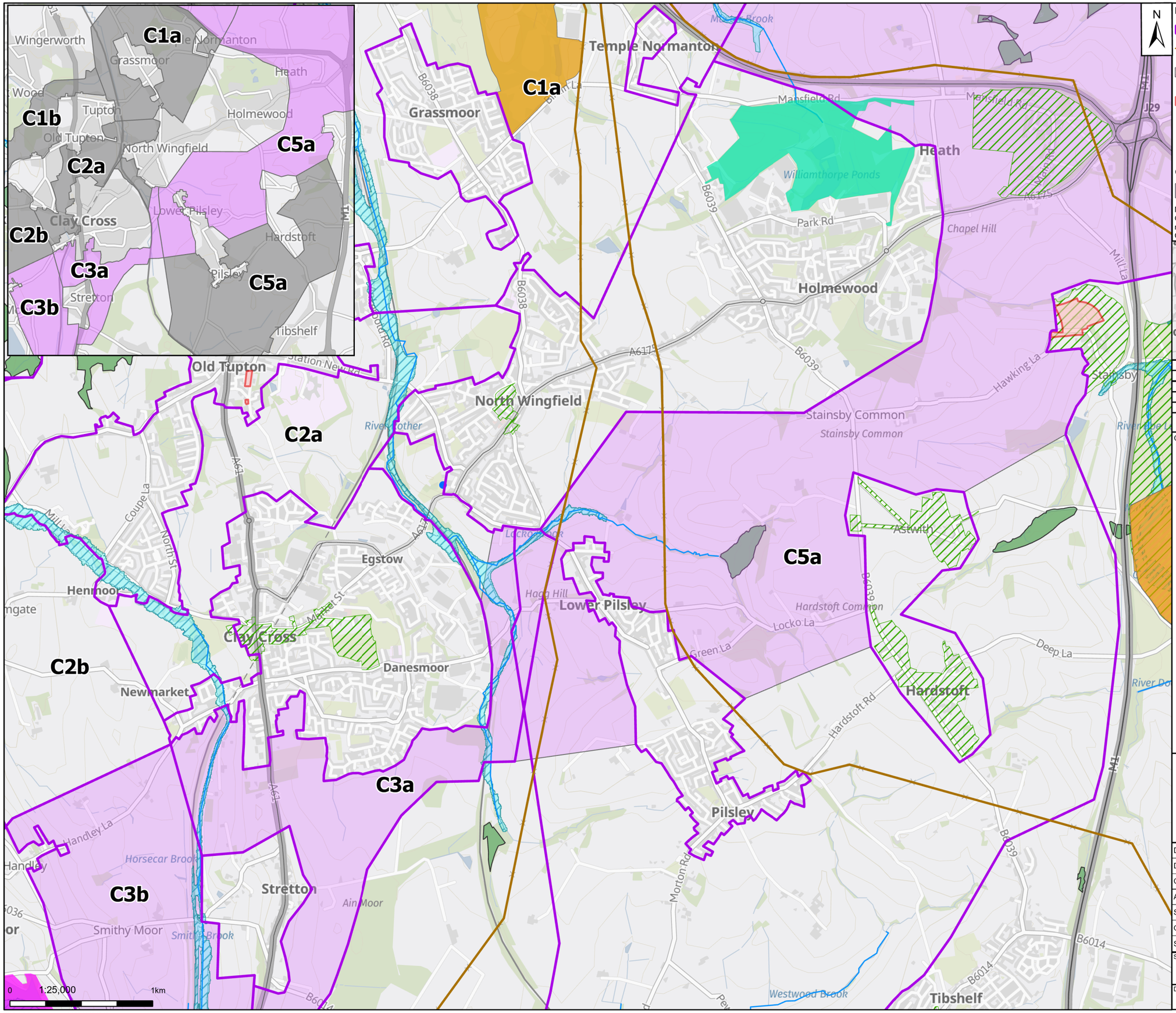

Legend

- Corridor Section
- 132kV
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Local Nature Reserve
- Country Park
- Ancient Woodland
- Site of Special Scientific Interest
- Main River
- Flood Zone 2
- Flood Zone 3
- Motorway
- A Road

Corridor Section Status

- Progressed
- Not Progressed

Notes
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Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
CZWE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 9-2
Determining the Routeing South towards Oakerthorpe

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:25,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00022-S2
Revision: P01

Print Date: 07-03-24 16:19:39

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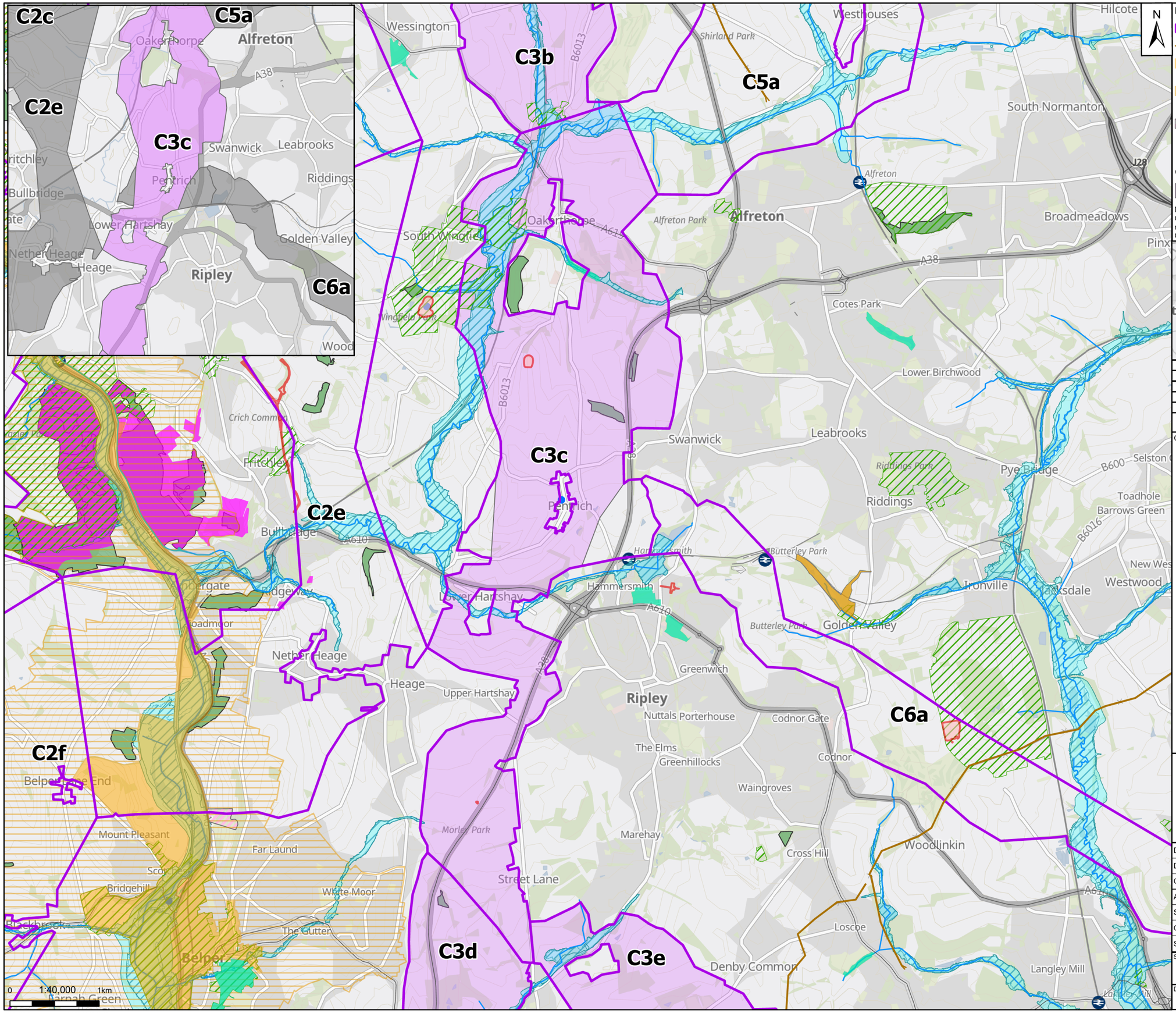

