

**The Great Grid Upgrade**

Chesterfield to Willington

# Preliminary Environmental Information Report

Volume 1: Chapter 4 Description of Project

March 2026

nationalgrid

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# 4. Description of the Project

## 4.1 Introduction

4.1.1 This chapter provides a description of the Chesterfield to Willington Project (the 'Project') and represents the current understanding of the Project's design parameters. These have been developed taking account of feedback received from non-statutory (Stage 1) consultation together with the ongoing survey, environmental assessment and design work.

4.1.2 The Project is a proposal by National Grid Electricity Transmission plc ('National Grid') to build the following principal components:

- A new 400 kV overhead line, approximately 60 kilometres (km) in length between a proposed new Chesterfield Substation and the existing Willington Substation. It is anticipated that this would comprise steel lattice pylons in accordance with National Grid's guidance and national planning policy.
- A new 400 kV Chesterfield Substation, to be built in the vicinity of the existing Chesterfield 275 kV Substation and the existing 132 kV National Grid Electricity Distribution (NGED) Substation to the south east of Chesterfield (referred to as the 'new Chesterfield Substation'). This is proposed to be a gas insulated switchgear substation.
- Replacement of short sections of existing overhead line and local changes to the lower voltage distribution networks to facilitate the construction of the Project.

4.1.3 The Project would include other required works, for example, temporary and permanent diversions of existing overhead line routes, temporary access roads, highway works, temporary works construction compounds, worksites and other ancillary works. The Project would also include utility diversions and drainage works. There would also be land required for mitigation and enhancement of the environment, including for Biodiversity Net Gain (BNG).

4.1.4 The Project would connect into the existing Willington Substation<sup>1</sup> located to the south west of Derby and a proposed new substation at Chesterfield. It is currently anticipated that the new Chesterfield Substation will be consented and delivered as part of a separate National Grid Project, titled 'Chesterfield to High Marnham', distinct from this Project. However, it is possible that the new Chesterfield Substation works are included as part of the development consent order (DCO) application for this Project. This would provide an alternative consenting mechanism, removing reliance on a separate planning application/consent and so mitigate against the risk of delay to the delivery of the Project.

4.1.5 In view of this potential inclusion, the new Chesterfield Substation and its potential environmental effects were considered in the Environmental Impact Assessment (EIA) Scoping Report (Ref 4.1), and have been included in this Preliminary

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<sup>1</sup> Separate from the Project, National Grid (Customer and Network Development) is developing plans for an extension to the existing substation to facilitate new customer connections. It is anticipated that these extension works would be delivered via permitted development rights and are expected to be completed by 2029. If confirmed, this potential development will be considered as part of the Project's cumulative assessment within the Environment Statement.

Environmental Information Report (PEIR) (where appropriate) and other associated statutory (Stage 2) consultation documentation. If the works are ultimately determined to be necessary to include as part of the Project, they will also be considered as part of the Environmental Statement (ES) within the DCO application.

4.1.6 This chapter should be read in conjunction with:

- **Chapter 1 Introduction;**
- **Chapter 3 Main Alternatives Considered.** This chapter describes the staged process that has been adopted in the development of the draft Order Limits; and
- **Chapter 5 Approach to Preliminary Environmental Information Report.**

4.1.7 This chapter is supported by the following plans and design drawings:

- **National Grid Chesterfield to Willington S.42 Overall Location Plan (EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000092);**
- **National Grid Chesterfield to Willington S.42 Master Key Plan (EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000091);**
- **National Grid Chesterfield to Willington S.42 Consultation Plan Series - Route Section Plans (EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000085, EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000086, EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000087, EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000088, EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000089 and EDN2-WSP-CONS-ZZZZZZ-DRW-OC-000090);**
- **Illustrative Overhead Line Limits of Deviation (LoD) (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-OH-000001);**
- **Illustrative Lattice Pylon Heights (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-OH-000002);**
- **Illustrative Bellmouth and Visibility Splay (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000001);**
- **Illustrative Crossroad and Visibility Splay (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000002);**
- **Illustrative Highways Passing Place (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000003);**
- **Illustrative Construction Compound (Main and Satellite) (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-CE-000001);**
- **Illustrative Haulage Road (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-CE-000002);** and
- **Illustrative Typical Culvert Arrangement (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-CE-000003).**

4.1.8 A Scoping Report (Ref 4.1) was prepared and submitted by National Grid to the Planning Inspectorate in October 2024. The Planning Inspectorate provided a Scoping Opinion (Ref 4.2) on behalf of the Secretary of State for Energy Security and Net Zero in December 2024. The responses from the Planning Inspectorate in relation to the description of the Project and how these requirements will be addressed by the applicant are set out in **Table 4.1**.

**Table 4.1: Summary of the Planning Inspectorate’s Scoping Opinion comments in relation to the description of the Project**

Scoping Opinion ID	Planning Inspectorate’s Comments	Response
2.1.1	<p><b>Flexibility – pylons:</b> <i>‘The Scoping Report refers to the potential use of alternative pylon designs (T pylons/ low height steel lattice pylons) as an embedded design measure. The pylon design(s) should be confirmed in the ES and committed to through the draft Development Consent Order (dDCO).</i></p> <p><i>The ES should provide dimensions of the pylons to be constructed. This should include maximum heights and widths of the steel work itself, along with details of the foundations that would be required at each pylon location. The ES should state whether the heights of structures are above Ordnance Datum (AOD), or above ground level. Terminology should be consistent throughout the ES and should correspond with any heights detailed within the dDCO and corresponding plans.</i></p> <p><i>The Inspectorate acknowledges that some flexibility may be required for micro-siting of pylons but would expect the proposed locations to be identified within the ES along with any Limits of Deviation (LoD) required (both laterally and vertically, i.e. in terms of the depths of foundations).’</i></p>	<p>The ES and draft DCO will define design parameters (minimum and maximum heights and pylon types) as well as LoD (laterally and vertically) for the design. Commentary surrounding expected minimum and maximum heights of pylons is presented within section 4.4 of this chapter, as well as the approach taken to providing flexibility within the design.</p> <p>A limit on the maximum depth of below ground works is not proposed. This is not considered necessary because, whilst a standard below ground LoD is not proposed, the Project would never go deeper than necessary for technical or environmental reasons as this would add engineering operational complexity and cost.</p>

Scoping Opinion ID	Planning Inspectorate's Comments	Response
2.1.2	<p><b>Construction compounds:</b> <i>'The ES should provide details regarding the number, location and dimensions of all construction compounds and access routes. The Applicant should make effort to locate the compounds where existing access to the construction site is available to reduce the need for new accesses and the resultant impacts.'</i></p>	<p>The number, location and dimensions of construction compounds and temporary access (including access points and haul roads) would be presented as part of the ES. Avoiding impacts through the use of existing access where appropriate, forms part of the mitigation hierarchy and has been adopted during design development. Further details of the development of the design are presented within <b>Chapter 7</b> of the <b>Design Development Report (DDR)</b> (Ref 4.3). Details of construction compounds are presented within section 4.5 of this chapter, and locations are presented on the accompanying figures (<b>Figure 4.2 Temporary Construction Works</b>).</p>
2.1.3	<p><b>Access tracks and pylon working areas:</b> <i>'The locations and types of access tracks (including culverts/temporary bridges) and pylon working areas should be identified within the ES.</i></p> <p><i>The ES should confirm whether any access tracks would be left in situ for maintenance activities, and if so, identify their locations. Proposed finished levels of any permanent access roads AOD should be identified within the ES (along with any necessary LoDs).'</i></p>	<p>The locations and types of temporary access (including access points and haul roads) as well as culverts and bridges, pylon working areas and LoDs used within assessments are presented within this chapter and the associated figures and appendices.</p> <p>These will be refined to include finished levels of proposed permanent access roads associated with the new Chesterfield Substation, which will remain in situ following the construction phase. These levels will be refined as the Project design advances and will be detailed with associated LODs, if required, at the ES stage. It is anticipated that temporary access (including access points and haul roads) and pylon working areas will be removed and reinstated following construction and commissioning of the Project.</p>
2.1.4	<p><b>Vegetation clearance:</b> <i>'The ES should identify where vegetation clearance is required, including the felling of trees. The Inspectorate acknowledges that some flexibility may be required for micro-siting of pylons but would expect the ES to provide clarity on the maximum extent of tree loss and to demonstrate that the design has</i></p>	<p>Assumptions surrounding the required vegetation clearance requirements are included within section 4.5 of this chapter. These will be refined as the Project design develops, and the maximum extent of vegetation loss will be assessed at the ES stage. <b>Chapter 5</b> and <b>Chapter 7</b> of the <b>DDR</b> (Ref 4.3) provide information surrounding how trees were considered within the options appraisal and the development of the proposed route alignment for the Project.</p>