Legend

- Corridor Section
- 132kV
- World Heritage Site
- World Heritage Site Buffer
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Country Park
- Local Nature Reserve
- Ancient Woodland
- Site of Special Scientific Interest
- Main River
- Flood Zone 2
- Flood Zone 3
- Motorway
- A Road

Corridor Section Status

- Progressed
- Not Progressed

Notes

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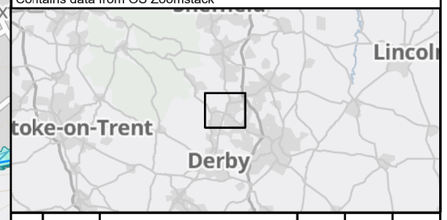

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client: nationalgrid

PROJECT: CHESTERFIELD TO WILLINGTON

Site: C2WE

Client: 1-3 Strand, London, WC2N 5EH

Title:

Figure 9-3
Determining the Routeing around Ripley and Other Settlements

Designed	R.A.	Date: 13 FEB 24	Signed
Drawn	R.M.	Date: 13 FEB 24	Signed
Checked	R.A.	Date: 13 FEB 24	Signed
Approved	J.J.	Date: 13 FEB 24	Signed
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description: For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00023-S2

Revision: P01

Print Date: 07-03-24 16:25:32

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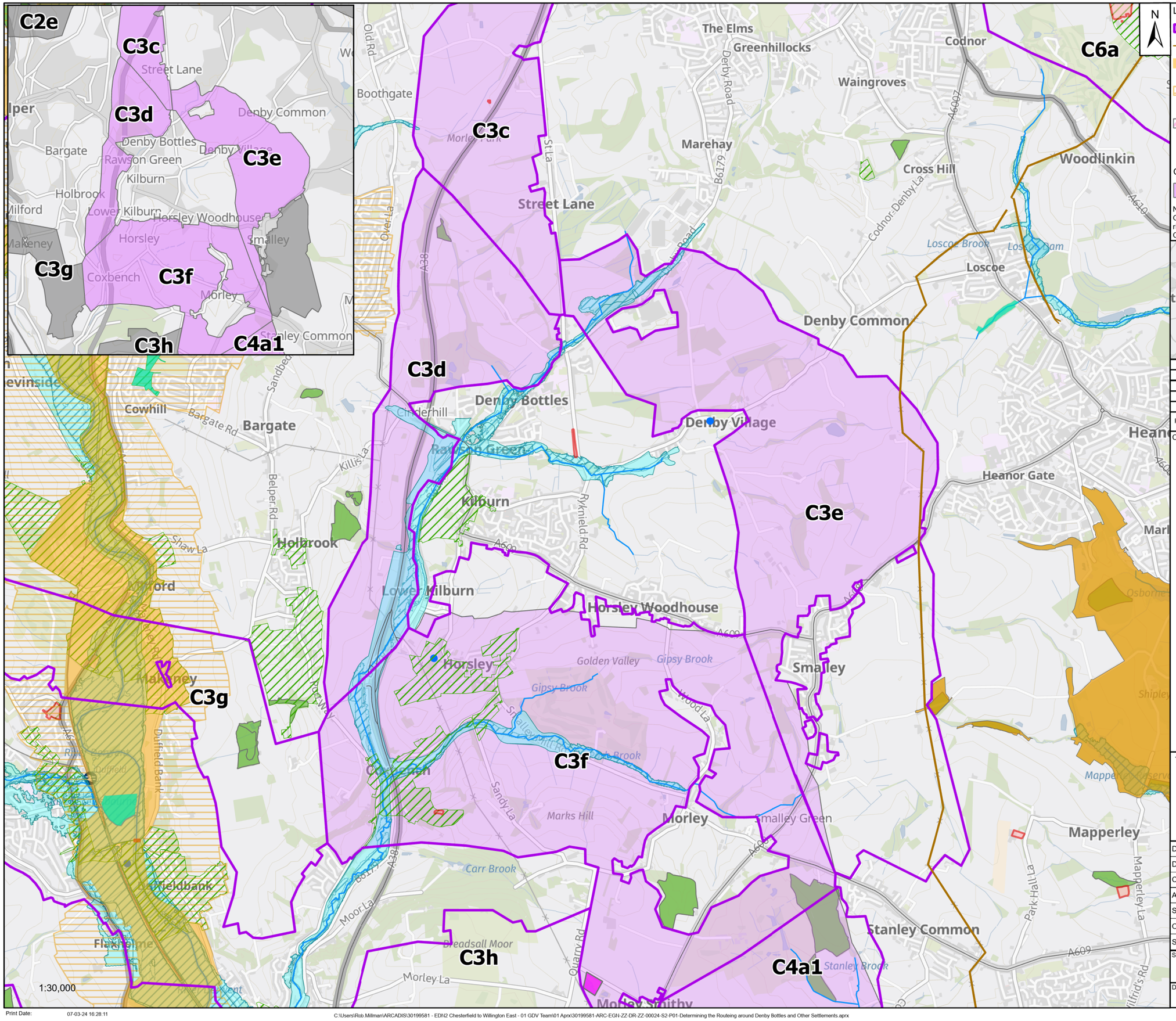

Legend

- Corridor Section
- 132kV
- World Heritage Site
- World Heritage Site Buffer
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Local Nature Reserve
- Country Park
- Ancient Woodland
- Site of Special Scientific Interest
- Main River
- Flood Zone 2
- Flood Zone 3
- A Road