Scoping Opinion ID	Planning Inspectorate's Comments	Response
	<p><i>sought to avoid or minimise loss of high-grade trees.</i></p> <p><i>Should any pockets of existing vegetation be relied upon to screen any parts of the Proposed Development, the Inspectorate expects their retention to be demonstrably secured.'</i></p>	<p>In addition, arboricultural surveys will be completed prior to the ES stage, and an Arboriculture Impact Assessment will be produced and submitted as part of the DCO submission. This will inform vegetation clearance requirements and highlight areas of high-grade trees.</p> <p>An Outline Landscape and Ecological Management Plan (LEMP) will be prepared and submitted as part of the DCO application. The Outline LEMP will secure the requirements for landscape mitigation planting, retention and screening.</p>
2.1.5	<p><b>LoDs:</b> <i>'The Inspectorate acknowledges the need for the proposed LoDs. These should be clearly detailed within the ES. All surveys and assessments should be of sufficient spatial scale to incorporate any LoD for all elements of the Proposed Development.'</i></p>	<p>Anticipated LoDs are presented within section 4.4 of this chapter. These will be refined as the Project design advances and will be detailed at ES stage.</p> <p>The preliminary surveys and assessments presented in this PEIR have been undertaken based on the nature of the Project works, professional judgement and feedback from statutory consultees engaged as part of the Project. Surveys will continue to be undertaken and results reported in the DCO application.</p>
2.1.6	<p><b>Landscaping:</b> <i>'The ES should identify all proposed landscaping and confirm whether any is relied upon to mitigate potentially significant landscape and/or visual effects. The Applicant should seek to agree the location and types of planting with relevant consultation bodies. The ES should explain and justify the assumptions made in respect of the growth rates of planting proposed to mitigation effects.'</i></p>	<p>The ES will present landscape mitigation measures to reduce potentially significant landscape and visual effects and will also justify the assumptions made in respect to growth rates of proposed planting. Consultation with relevant bodies will be undertaken as the development of landscape mitigation measures progresses.</p> <p>The preliminary assessment of landscape and visual effects has been carried out at the construction and operational phase of year 0 without any mitigation proposed to represent a 'worst-case' scenario, contrasted with year 15, when the mitigation planting is largely effective. The preliminary assessment is presented in <b>Chapter 6 Landscape and Visual</b>.</p>

Scoping Opinion ID	Planning Inspectorate's Comments	Response
2.1.7	<p><b>Employment:</b> <i>'The ES should set out the expected number and nature of employment opportunities during each phase of the Proposed Development. This should be described in the context of the workforce availability in the area at a time. The ES should detail how any mismatch between supply and demand would be addressed and consider the origins of its workforce in all relevant aspect assessments (notably socio-economics and traffic and transport). All assumptions made in this regard should be set out in the ES.'</i></p>	<p>The anticipated workforce numbers and the nature of the roles required during the construction of the Project are set out within section 4.5 of this chapter. Indicative employment requirements during operation are also presented within this chapter. Elements surrounding the preliminary assessment of employment opportunities associated with the Project, as well as assumptions surrounding the origins and requirements for temporary accommodation are presented within <b>Chapter 15 Socio-economics, Recreation and Tourism</b>. In addition, preliminary consideration of workforce vehicle movements has been included within <b>Chapter 12 Traffic and Transport</b>. These assessments will be updated as the Project progresses and presented within the ES.</p>
2.1.8	<p><b>Lighting:</b> <i>'The proposed lighting for all phases of the Proposed Development should be described within the ES.'</i></p>	<p>The ES will describe lighting requirements for both the construction and operational phase of the Project. The lighting requirements will include lighting at construction compounds and at the new Chesterfield Substation to allow for the safe movement and operation of equipment. In addition, there is the potential for the installation of safety lights on the peak of the pylons, where considered to be necessary.</p> <p>As part of defining the lighting requirements, a specialist aviation consultant has been engaged by National Grid to support in ongoing discussion and analysis relating to the operational safety of aircraft in the vicinity of the Project. Ongoing consultation with the Civil Aviation Authority, Ministry of Defence and East Midlands Airport will continue as the design of the Project progresses.</p> <p>Lighting requirements will be defined as the design of the Project evolves and will be assessed in each of the topic chapters of the ES. Lighting requirements will be secured by means of the Outline Code of Construction Practice (CoCP) (prepared at the ES stage), as well as an appropriate operational strategy/management plan, if required.</p>

Scoping Opinion ID	Planning Inspectorate's Comments	Response
2.1.9	<p><b>Working hours:</b> <i>'The ES should provide details of the anticipated construction working hours upon which the assessment of likely significant effects has been based (including any night-time working required). This should be consistent with the working hours specified in the dDCO.'</i></p>	<p>Anticipated construction working hours are presented within section 4.5 of this chapter and will be presented in the ES and secured by the draft DCO.</p>
2.1.10	<p><b>Residues and emissions:</b> <i>'The ES should provide an estimate, by type and quantity, of anticipated residues and emissions resulting from construction and operation of the Proposed Development, as required by Schedule 4(1)(d) of the EIA Regulations 2017.'</i></p>	<p>Details and preliminary assessments (where applicable) of residues and emissions are presented within topic chapters including <b>Chapter 6 Landscape and Visual, Chapter 9 Hydrology and Land Drainage, Chapter 10 Geology and Hydrogeology, Chapter 12 Traffic and Transport, Chapter 13 Air Quality</b> and <b>Chapter 14 Noise and Vibration</b>.</p> <p>The Project has and will continue to be designed in accordance with National Grid's design standards and would be compliant with guidelines and policies relating to electric and magnetic fields (EMF) stated within the National Policy Statement for Electricity Networks Infrastructure (NPS EN-5) (Ref 4.4), as outlined within this chapter. A standalone EMF report will be prepared and submitted as part of the DCO application.</p> <p>The assessment of material assets and waste was scoped out for further assessment, as detailed within Chapter 5 of the Scoping Report (Ref 4.1).</p>

4.1.9 **Table 4.2** provides a summary of the consultation feedback from specific stakeholders provided as part of the Scoping Opinion (December 2024) (Ref 4.2) in relation to the description of the Project.

**Table 4.2: Summary of stakeholder Scoping Opinion responses in relation to the description of the Project**

Consultee	Summary of Key Topics Raised	Response
Ault Hucknall Parish Council and Glapwell Parish Council	<p>Both Ault Hucknall Parish Council and Glapwell Parish Council individually made the following comment in their responses:</p> <p><i>‘We have been approached by a number of our community concerned about the route passing over or extremely close to their properties, especially of such high capacity, contravening your own EN-5 guidance. We would want reassurance that all parts of the proposed route within our ward would be fully compliant with this.’</i></p>	<p>The Project will be designed in accordance with National Grid’s design standards and each individual environmental aspect chapter details how the Project addresses the relevant guidelines and policies including those stated within NPS EN-5 (Ref 4.4). The design standards and guidelines are included as design embedded mitigation measures, which are further detailed within this chapter. In addition, an EMF Report will be prepared and submitted as part of the DCO application.</p>
Barrow Upon Trent Parish Council	<p><i>‘South Derbyshire (Swarkestone, Barrow upon Trent, Stenson Fields &amp; Twyford) are already subject to massive change with the proposed Infinity Garden Village Development. Is this going to be taken into consideration at all when this route is planned? The impact on the highways is going to be immeasurable, what mitigation will be put in place for the Pylon project?’</i></p>	<p>The proposed Infinity Garden Village development has been taken in to account during the development of the Project. The development itself is not located within the draft Order Limits for the Project. An assessment of cumulative effects arising from committed developments within the vicinity of the Project is presented within <b>Chapter 17 Cumulative Effects</b>.</p> <p>The Project design continues to evolve with due cognisance of surrounding constraints through sensitive routeing and siting to avoid and reduce, as far as practicable, impacts on identified receptors which include the road network, as detailed within the embedded mitigation measures within this chapter. An assessment on effects to road networks is presented in <b>Chapter 12 Traffic and Transport</b>.</p>

Consultee	Summary of Key Topics Raised	Response
Bolsover District Council	<p><i>‘Consideration should be given to whether alternative pylons, such as T-pylons, could be used. However, this would require a full visual assessment to be conducted to determine whether there were design benefits to alternative pylon types.’</i></p>	<p>The pylon type(s) used for the Project will be determined through ongoing design studies, assessment and survey, coupled with feedback from consultation.</p> <p>The main type of pylon used by National Grid on the National Electricity Transmission System (NETS) in England and Wales is the steel lattice pylon. Alternative pylon types, such as T-pylons (of steel monopole construction similar to a modern wind turbine), have been approved for use, which may achieve the technical performance required for the Project; however, at this stage of the Project, it is assumed that steel lattice pylons will be used (in accordance with National Grid’s guidance and national planning policy). In previous projects, the visual benefits of utilising standard steel lattice pylons have been recognised, especially when siting a new overhead line close to existing lines that use the same pylon type. Further information on the consideration of pylon types is presented in <b>Chapter 6</b> of the <b>DDR</b> (Ref 4.3) prepared for the Stage 2 consultation. The assessments undertaken within this PEIR are based upon the use of steel lattice pylons for the Project. Within the ES, where appropriate, the topic chapters will assess the pylon types chosen in a given location, where these differ from steel lattice pylons. If any flexibility remains in the pylon types in a given location, each topic chapter will clearly state and assess the precautionary worst-case scenario.</p>
Canal and River Trust	<p><i>‘We are particularly keen to understand where any crossings of the canal may be proposed as any such crossing of our property will require our prior consent, and our preference is always for underground crossings rather than overhead crossings’.</i></p>	<p>Ongoing engagement with the Canal and River Trust is being undertaken with regards to the crossing point of the canal. During engagement to date the Canal and River Trust have been receptive to proposals to oversail their assets providing that the Project can demonstrate that it will meet their Code of Practice for Works Affecting the Canal and River Trust (Ref 4.5). Engagement will continue as the Project progresses. In addition, consideration of the impacts to the canal and users are included within <b>Chapter 6</b></p>

Consultee	Summary of Key Topics Raised	Response
	<p>The Canal and River Trust also requested that the ES should take account of the Code of Practice for Works Affecting the Canal and River Trust.</p>	<p><b>Landscape and Visual, Chapter 7 Ecology and Biodiversity, Chapter 8 Historic Environment and Chapter 9 Hydrology and Land Drainage.</b></p> <p>The Code of Practice for Works Affecting the Canal and River Trust will be considered within the development of the design, with measures ultimately included in the CoCP if relevant.</p>
<p>Clay Cross Parish Council and Stanley and Stanley Common Parish Council</p>	<p>Both Clay Cross Parish Council and Stanley and Stanley Common Parish Council individually made the following comment in their responses: <i>‘We are aware that landowners and farmers are being approached about the prospect of up to 75 metre high pylons on their properties. Why has National Grid not previously been open about these extreme industrial-scale pylons and where are these taken account of in the scoping decisions that are required, for example, has the zone of theoretical visibility been adjusted accordingly?’</i></p>	<p>Indicative heights of pylons along with the LoDs are presented within this chapter and <b>Appendix 4B Indicative Pylon Schedules</b>. Zones of Theoretical Visibility and a visual assessment of the Project are included within <b>Chapter 6 Landscape and Visual</b>.</p> <p>At this stage proposals are preliminary. The pylon type(s) and heights for the Project will continue to be refined through detailed design and development of the ES for DCO submission based on the outputs of ongoing technical studies, assessment and survey, coupled with feedback from ongoing consultations.</p>
<p>Draycott and Church Wilne Parish Council</p>	<p><i>‘There has been mention by some people affected along the ‘preferred corridor EDN-2’ of pylons of 75m in height, not 50m. Our parish sits in flat land in the Trent valley so any structure of 50m let alone 75m will be visible for a considerable distance. Even though the preferred route skirts the edge of our parish it will be visible from the majority of properties and as such will adversely affect their rural view of the horizon and skyline. The inclusion of the relative</i></p>	<p>Indicative heights of pylons along with the LoDs are presented within this chapter and <b>Appendix 4B Indicative Pylon Schedules</b>.</p> <p>A visual assessment of the Project is included in <b>Chapter 6 Landscape and Visual</b>.</p> <p>At this stage proposals are preliminary. The pylon type(s) and heights for the Project will continue to be refined through detailed design and development of the ES for DCO submission based on the outputs of ongoing technical studies, assessment and survey, coupled with feedback from ongoing consultations.</p>

Consultee	Summary of Key Topics Raised	Response
	<p><i>scale and aesthetic suitability of the final choice should be included. East Midlands airport is barely 7.0 km from our parish with one of its flight paths passing over our village; has the introduction of such structures in such an area been considered and if so will they require red safety lights which will affect the night sky.'</i></p>	<p>The requirement for the installation of safety lights on the peak of the pylons will be evaluated as the design develops. Should safety lights be required, this will be assessed at the ES stage. A specialist aviation consultant has been engaged by National Grid to support in ongoing discussion and analysis relating to the operational safety of aircraft in the vicinity of the Project. Ongoing consultation with the Civil Aviation Authority, Ministry of Defence and East Midlands Airport will be undertaken as the design of the Project progresses.</p>
<p>Health and Safety Executive</p>	<p><i>'Based on the EIA it is not clear whether the applicant has considered the hazard classification of any chemicals that are proposed to be present at the development. This may be because there are no relevant hazardous substances.</i></p> <p><i>Hazard classification is relevant to the potential for accidents. For example, hazardous substances planning consent is required to store or use any of the Categories of Substances or Named Hazardous Substances set out in Schedule 1 of The Planning (Hazardous Substances) Regulations 2015 as amended, if those hazardous substances will be present on, over or under the land at or above the controlled quantities. There is an 'addition rule' in Part 4 of Schedule 1 for below-threshold substances. If hazardous substances planning consent is required, please consult the relevant Hazardous Substance Authority (usually the Local Planning Authority) on the application.'</i></p>	<p>The design of the Project has been undertaken with due cognisance of prevailing legislation including The Control of Substances Hazardous to Health (COSHH) Regulations 2002 (Ref 4.6).</p> <p>The Draft Outline CoCP is presented in <b>Appendix 4A Draft Outline Code of Construction Practice</b>; this includes measures for the use and management of chemical substances during the construction phase.</p> <p>Significant quantities of hazardous substances are not anticipated during the operation of the Project. Where hazardous substances are required during operation of the Project (for example during maintenance activities), these will be managed in accordance with Environment Agency and Department for Environment, Food and Rural Affairs guidance and procedures. Further details are presented in <b>Chapter 10 Geology and Hydrogeology</b>.</p>

Consultee	Summary of Key Topics Raised	Response
National Highways	<p><i>'...the Applicant should note that any new access from the SRN must be designed and delivered in accordance with Design Manual for Roads and Bridges (DMRB). This includes temporary accesses for construction purposes. As per DMRB, new connections to slip or connector roads will not be permitted for safety and operational reasons.'</i></p>	<p>The proposed access design for the Project factors in both requirements for temporary accesses that are necessary during the construction phase and any permanent access retained for operation and will be designed in accordance with the Design Manual for Roads and Bridges (DMRB). Ongoing design works will be informed by surveys and road safety audits in accordance with DMRB GG 119 (Ref 4.7). Engagement with statutory bodies, including National Highways and the local highway authorities, will be undertaken with respect to the access designs and relevant technical approvals obtained, the process for which will be set out in the draft DCO. The pre-application advice received from National Highways during Stage 1 consultation prohibited the installation of new temporary or permanent accesses off the high-speed Strategic Road Network (SRN). Consequently, this has been factored into the Project design with no accesses currently proposed off the SRN.</p>
National Highways	<p><i>'...the location of pylons or any other structures within the highway boundary will not be permitted. In addition, it is recommended that structures are positioned at a sufficient distance from our network so as not to cause a concern for National Highways network and operations and so that they can be maintained in future without encroachment onto National Highways land'.</i></p>	<p>The response received from National Highways is acknowledged and as part of ongoing design development efforts will be made to ensure that permanent works (i.e. pylons) as well as aspects of the temporary access design such as haul roads, and work areas around the pylons are not sited on National Highways land as far as reasonably practicable. Overhead lines will oversail the SRN at points along the route including the A38, A52, A6 and A50 and hence there will be a degree of interface during both construction and operation. Aspects of temporary works such as installation of crossing protection (netted scaffolding or other alternative methodologies available) to facilitate overhead line stringing will require access to National Highways land for deployment and removal of protective netting as well as for undertaking any essential vegetation clearance. These activities would be co-ordinated with National Highways to secure the necessary road space and permits as required in accordance with the New Roads and Street Works Act 1991 (Ref 4.8). Ongoing engagement with National Highways</p>