Corridor Section Status

- Progressed
- Not Progressed

Notes
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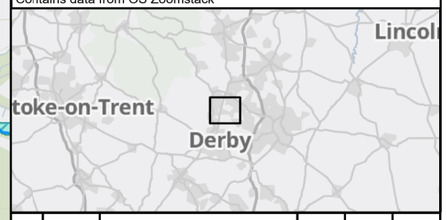

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 9-4
Determining the Routeing around Denby Bottles and Other Settlements

Designed	R.A.	Date: 13 FEB 24	Signed
Drawn	R.M.	Date: 13 FEB 24	Signed
Checked	R.A.	Date: 13 FEB 24	Signed
Approved	J.J.	Date: 13 FEB 24	Signed
Scale:	1:30,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00024-S2
Revision: P01

Print Date: 07-03-24 16:28:11

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C3g C3f C3e C2g C3h C4a1 C6a C1e C1f C1g C4a

C3d C3g C3f C3e C3h C4a1 C6a C1d C1e C1f C1g C4a

N

Legend

- Existing Substation
- Corridor Section
- 400kV
- 132kV
- World Heritage Site
- World Heritage Site Buffer
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Country Park
- Local Nature Reserve
- Ancient Woodland
- Site of Special Scientific Interest
- Main River
- Flood Zone 2
- Flood Zone 3
- A Road

Corridor Section Status

- Progressed
- Not Progressed

Notes

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Stoke-on-Trent Derby Lichfield Leicester

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client: nationalgrid

PROJECT: CHESTERFIELD TO WILLINGTON

Site: C2WE

Client: 1-3 Strand London WC2N 5EH

Title:

Figure 9-5
Determining the Routeing around Derby to Willington Substation

Designed	R.A.	Date: 13 FEB 24	Signed:
Drawn	R.M.	Date: 13 FEB 24	Signed:
Checked	R.A.	Date: 13 FEB 24	Signed:
Approved	J.J.	Date: 13 FEB 24	Signed:
Scale:	1:62,500	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description: For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00025-S2

Revision: P01

0 1:62,500 2km

Print Date: 07-03-24 16:30:50

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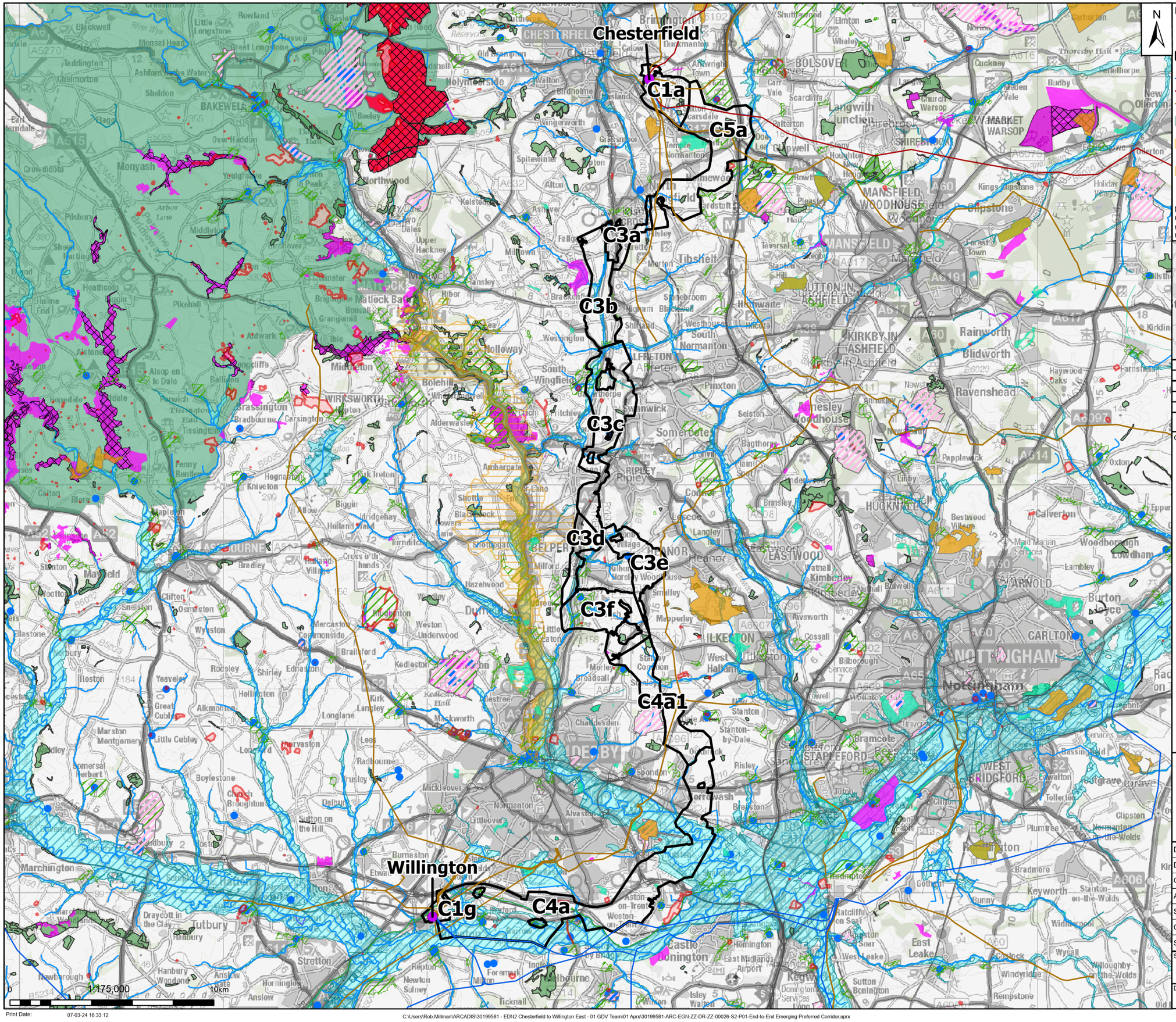

Legend

- Existing Substation
- Emerging Preferred Corridor
- 400kV
- 275kV
- 132kV
- Peak District National Park
- World Heritage Site
- World Heritage Site Buffer
- Registered Park and Garden
- Scheduled Monument
- Conservation Area
- Grade I Listed Building
- Country Park
- Local Nature Reserve
- Ancient Woodland
- Site of Special Scientific Interest
- Special Protection Area
- Special Areas of Conservation
- Main River
- Flood Zone 2
- Flood Zone 3
- Motorway
- A Road

Notes

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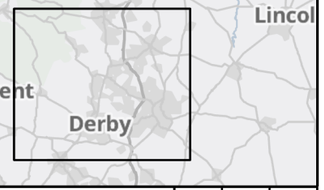