Consultee	Summary of Key Topics Raised	Response
		<p>regarding the designs of the Project will be undertaken and the necessary technical approvals obtained, the process for which will be set out in the draft DCO.</p> <p>All traffic management activities will be carried out by specialist contractors in accordance with relevant codes of practice under the New Roads and Street Works Act 1991.</p> <p>The type of traffic management is dependent on various factors including location, road type, the activity, phasing and extent of works, duration and timing. Provision for temporary traffic management is intended to be included within the DCO application and activities co-ordinated with the relevant highway authority.</p>
National Highways	<p><i>'Any structures that are within the 'fall distance' of National Highways network will need structural approval from National Highways.'</i></p>	<p>The response received from National Highways is acknowledged and noted. The proposed route alignment and siting of pylons is influenced by several factors and constraints, therefore siting pylons outside of fall distance from National Highways network land boundary is not always practicable. Ongoing engagement with National Highways regarding the designs of the Project will be undertaken and the necessary technical approvals obtained, the process for which will be set out in the draft DCO.</p>
National Highways	<p><i>'It is understood that some vegetation may need to be removed, for example to facilitate access. In relation to National Highways owned vegetation, the Applicant should adhere to BS5837: 2012 Trees in relation to design, demolition and construction. This is to ensure that our tree stock and associated root systems are protected.'</i></p>	<p>Assumptions surrounding the required vegetation clearance requirements are included within this chapter. These will be refined as the Project design develops, and the maximum extent of vegetation loss will be assessed at the ES stage.</p> <p>In addition, arboricultural surveys will be completed prior to the ES stage, and an Arboriculture Impact Assessment will be produced and submitted as part of the DCO submission. This will inform vegetation clearance requirements and highlight areas of high-value trees and establish root protection zones. The Project will adhere to British Standard (BS) 5837:2012 (Ref 4.9) and measures relating to this are outlined within <b>Appendix 4A Draft Outline Code of Construction Practice</b>.</p>

Consultee	Summary of Key Topics Raised	Response
National Highways	<p><i>'The construction phase may have an impact on drainage and National Highways will wish to ensure the integrity of our own drainage assets. In that regard, the Applicant should note that new connections to our drainage assets will not be permitted. This is in accordance with DfT Circular 01/2022.'</i></p>	<p>The comment from National Highways is acknowledged and will be considered as part of the drainage strategy and design. The proposed access design for the Project factoring in both requirements for temporary accesses necessary during the construction phase and any permanent access retained for operation will be designed in accordance with the DMRB; this includes drainage design, for which CG 501 (Ref 4.10) will provide the over-arching requirements which will be followed. National Grid notes that new connections will not be permitted to National Highways' existing drainage assets. The drainage strategy for the Project will be developed in accordance with Sustainable Drainage Systems (SuDS) principles outlined in the SuDS Manual 2015 (C753) (Ref 4.11). Given that advice received from National Highways during Stage 1 consultation stated that installation of new temporary or permanent accesses off the high-speed SRN would also be prohibited, it is anticipated the interaction with National Highways drainage assets would be limited. National Grid will obtain utility records and undertake survey works to inform the development of the design. Ongoing engagement with National Highways will be undertaken as the design progresses.</p>
National Highways	<p><i>'We understand that lighting may be necessary, particularly to facilitate construction activities. We would wish to ensure that any light spill from construction sites does not cause a safety hazard on our roads. As such, we should be consulted on details of lighting for any site in proximity to our network.'</i></p>	<p>Lighting requirements for construction activities will be assessed as part of the ES. Temporary lighting will be required at active worksites, welfare areas and construction compounds during construction working hours in the winter period where daylight is limited or for night works where necessary. National Grid will have regard to the safety of road users and will seek as far as practicable to keep light spill to a minimum so as to avoid creation of a safety hazard on the highways network. Measures for the management of lighting during construction are presented within <b>Appendix 4A Draft Outline Code of Construction Practice</b>.</p>

Consultee	Summary of Key Topics Raised	Response
North East Derbyshire District Council	<p><i>'In relation to the embedded mitigation measures, the Scoping Opinion states that the preferred route 'avoids and reduces impacts on individual receptors.' It is considered that this judgement can only be made once the evidence regarding the discounting of the alternatives is available.'</i></p>	<p>Embedded mitigation measures are detailed within this chapter. The avoidance and reduction of impacts on receptors has been included, where practicable throughout the development of the design of the Project.</p> <p>Consideration of alternatives is presented in <b>Chapter 3 Main Alternatives Considered</b> and includes reasoning for discounting them.</p>
North East Derbyshire District Council	<p><i>'In relation to the design of the pylon structures, it is considered that the T- pylon/low height structures should be the only design in scope for areas designated in Local Plans as higher value landscape areas, close to settlements, or within/affecting the setting of heritage assets, except where undergrounding is physically possible.'</i></p>	<p>The pylon type(s) used for the Project will be determined through ongoing design studies, assessments and surveys, coupled with feedback from consultations.</p> <p>The main type of pylon used by National Grid on the NETS in England and Wales is the steel lattice pylon. Alternative pylon types, such as T-pylons (of steel monopole construction similar to a modern wind turbine), have been approved for use, which may achieve the technical performance required for the Project; 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). In previous projects, the visual benefits of utilising standard steel lattice steel pylons have been recognised, especially when siting a new overhead line close to existing lines that use the same pylon type. Further information on the consideration of pylon types is presented in <b>Chapter 6</b> of the <b>DDR</b> (Ref 4.3) prepared for the Stage 2 consultation. The assessments undertaken within this PEIR are based upon the use of steel lattice pylons for the Project. Within the ES, where appropriate, the topic chapters will assess the pylon types chosen in a given location, where these differ from steel lattice pylons. If any flexibility remains in the pylon types in a given location, each topic chapter will clearly state and assess the precautionary worst-case scenario.</p>

Consultee	Summary of Key Topics Raised	Response
North East Derbyshire District Council	<p><i>'In relation to undergrounding, the assessment needs to be landscape impact led and the cost issues need to be fully considered in light of a more detailed assessment as to the viability of the discounted alternatives.'</i></p>	<p>A consideration of alternatives including undergrounding is presented within <b>Chapter 3 Main Alternatives Considered</b>.</p>
South Derbyshire District Council	<p><i>'The use of standard lattice towers is rather unimaginative for what will be a significant intrusion into the landscape and we would advise that if undergrounding is not possible the opportunity ought to be explored to utilise more contemporary T-Pylons that are as small as possible since, they would sit rather more elegantly in the landscape'</i></p> <p><i>'Any supporting infrastructure also ought to be designed to blend into the landscape, be suitably mitigated with planting, and be coloured so as to be as unobtrusive as possible.'</i></p>	<p>The pylon type(s) used for the Project will be determined through ongoing design studies, assessment and survey, coupled with feedback from consultations.</p> <p>The main type of pylon used by National Grid on the NETS in England and Wales is the steel lattice pylon. Alternative pylon types, such as T-pylons (of steel monopole construction similar to a modern wind turbine), have been approved for use, which may achieve the technical performance required for the Project; 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). In previous projects, the visual benefits of utilising standard steel lattice pylons have been recognised, especially when siting a new overhead line close to existing lines that use the same pylon type. Further information on the consideration of pylon types is presented in <b>Chapter 6</b> of the <b>DDR</b> (Ref 4.3) prepared for the Stage 2 consultation. The assessments undertaken within this PEIR are based upon the use of steel lattice pylons for the Project. Within the ES, where appropriate, the topic chapters will assess the pylon types chosen in a given location, where these differ from steel lattice pylons. If any flexibility remains in the pylon types in a given location, each topic chapter will clearly state and assess the precautionary worst-case scenario.</p> <p>Supporting infrastructure (including substations) will be designed in accordance with relevant legislation and guidance including the Holford Rules (Ref 4.12) and Horlock Rules (Ref 4.13), which</p>

Consultee	Summary of Key Topics Raised	Response
		<p>include guidelines for the design of infrastructure in relation to minimising landscape (among other) impacts.</p> <p>Mitigation planting will be considered and developed as the design of the Project evolves and will be secured via the Outline LEMP which will accompany the DCO submission. Mitigation planting will also be included within the assessments at the ES stage.</p>
South Derbyshire District Council	<i>'Further consideration should be given to... Removal redundant infrastructure.'</i>	Works associated with existing infrastructure, including the diversion and undergrounding of existing infrastructure are outlined within this chapter.
Network Rail	<i>'Please note that if the intention is to install cabling under, through and/or above railway land, the developer will require an easement from Network Rail, and in turn, we would recommend that the developer engage with us early in the planning of their scheme to discuss and agree this particular element of the proposal.'</i>	Proactive steps will be taken to engage and consult with Network Rail as the Project progresses to inform the design work and the necessary approvals obtained, the process for which will be set out in the draft DCO. Details of the engagement with Network Rail to date are presented within <b>Chapter 12 Traffic and Transport</b> .