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client: nationalgrid

PROJECT: CHESTERFIELD TO WILLINGTON

Site: CZWE

Client: 1-3 Strand, London, WC2N 5EH

Title:

Figure 9-6
End-to-End Emerging Preferred Corridor

Designed	R.A.	Date: 13 FEB 24	Signed
Drawn	R.M.	Date: 13 FEB 24	Signed
Checked	R.A.	Date: 13 FEB 24	Signed
Approved	J.J.	Date: 13 FEB 24	Signed
Scale:	1:175,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description: For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00026-S2

Revision: P01

Print Date: 07-03-24 16:33:12

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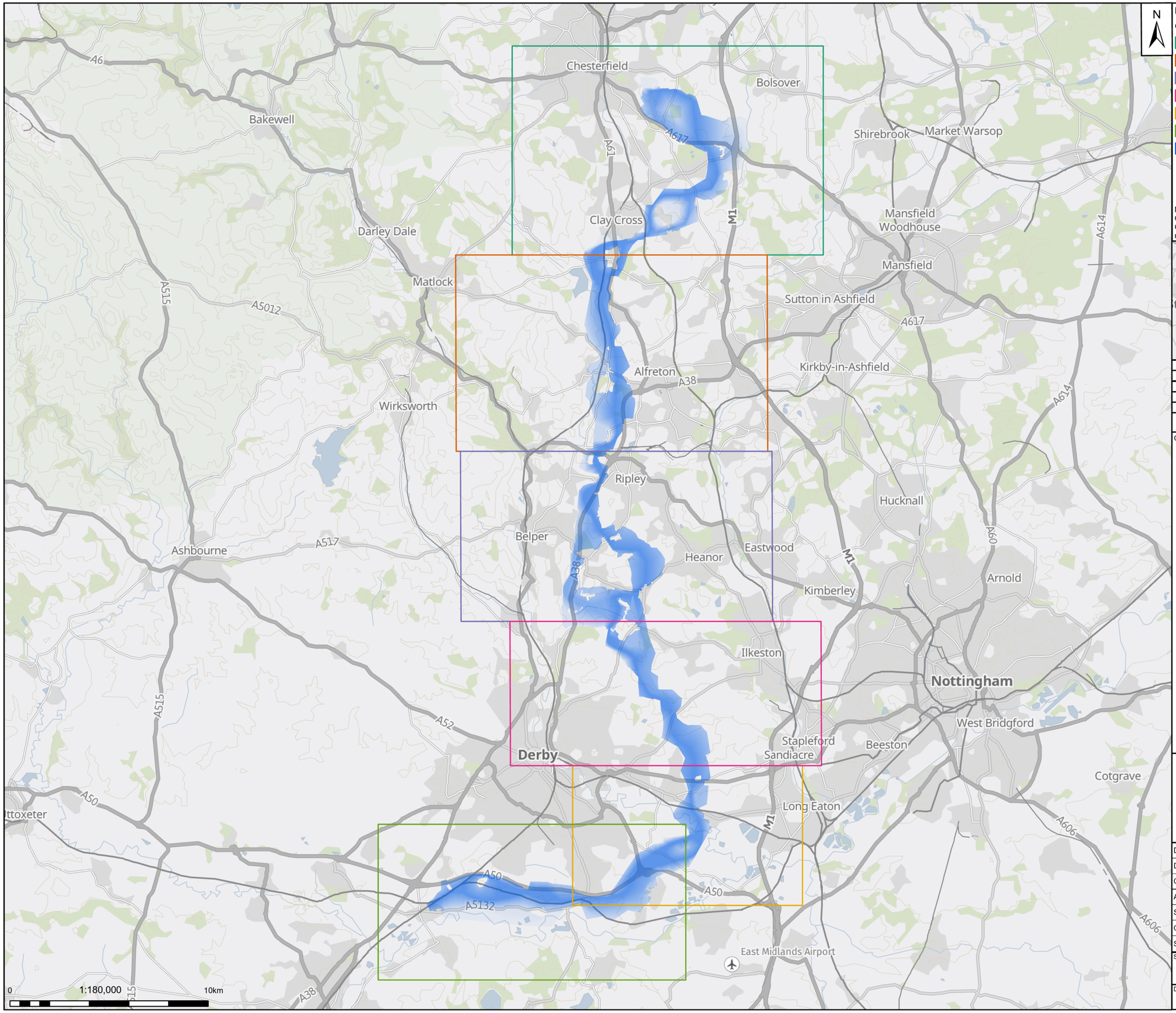
Appendix B

Graduated Swathe (Detailed)



Legend

Graduated Swathe Section

- Section 1
- Section 2
- Section 3
- Section 4
- Section 5
- Section 6
- Graduated Swathe

Notes

Chesterfield_to_Willington_East_10056387_Graduated_Swathe:

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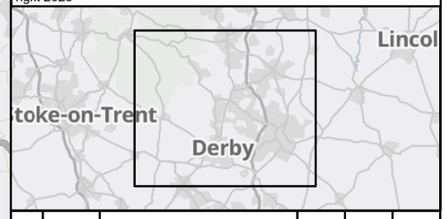

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-1
Emerging Preferred Corridor - Keyplan for Graduated Swathe Sections

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:180,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:

For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00027-S2

Revision: P01

Print Date: 01-03-24 14:35:17

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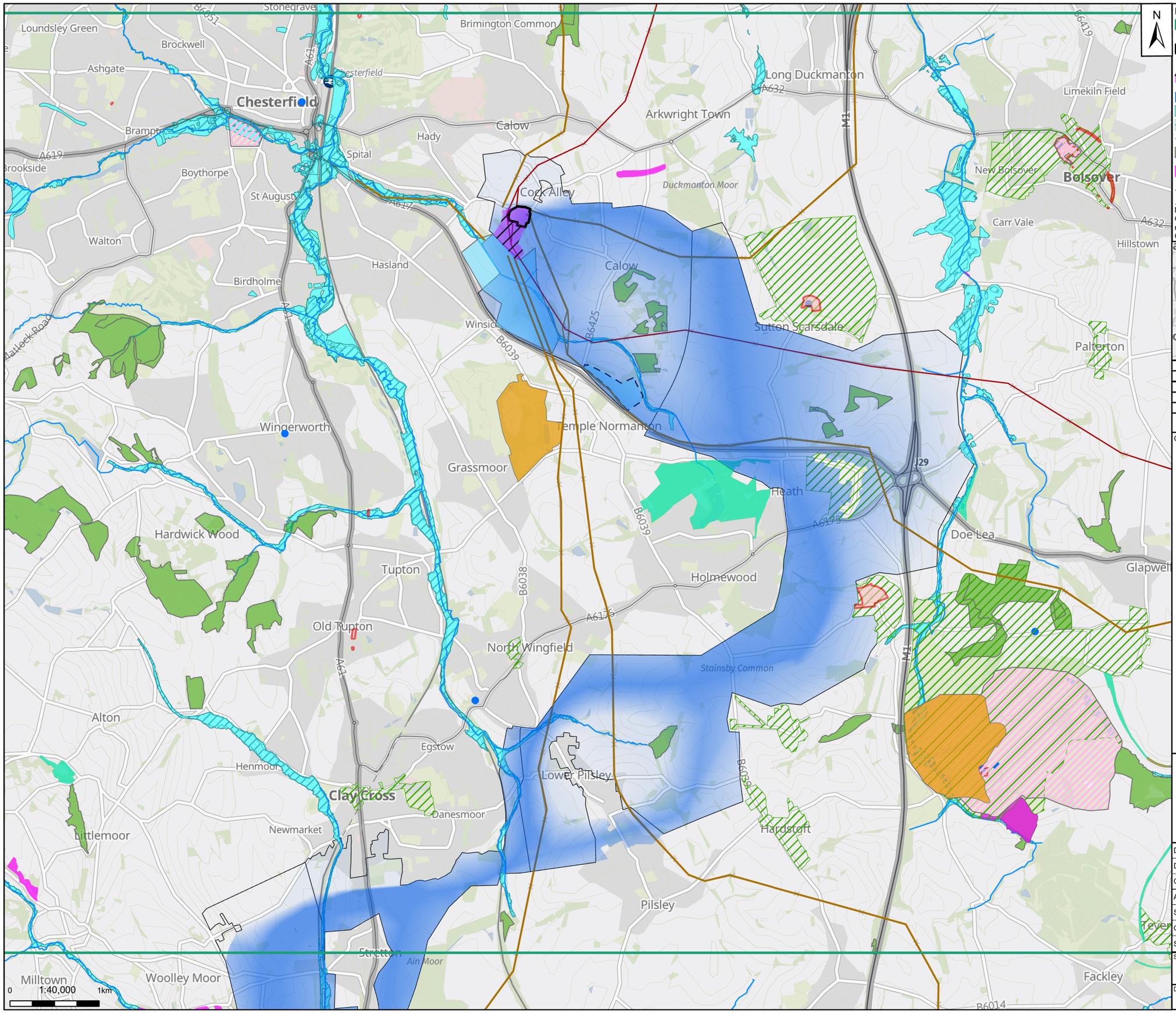

Legend

- Section 1
- Indicative Boundary of Existing Substation
- Indicative Boundary of New Substation
- Graduated Swathe
- Flood Zone 2
- Flood Zone 3
- Main River
- Ancient Woodland
- Site of Special Scientific Interest
- Motorway
- A Road
- Grade I Listed Building
- Conservation Area
- Scheduled Monument
- Registered Park and Garden
- Existing Solar Farm
- Solar Farm Planning Application
- Local Nature Reserve
- Country Park
- 275kV
- 132kV

Notes

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01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-2
Graduated Swathe Section 1

Designed	R.A.	Date: 13 FEB 24	Signed:
Drawn	R.M.	Date: 13 FEB 24	Signed:
Checked	R.A.	Date: 13 FEB 24	Signed:
Approved	J.J.	Date: 13 FEB 24	Signed:
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00028-S2

Revision: P01

Print Date: 07-03-24 16:43:49

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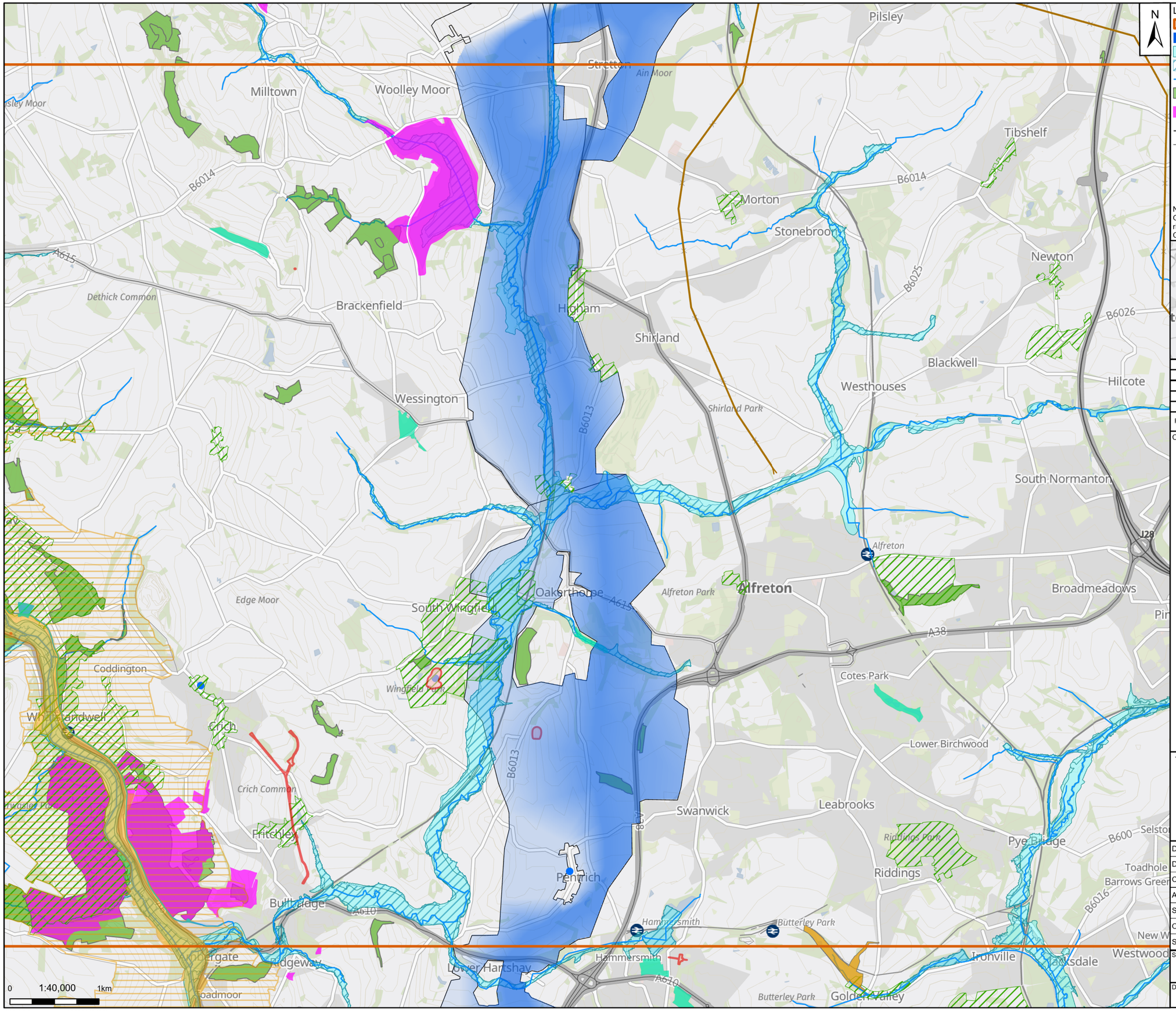

Legend

- Section 2
- Graduated Swathe
- Flood Zone 2
- Flood Zone 3
- Main River
- Ancient Woodland
- Site of Special Scientific Interest
- Motorway
- A Road
- Grade I Listed Building
- Conservation Area
- Scheduled Monument
- World Heritage Site
- World Heritage Site Buffer
- Local Nature Reserve
- Country Park
- 132kV

Notes

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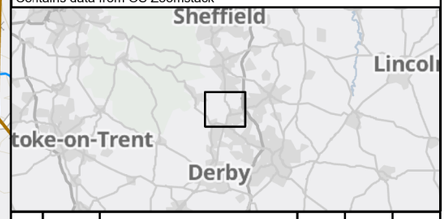

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-3
Graduated Swathe Section 2

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

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Revision: P01

Print Date: 07-03-24 16:42:28

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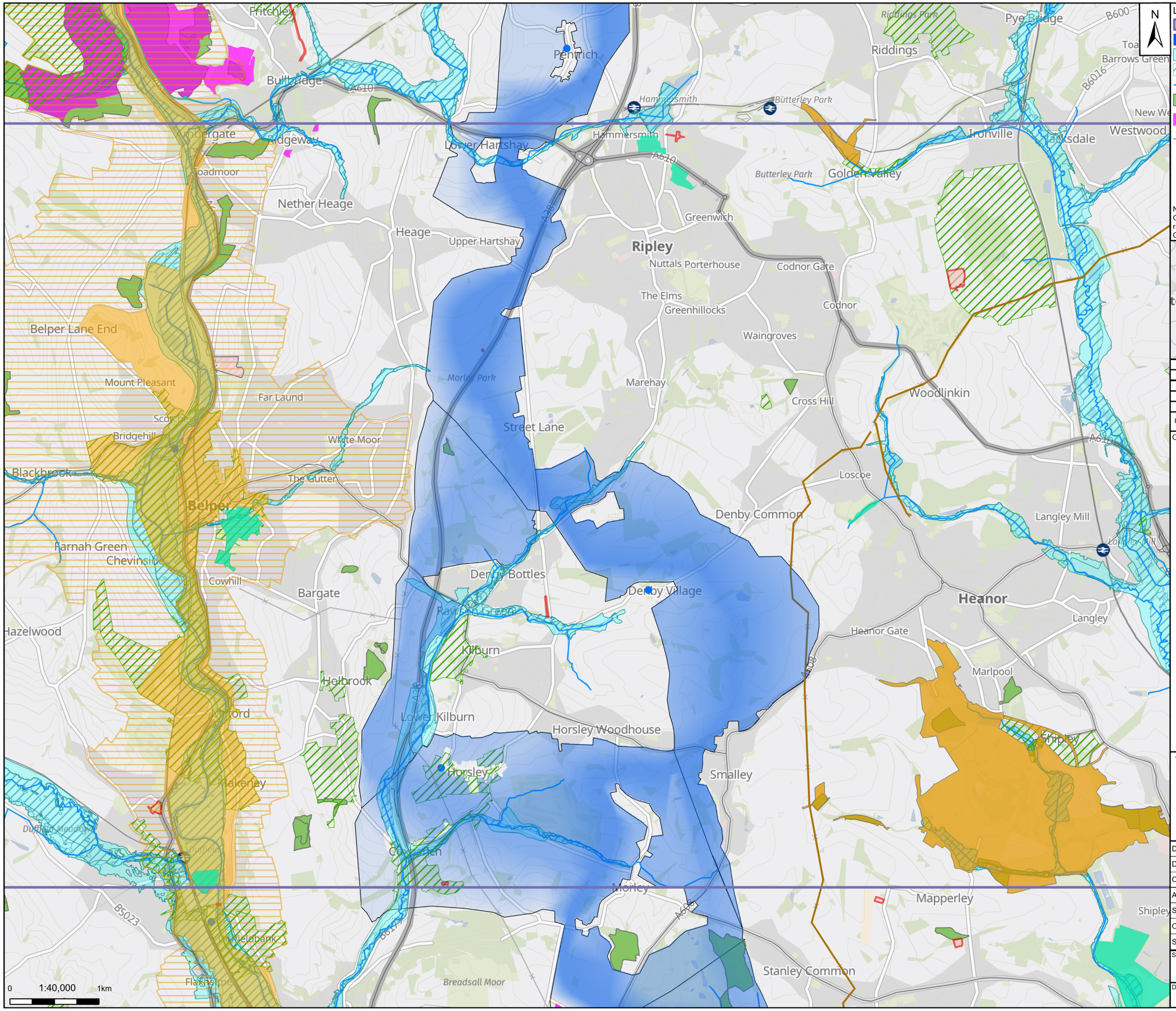

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-4
Graduated Swathe Section 3