- 4.1.10 In addition, key feedback from the Stage 1 consultation related to the description of the Project has been considered in **Table 4.3**. Consideration of wider feedback received during the Stage 1 consultation is presented in the Stage 1 Consultation Feedback Report (Ref 4.14).

**Table 4.3: Summary of the key Stage 1 consultation feedback relating to the description of the Project**

Consultee	Summary of Key Topics Raised	Response
Ministry of Defence June 2024	<i>‘...the MOD requests that the structure is fitted with aviation warning lighting. The pylons should be fitted with a minimum intensity 25 candela omni directional red flashing light or equivalent infra-red light fitted at the highest practicable point of the structure.’</i>	<p>The requirement for the installation of safety lights on the peak of the pylons will be evaluated as the design develops. Should safety lights be required, this will be assessed at the ES stage and secured by an appropriate strategy/management plan, if required.</p> <p>A specialist aviation consultant has been engaged by National Grid to support in ongoing discussion and analysis relating to the operational safety of airfields or aircraft in the vicinity of the Project. Ongoing consultation with the Civil Aviation Authority, Ministry of Defence and East Midlands Airport will be undertaken as the design of the Project progresses.</p>
Bolsover District Council October 2024	<i>‘The consultation documentation references steel lattice pylons which are 50m high. Alternative options could be the utilisation of National Grid’s new T-pylons. It is understood these pylons are lower at 35m high, are sleeker on a single pole and utilise less land area. It is also indicated that they have less of an impact on the landscape than the traditional lattice pylons.’</i>	<p>The pylon type(s) used for the Project will be determined through ongoing design studies, assessment and survey, coupled with feedback from consultation.</p> <p>The main type of pylon used by National Grid on the NETS in England and Wales is the steel lattice pylon. Alternative pylon types, such as T-pylons (of steel monopole construction similar to a modern wind turbine), have been approved for use, which may achieve the technical performance required for the Project; 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). In previous projects, the visual benefits of utilising standard steel lattice pylons have been recognised, especially when siting a new overhead line close to existing lines that use the same pylon type. Further information on the consideration of pylon types is presented in the <b>DDR</b> (Ref 4.3) prepared for Stage 2 consultation. The assessments undertaken within this PEIR are based upon the use of steel lattice pylons for the Project. Within the ES, where appropriate, the topic chapters will assess the pylon types chosen in a given location, where these differ from steel lattice pylons. If any flexibility remains in the pylon types in a given location, each topic chapter will clearly state and assess the precautionary worst-case scenario.</p>

## 4.2 Location of the Project

### Draft Order Limits

- 4.2.1 The draft Order Limits are defined as the maximum extent of land within which the Project, as described in this chapter, will be carried out. They include both permanent and temporary land required to construct and operate the Project. The draft Order Limits are illustrated on **Figure 4.1 Proposed Project Design**.
- 4.2.2 The draft Order Limits lie entirely within the administrative boundary of Derbyshire County Council. **Figure 1.1 Project Location and Route Sections** presents the location of the draft Order Limits.

### Route Sections

- 4.2.3 For the purpose of reporting in this PEIR, the Project has been divided into six geographical sections, running from north to south and comprises:
- Section 1: Chesterfield Substation to Tibshelf: The proposed route alignment is situated south east of Chesterfield located at the northernmost extent of the Project. Section 1 encompasses the land and works associated with the new Chesterfield Substation and covers an area extending from west of Hassocky Road in a south easterly direction towards Heath, before turning south passing Stainsby, Astwith, and Hardstoft towards Tibshelf.
  - Section 2 Tibshelf to Ripley: The proposed route alignment extends from B6014 Doe Hill Lane west of Tibshelf, progressing in a generally south westerly direction toward Alfreton and then continues in the direction of Pentrich, broadly following the A38 corridor routeing southwards towards Ripley until reaching Lower Hartshay immediately south of the A610.
  - Section 3 Ripley to Morley: The proposed route alignment in this section starts west of Ripley and extends to Morley, forming the central part of the Project. The alignment extends from the A610 passing through Lower Hartshay, progressing in a generally southerly direction closely following the western side of the A38 corridor toward the settlements of Cinderhill, Holbrook and Kilburn. The route crosses the A38 between Horsley and Coxbench, before reaching Morley.
  - Section 4 Morley to Ockbrook: The proposed route alignment extends from the north east of Morley Smithy where it crosses the A608 and continues south east, passing south west of Stanley and circumnavigating around Locko Park Registered Park and Garden. The alignment then progresses southwards until the A6096 and turns south east running around the north east side of Ockbrook.
  - Section 5 Ockbrook to Aston-on-Trent: The proposed route alignment continues from the south east side of Ockbrook and progresses in a generally southerly direction. After crossing the A52 (Brian Clough Way), it continues southwards crossing the A6005 and Derby to Nottingham Railway Line between Borrowash and Draycott. The route then crosses the River Derwent, circumnavigating eastwards around Ambaston and Elvaston, before turning south west, thereby avoiding direct impacts to these settlements. Continuing south west, the proposed route alignment passes between Thulston and the Trent Valley Crematorium before crossing the A6 Derby Spur near the A50 Junction 2 (Aston Interchange) and then follows the A50 towards Chellaston.

- Section 6 Aston-on-Trent to Willington Substation: The proposed route alignment begins to the north west of Aston-on-Trent and follows a generally south westerly direction. After crossing the A50, the route runs parallel to the Castle Donington railway line, remaining south of the A50. It then crosses the Trent and Mersey Canal and Castle Donington Line just north west of Barrow upon Trent and continues roughly parallel to Twyford Road (A5132). Along this stretch, the proposed route alignment intersects and crosses multiple existing 132 kV overhead lines owned and operated by NGED before entering the Willington Substation from the north east.

## 4.3 Environmental Design Principles

- 4.3.1 The Project will be designed, constructed, maintained, and operated in accordance with relevant legislation and guidance. National Grid policies and processes, which contain details on design standards and technical specifications required to be met when designing, constructing, maintaining, and operating assets such as those proposed on the Project, will be adhered to.
- 4.3.2 **Chapter 2 Legislative, Regulatory and Planning Policy Context** of this PEIR sets out the overarching policy relevant to the Project which is inclusive of, but not limited to, the Overarching National Policy Statement for Energy (NPS EN-1) (Ref 4.15) and NPS EN-5 (Ref 4.4).
- 4.3.3 The guidelines set out in the Holford Rules and Horlock Rules (which are defined within **Chapter 2 Legislative, Regulatory and Planning Policy Context**) as well as good design principles have been, and will continue to be considered as part of the design process. This includes locating Project features away from sensitive receptors, where practicable, and considering measures that can be embedded into the design.
- 4.3.4 **Table 4.4** outlines the principal design embedded and good practice mitigation measures that have been included to date. As the Project develops and progresses, more measures will be identified and included within the Project design. The topic chapters (**Chapters 6 to 16**) presented within this PEIR also set out the design embedded mitigation measures relevant to their assessments.

**Table 4.4: Embedded mitigation measures incorporated into the Project design**

Embedded Mitigation Measures	Benefits
Sensitive routing and siting to develop the proposed route alignment, siting of the new Chesterfield 400 kV Substation and development of the draft Order Limits.	Avoids and reduces, as far as practicable, impacts on identified receptors or environmental constraints, in line with NPS EN-1, NPS EN-5, the Holford Rules and Horlock Rules. Further information on the approach to routing and siting is presented in <b>Chapter 3 Main Alternatives Considered</b> and the <b>DDR</b> (Ref 4.3).
Code of Construction Practice (CoCP)	A CoCP will be implemented during the construction phase and will outline the mitigation requirements to be adhered to. The Draft Outline CoCP is included in <b>Appendix 4A</b> . An updated Outline CoCP will be submitted with the DCO application.