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00030-S2
Revision: P01

Print Date: 07-03-24 16:45:24

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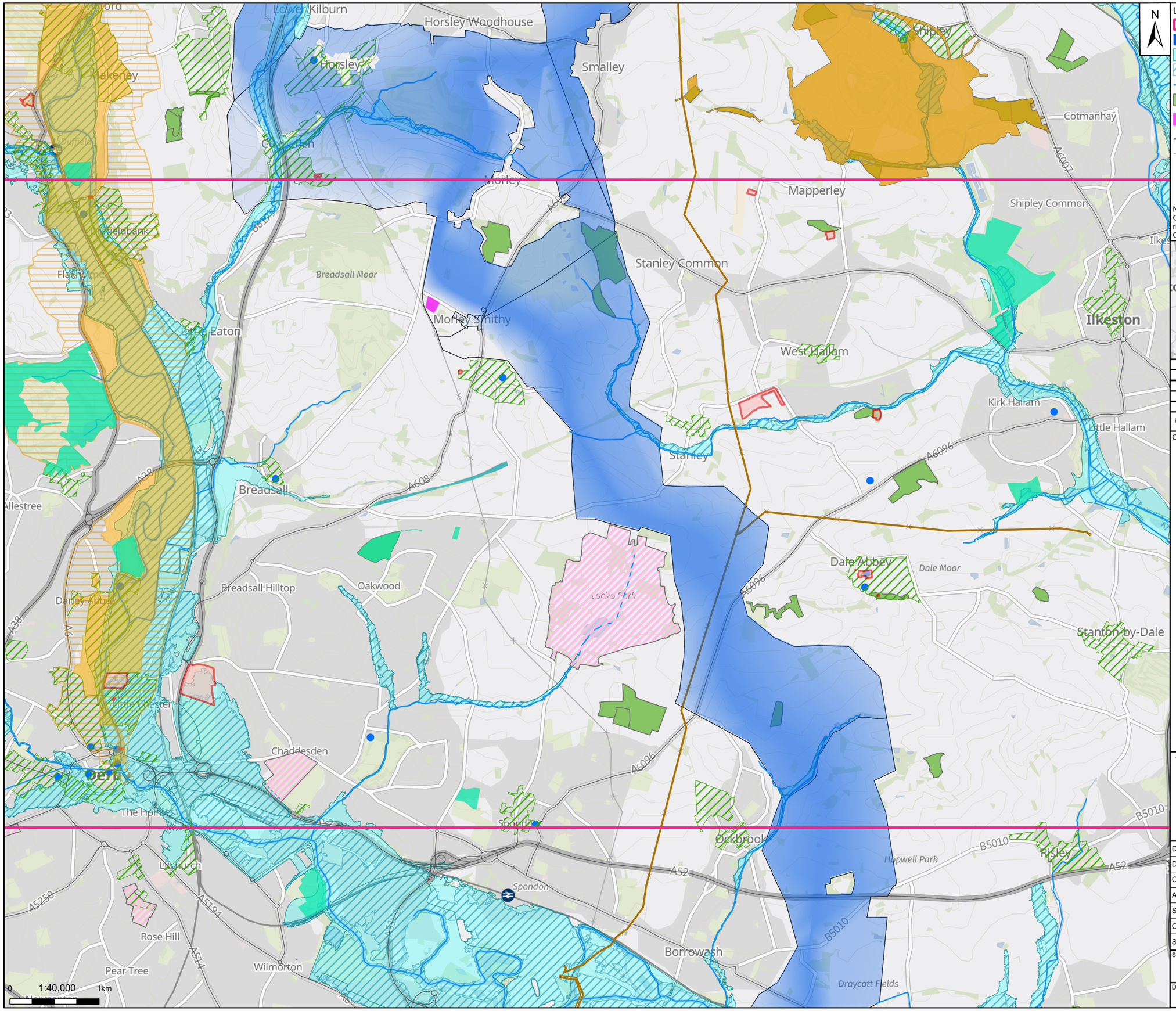
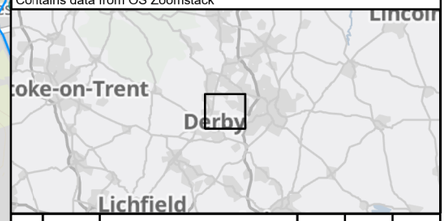


Legend

- Section 4
- Graduated Swathe
- Flood Zone 2
- Flood Zone 3
- Main River
- Ancient Woodland
- Site of Special Scientific Interest
- Motorway
- A Road
- Grade I Listed Building
- Conservation Area
- Scheduled Monument
- Registered Park and Garden
- World Heritage Site
- World Heritage Site Buffer
- Local Nature Reserve
- Country Park
- 132kV

Notes



Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client: nationalgrid

PROJECT: CHESTERFIELD TO WILLINGTON

Site: C2WE

Client: 1-3 Strand, London, WC2N 5EH

Title:

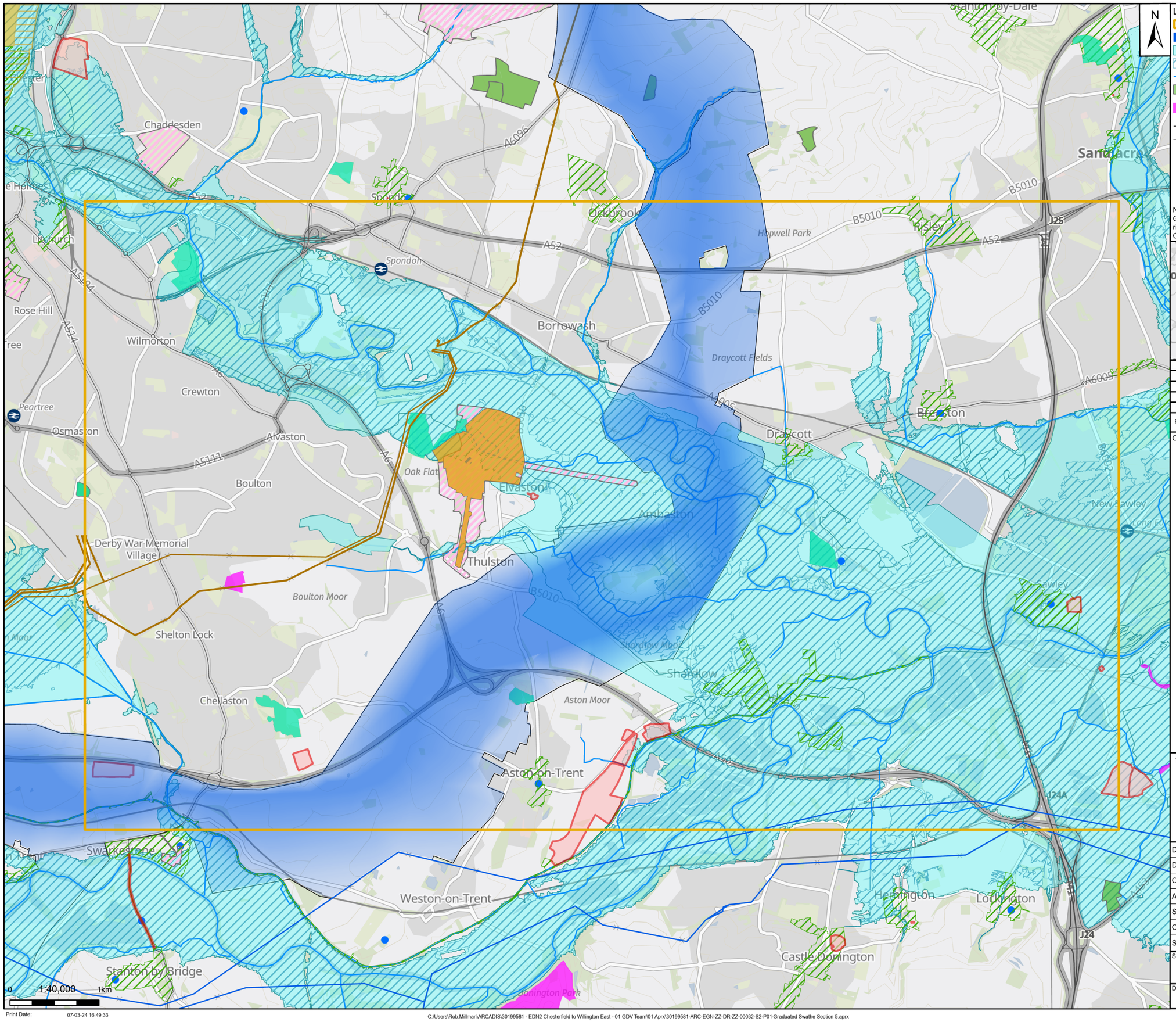
Figure 10-5
Graduated Swathe Section 4

Designed	R.A.	Date: 13 FEB 24	Signed:
Drawn	R.M.	Date: 13 FEB 24	Signed:
Checked	R.A.	Date: 13 FEB 24	Signed:
Approved	J.J.	Date: 13 FEB 24	Signed:
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description: For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00031-S2