Embedded Mitigation Measures	Benefits
<p>Sensitive siting and strategic location of temporary access (including access points and haul roads) and other temporary construction elements to minimise the loss of mature vegetation where practicable.</p>	<p>Reduction of construction traffic impacts to the local road network during the construction phase. In addition, this measure would lead to a reduction of the impacts to identified environmental and socio-economic receptors, as well as to the existing landscape character. <b>Chapter 8</b> of the <b>DDR</b> (Ref 4.3) presents further details of the consideration of siting of temporary works.</p>
<p>Pylon fittings</p>	<p>Pylon fittings, such as insulators, dampers, spacers and clamps, are designed and procured in accordance with a series of National Grid Technical Specifications and must be type registered (rigorously tested) to ensure the fitting conforms to the specification. These processes reduce the potential for audible noise and tones to occur from all types of fittings, including insulators. Where noise does occur, it is likely to be localised and of short duration. If this is due to a fault, action can be taken to rectify it. Where noise from fittings does occur which results in a complaint, appropriate action can be taken to seek to remedy the cause of the noise, usually through cleaning or replacing the relevant fitting.</p>
<p>Diversion, removal or undergrounding of existing third-party infrastructure within the draft Order Limits.</p>	<p>Reduction of environmental impacts associated with diversion, removal or undergrounding of third-party assets. This includes landscape and visual and historic environment impacts where overhead line electricity infrastructure is consolidated or routed in parallel. Further information on these is presented within section 4.4 of this chapter.</p>
<p>The Project would be designed in accordance with National Grid design standards and would be compliant with the guidelines and policies relating to EMF stated in NPS EN-5, including the International Commission on Non-Ionizing Radiation Protection guidelines (Ref 4.16) and the Department of Energy and Climate Change publication Power Lines: Demonstrating compliance with EMF public exposure guidelines. A Voluntary Code of Practice (Ref 4.17).</p>	<p>Compliance with these guidelines and policies mean that the Project has designed out potential effects from EMF to a level that adheres to overarching health and safety standards.</p>
<p>The Project would be designed to comply with design safety standards including National Electricity Transmission System Security and Quality of Supply Standards (NETS</p>	<p>Existing National Grid processes are designed to identify potential safety risks during construction and operation and to design these out at each stage of Project development.</p>

Embedded Mitigation Measures	Benefits
<p>SQSS) (Ref 4.18) and the suite of National Grid policies, processes and specifications which contains details on design standards required to be met when designing, constructing, and operating its projects.</p>	<p>A holistic network design approach based on the application of NETS SQSS as well as policies, processes and specifications will help to deliver a coordinated, economical and resilient electricity transmission system with an environmentally sensitive design.</p>
<p>Landscape mitigation planting will be allowed for within the Project design. An Outline LEMP will be prepared as part of the ES, which will secure the implementation of any proposals for planting and indicative species mixes.</p>	<p>Reduction in effects on landscape and views. Areas of mitigation planting will be defined for the ES stage.</p>
<p>Biodiversity Net Gain (BNG) would be embedded as part of the Project design evolution.</p>	<p>Embedding BNG from early design stages will ensure improved environmental outcomes and ensure that National Grid complies with statutory requirements for Nationally Significant Infrastructure Projects. The Project would result in an overall net improvement to biodiversity through the delivery of BNG, using a combination of on-site and off-site mitigation. National Grid has committed to 10% in Environmental Gain including, as a minimum, 10% BNG across all its construction projects, including the Project.</p>
<p>Surface water drainage systems would provide attenuation of runoff from impermeable surfaces at greenfield rates, with an allowance for climate change and appropriate pollution prevention measures incorporating the use of SuDS, where practicable.</p>	<p>Reduction of water quality impacts to watercourses.</p>
<p>Any requirements for water supply and foul water treatment and disposal for temporary construction compounds, and for office and welfare facilities at substation(s) during operation would be designed to minimise impacts on water resources and receiving water quality, for example, by reusing water wherever practicable.</p>	<p>Reduction of impacts to water quality within receiving watercourses.</p>
<p>For temporary access (e.g. haul roads), crossings of Main Rivers would be avoided where reasonably practicable or crossed using a clear span bridge or suitable culvert subject to design, constructability, site constraints and agreement by the relevant statutory bodies.</p>	<p>Reduction of impacts to watercourses (including to the riparian zone and water quality) by removing works from within the watercourse itself.</p>

Embedded Mitigation Measures	Benefits
<p>Pylons will not be located within the relevant permitting stand-off distances<sup>2</sup> around watercourses as far as reasonably practicable. Specifically, for non-tidal Main Rivers, appropriate stand-off distances have been considered from the bank top or from any flood defence structure, and these will be maintained where practicable. Changes to ordinary watercourses that might obstruct or alter the flow of an ordinary watercourse will be subject to further review, and Ordinary Watercourse Consent will be sought and obtained, where relevant, prior to any works being undertaken.</p>	<p>Avoidance of direct impacts to watercourses and flood defence structures.</p>

## Application of the Rochdale Envelope

- 4.3.5 The ‘Rochdale Envelope’ approach enables robust environmental assessment of a Project within ‘clearly defined parameters’ relating to the design of the Project. The Planning Inspectorate’s Advice Note Nine: Rochdale Envelope (Ref 4.19) provides guidance on the use of the ‘Rochdale Envelope’ surrounding the degree of flexibility that may be considered appropriate within a DCO application under the Planning Act 2008 (Ref 4.20). The Advice Note acknowledges that there may be parameters of a project’s design that are not yet fixed and, therefore, it is necessary for the PEIR and ES to assess likely worst-case scenarios to ensure that the likely significant environmental effects of the project have been assessed. As recognised by the Advice Note, a necessary and proportionate degree of flexibility needs to be incorporated into the design of a development so that unforeseen constraints encountered after a development has been consented can be addressed.
- 4.3.6 Within this PEIR, the description of the Project reflects the design work undertaken to date. However, as the Project evolves sufficient flexibility within the design would be allowed to provide the Main Works Contractor with sufficient scope for value engineering through innovative design and/or construction techniques. In order to provide sufficient flexibility, a realistic worst-case scenario has been assumed for the purposes of this PEIR.
- 4.3.7 The preliminary assessments reporting in this PEIR have been undertaken using a parameters approach which uses maximum parameters within which the Project may be constructed and operated. The maximum parameters include LoDs within which each component of the Project would be located and are defined within section 4.4 of this chapter. The assessments within the topic chapters have undertaken the assessments based on the worst-case scenario within the maximum parameters (which include the LoDs).

<sup>2</sup> Stand-off distances refer to a buffer between the proposed infrastructure and associated construction works and a receptor such as a watercourse.

## Approach to Material Assets and Waste

- 4.3.8 Where practicable, materials used during construction of the temporary works (e.g. aggregates for haul road construction) would be sourced from other construction projects within the region and reused at other construction projects after completion of the Project.
- 4.3.9 The Project will require the use of new materials during construction (for example galvanised steel for the pylons and reinforced concrete for the foundations). Further details surrounding the materials anticipated to be used during construction will be included in the ES.
- 4.3.10 The source of the materials to be used during construction is unlikely to be identified until the post-consent stages of the Project. However, due to the nature of the Project, the use of secondary (reused/recycled) sources during construction of the permanent works may often not be practicable, as they could affect the operation and the design life of the Project. National Grid has existing processes in place to source materials from sustainable sources and to use recycled materials, where these do not compromise the required design standards and operational life of the Project.
- 4.3.11 National Grid is committed to the waste hierarchy and although waste will be generated, it will be responsibly managed. The Main Works Contractor would produce a Site Waste Management Plan prior to construction (commitment GG22 in **Appendix 4A Draft Outline Code of Construction Practice**). This would set out good construction and management practices, including how the Project will apply the waste hierarchy throughout detailed design and construction phases with measures to reduce the generation of waste and appropriate measures to reuse and recycle materials, where practicable. It would also identify appropriately licensed carriers. For non-waste materials, the Main Works Contractor would also, where necessary, prepare a Materials Management Plan (MMP) to outline how materials would be managed to ensure they are not treated as waste, in accordance with Contaminated Land: Applications in Real Environments (CL:AIRE) protocols (Ref 4.21).
- 4.3.12 Taking the above into account, the Scoping Report (Ref 4.1) states that the effects of any waste producing activities will be addressed as part of relevant environmental aspects and associated strategies. Consequently, a standalone environmental topic chapter on waste has been scoped out. The Scoping Opinion (Ref 4.2) agrees with this approach and indicates that any relevant impacts should be clearly cross-referenced within the ES. Consideration of relevant waste impacts (including waste vehicle movements) is presented in **Chapter 10 Geology and Hydrogeology, Chapter 11 Agriculture and Soils, Chapter 12 Traffic and Transport and Appendix 4A Draft Outline Code of Construction Practice**.

## Approach to Energy Consumption

- 4.3.13 The Project aims to support the UK's transition to Net Zero emissions by 2050. National Grid has a statutory duty to develop and maintain an efficient, coordinated, and economical electricity transmission system.
- 4.3.14 The Project will consume energy during manufacture and construction. The Project will consider a range of measures to reduce energy consumption during construction, such as the use of energy efficient plant and equipment, where practicable. These will be set out within the Outline CoCP, which will be submitted with the DCO application. The Project will aim to use local grid supply points for temporary site power, where feasible. Where not practicable, an alternative sustainable option would be used, such as appropriately sized alternatively fuelled or hybrid generators.

- 4.3.15 A Construction Traffic Management Plan (CTMP), to be developed in accordance with the Outline CTMP submitted in support of the DCO application, will set out measures to reduce journeys through car sharing and use of public transport where practicable, thus decreasing fuel and energy consumption.
- 4.3.16 Energy consumption during operation would be limited to the energy required to operate and maintain the Project. There may also be small volumes of material assets to replace components. National Grid also has existing processes in place to monitor its energy consumption across the network. The operational energy requirements would be managed as part of the wider network operation.
- 4.3.17 The measures outlined above would reduce the energy consumption of the Project during both construction and operation.

## **Approach to Climate Change Resilience**

- 4.3.18 The UK's climate is changing. Since the 1980s the UK climate has been warming at a rate of approximately 0.25 °C per decade, and the last three years have been in the UK's top five warmest on record. The UK's climate has also become steadily wetter since the 1980s with the most recent decade (2015 to 2024) 2 per cent wetter than 1991 to 2020 and 10 per cent wetter than 1961 to 1990. Weather extremes are becoming more frequent, with the all-time highest maximum temperature recorded in the last decade, and the period between October 2023 to March 2024 recording over 150 per cent of the 1991 to 2020 average rainfall, resulting in widespread flooding. Other climate change trends such as drought, wind, sea level rise and flood risk, snow and humidity are predicted to change (Ref 4.22).
- 4.3.19 The Scoping Report (Ref 4.1) included a climate change resilience screening assessment, which evaluated the projected climate change trends, receptors and design measures in place which enhanced resilience to climate change. The climate change resilience screening assessment concluded that climate change resilience could be scoped out as a topic; however, the interface with all other topics will be scoped in, in the form of an In-Combination Climate Impact (ICCI) assessment. The Scoping Opinion (Ref 4.2) agreed with this approach but requested that standards, measures or processes that would be relied upon to mitigate the potential for likely significant effects to the Project are noted. The approach to the ICCI assessment, and measures to build climate resilience into the design and operation of the Project are outlined below. The ICCI assessment will be included as part of the ES submitted with the DCO application.

### **In-Combination Climate Impact (ICCI) assessment**

- 4.3.20 The ICCI assessment will be a qualitative assessment which will identify if any reported effects will be exacerbated or ameliorated by climate change, and if any further mitigation measures will be required. The ICCI assessment will also assess whether the mitigation measures will continue to be effective considering changes to climate.

### **Measures to build the Project's resilience to climate change**

- 4.3.21 Section 5.18 of the Scoping Report (Ref 4.1) noted a number of design embedded and good practice measures for the construction and operational phases. These measures have been reviewed and are presented below to demonstrate how climate change impacts will be managed and secured.

- 4.3.22 At the construction phase, the Outline CoCP will include measures for the Main Works Contractor to adhere to, to manage weather-related impacts. The measures are outlined within **Appendix 4A Draft Outline Code of Construction Practice**. In addition, geo-environmental and geotechnical intrusive and non-intrusive ground investigation surveys and assessment would be undertaken in accordance with current best practice including BS 5930 (Ref 4.23), BS 10175 (Ref 4.24), Eurocode 7 (Ref 4.25) and UK Specification for Ground Investigation (Ref 4.26). These would inform, if required, a site remediation strategy, slope stability assessments, foundation design, and piling work risk assessments where appropriate (GH01). This will be secured through the Outline CoCP, which will accompany the ES, and be relevant to substations and pylons.
- 4.3.23 For the operational phase, the following measures have been identified:
- Network assets will be manufactured to National Grid Electricity Transmission (NGET) standards (and where relevant international standards) and designed to operate within particular temperature parameters. This applies to the substations, pylons and overhead lines. New electricity infrastructure will also align with SQSS Code Documents (Ref 4.27) which include operational criteria and management measures that address adverse conditions that could increase the likelihood of faults (e.g. high winds, lightning, very high or low ambient temperatures, high precipitation and flooding).
  - The foundation design for pylons will be site-specific, informed by geo-environmental and geotechnical intrusive and non-intrusive ground investigation surveys, and are anticipated to be either conventional pad and column foundations or piled, but subject to site conditions alternative design solutions could be required.
  - Foundation, geotechnical design and partial factors on soil properties shall comply with and be checked in accordance with BS EN 1997-1 Geotechnical Designs – General Rules (Ref 4.28), the UK National Annexes (Ref 4.29), and in accordance with the recommendations of BS 8004:2015 Code of Practice for Foundations (Ref 4.30).
  - Substation design will be in accordance with National Grid standards, which currently consider substations to be resilient to a wind speed of 34 m/s (76 mph). Overhead lines are designed to factor in climatic conditions including extreme wind load cases in accordance with BS EN 50341-1 (Ref 4.31) and the National Normative Aspects for Great Britain and Northern Ireland. Given the transient nature of overhead line routeing, criteria is heavily influenced by geographical location. Pylon design will be in accordance with National Grid standards which account for extreme wind conditions. The detailed design will take into account any updates to prevailing legislation, standards and National Grid policies, procedures and design specifications which are published during the design phase.
  - Overarching legislation for earthing is governed by The Electricity Safety, Quality and Continuity Regulations 2002 (Ref 4.32). Earthing provision is essential for all electricity infrastructure designed and installed across the country including overhead lines. Works on National Grid electricity assets during construction and operation are carried out and controlled in accordance with National Safety Instructions. Earthing requirements for substations will align with National Grid Technical Specifications (TS) 2.01 Part 1 (Relevant Electrical Standards - RES) Substations Part 1 – Procedural (Ref 4.33) (as amended) to mitigate the risk of lightning strike.

- The design will consider flood management measures through the Preliminary Flood Risk Assessment (**Appendix 9A Preliminary Flood Risk Assessment**), and the Flood Risk Assessment at the ES stage, which will include an allowance for climate change. As required, additional design measures for substations and pylons will be embedded into the design such as minimum distances from watercourses and flood mitigation measures.
- Vegetation management to reduce the risk posed by wildfire and falling trees will align with National Grid vegetation management policies.
- Health and safety measures for human health receptors would be managed through adherence to National Grid health and safety procedures and in accordance with the Health and Safety at Work etc. Act 1974 (Ref 4.34).
- A LEMP will be developed prior to construction to manage planted landscapes. An Outline LEMP will be submitted as part of the DCO application.
- During operation, National Grid will adhere to the Climate Change Adaptation Report (Ref 4.35), which requires the monitoring of potential climate change impacts, and updates to National Grid's Policy, Procedure and Design Standards (as required).