Revision: P01



Legend

- Section 5
- Graduated Swathe
- Flood Zone 2
- Flood Zone 3
- Main River
- Ancient Woodland
- Site of Special Scientific Interest
- Motorway
- A Road
- Grade I Listed Building
- Conservation Area
- Scheduled Monument
- Registered Park and Garden
- World Heritage Site
- World Heritage Site Buffer
- Local Nature Reserve
- Country Park
- 400kV
- 132kV

Notes
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Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
C2WE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-6
Graduated Swathe Section 5

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:40,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00032-S2
Revision: P01

Print Date: 07-03-24 16:49:33

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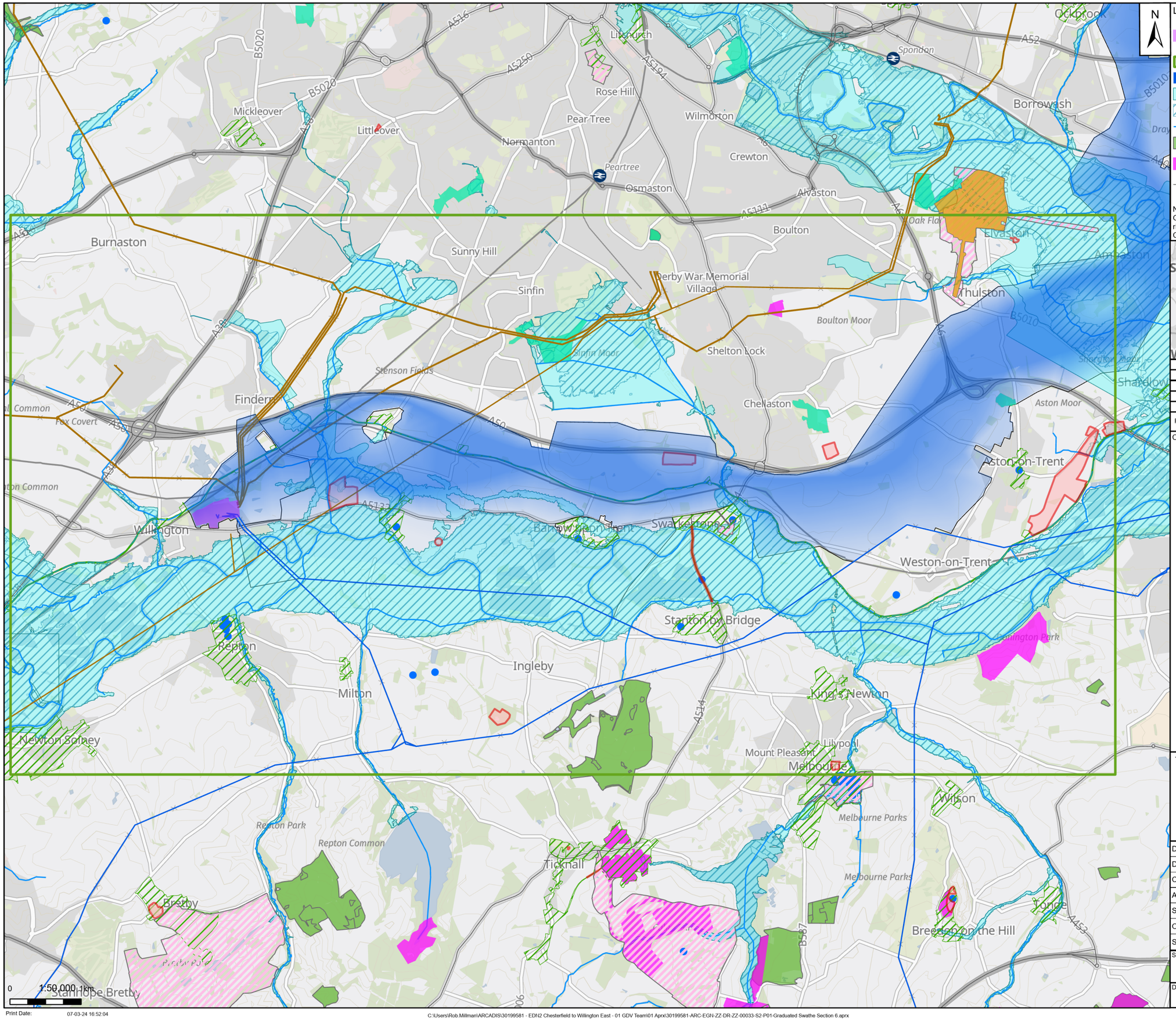

Legend

- Indicative Boundary of Existing Substation
- Section 6
- Graduated Swathe
- Flood Zone 2
- Flood Zone 3
- Main River
- Ancient Woodland
- Site of Special Scientific Interest
- A Road
- Grade I Listed Building
- Conservation Area
- Scheduled Monument
- Registered Park and Garden
- Local Nature Reserve
- Country Park
- 400kV
- 132kV

Notes
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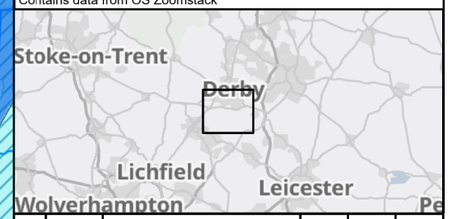

Rev	Date	Description	Drawn	Check	Approv
01	13/02/24	INITIAL ISSUE	RM	RA	JJ

Client:

nationalgrid

PROJECT:
CHESTERFIELD TO WILLINGTON

Site
CZWE

Client
1-3 Strand
London
WC2N 5EH

Title:

Figure 10-7
Graduated Swathe Section 6

Designed	R.A.	Date 13 FEB 24	Signed
Drawn	R.M.	Date 13 FEB 24	Signed
Checked	R.A.	Date 13 FEB 24	Signed
Approved	J.J.	Date 13 FEB 24	Signed
Scale:	1:50,000	Datum:	AOD
Original Size:	A3	Grid:	OS
Suitability Code:	S2	Project Number:	30199581

Suitability Description:
For Information

Drawing Number: 30199581-ARC-EGN-ZZ-DR-ZZ-00033-S2
Revision: P01

Print Date: 07-03-24 16:52:04

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National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom

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No. 4031152
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