## 4.4 Proposed Infrastructure

### Proposed 400 kV Overhead Line

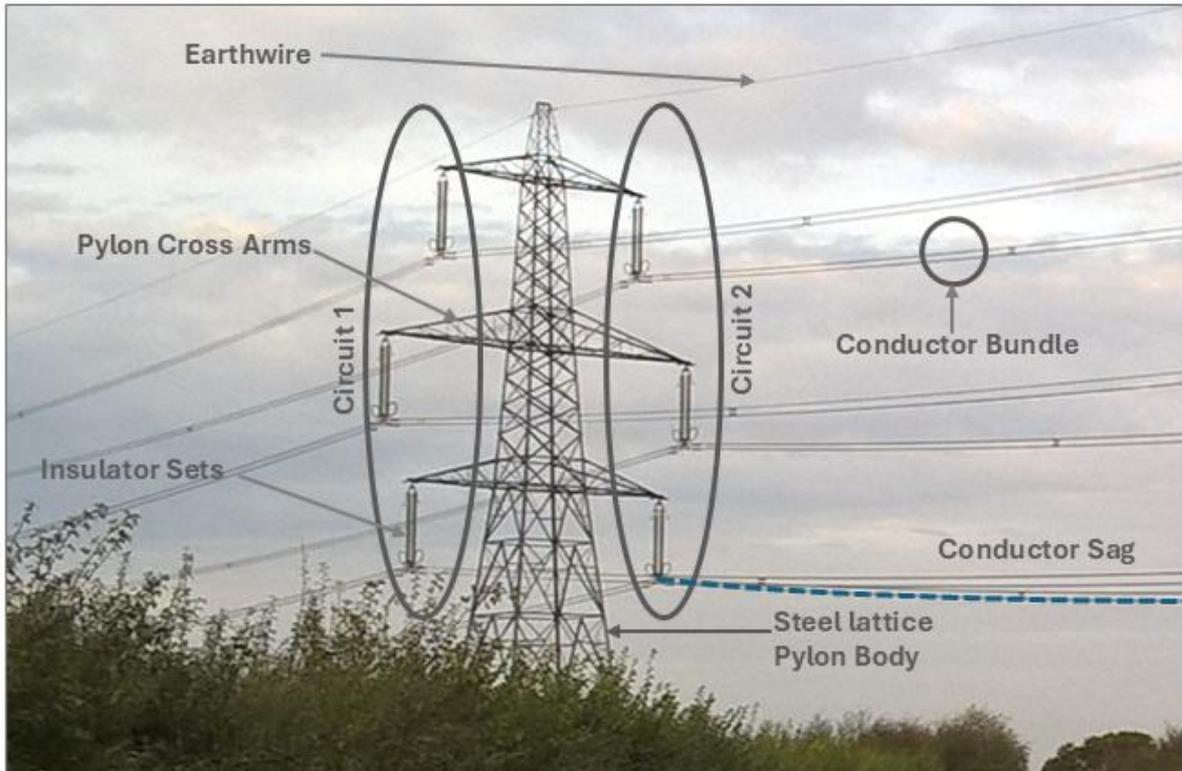
#### Pylons and conductors

- 4.4.1 Pylons are overhead line structures which carry overhead electrical conductors, insulators and fittings. The main components of an overhead line are shown in **Image 4.1** which shows a typical steel lattice pylon.
- 4.4.2 The Project will carry a voltage of 400 kV with two discrete electrical circuits that can be operated independently of one another, which will increase the resilience of the transmission system.
- 4.4.3 Electrical power would be transmitted through conductors (often referred to as wires). The conductors are attached to the end of a set of insulators extending from the pylon cross arms that electrically isolate the conductors from the main structure of the pylon. Insulators can be made of different types of material, but the most common industry standard is either glass or polymeric.
- 4.4.4 On a typical double circuit pylon, as shown in **Image 4.1**, six pylon cross arms are stacked above each other, three on each side of the pylon body. 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 **Image 4.1**). The top of the pylons supports a smaller earth wire(s) that carries data between substations and also provides shielding for the conductors from lightning strikes. 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.
- 4.4.5 Pylons are in general either: suspension pylons (from which the conductor is suspended), or tension (angled) pylons (structures which hold conductors in tension where the proposed route alignment of an overhead line changes direction, or to maintain tension in long straight sections of the route). Suspension pylons would

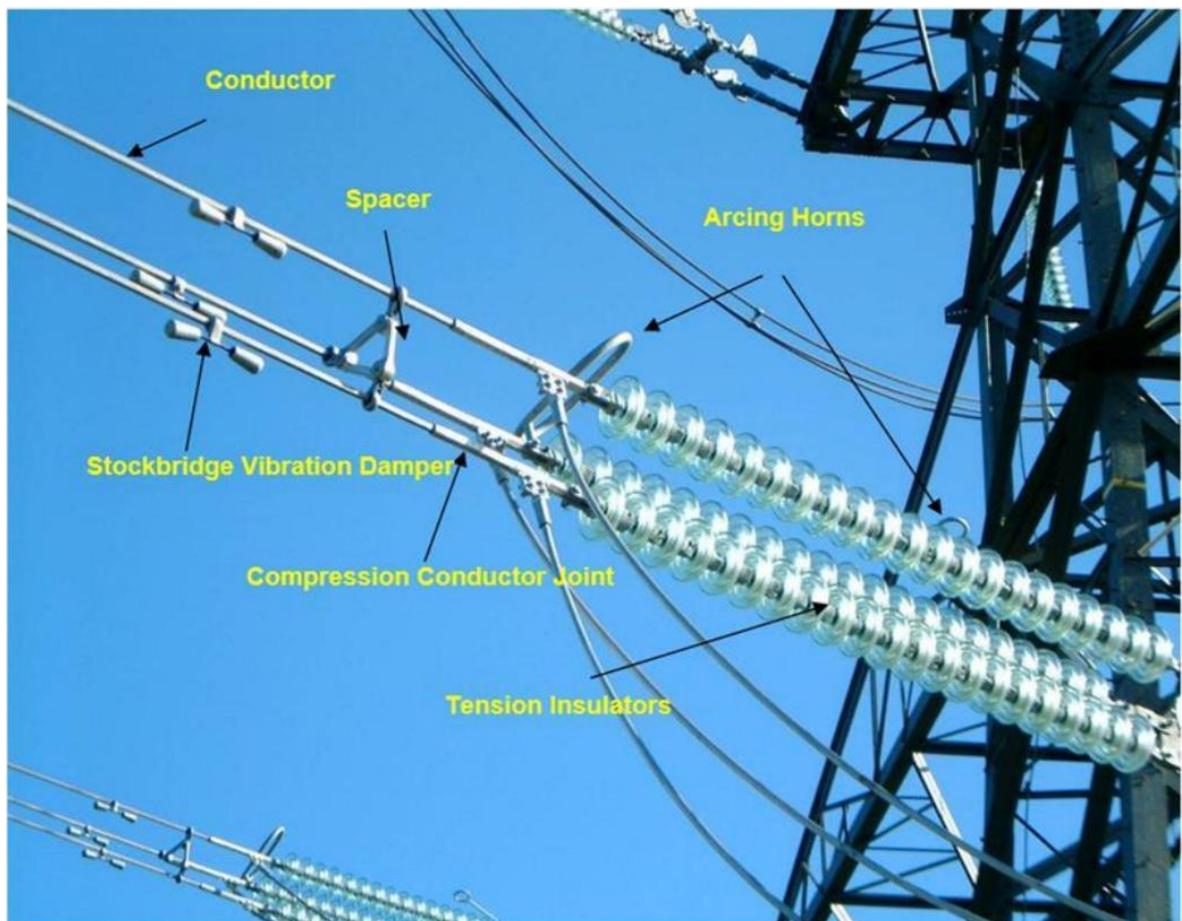
typically have a single insulator string hanging vertically downwards from the end of each crossarm to carry the conductor bundle, giving six sets of suspension insulators on each suspension pylon. A tension pylon would typically have one insulator string per conductor in each conductor bundle attached to the end of each cross arm (i.e. three insulator strings for a conductor bundle consisting of three conductors). For one circuit on one side of the pylon, there will be a total of 18 sets of tension insulators (nine sets facing along one direction of the overhead line route, and nine sets facing the opposite direction). Across both circuits that would equate to a total of 36 sets of tension insulators per tension pylon. Tension insulators are oriented roughly horizontally outwards from the end of the crossarm and accommodate the longitudinal force of the tension of the conductors. The typical configuration of overhead line conductor fittings is shown in **Image 4.2**.

- 4.4.6 A typical pylon operating at 400 kV is approximately 50 m in height; however, localised requirements may lead to the need for taller pylons. At this stage of the design, pylons proposed for the Project are likely to range between 44.5 m and 66.0 m in height (above ground level). In some locations, such as overhead line entries to substations, terminal pylons are required. Indicative pylon heights will be provided within the ES which will be limited by a vertical LoD to be defined through the development of the Project and the need to cross roads, railways, overhead apparatus such as other electricity lines, watercourses and other constraints. **Appendix 4B Indicative Pylon Schedules** presents indicative pylon types and heights.
- 4.4.7 A typical span distance between pylons is approximately 350 m. In broad terms there are typically three pylons for every km of overhead line. Double circuit overhead lines of this voltage typically require a minimum corridor width of 70 m to 100 m to establish a route.
- 4.4.8 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.
- 4.4.9 National Grid's Generic Design Principles for Overhead Lines (Ref 4.36) sets out minimum distances between the conductors, the ground and various other features, to ensure safe operation. The minimum clearance required between the conductors and the ground is typically 7.6 m at the maximum sag (i.e. the lowest point of the conductors between two pylons). In order to maintain these clearances, pylons need to be a minimum height at the point that the lowest conductor is attached to the pylon arms. This height is dependent on several factors including the distance between pylons, planned operating temperature and conductor wire composition, the intervening topography and the land uses of the land being crossed. For example, crossings of navigable rivers, railway lines, and highways may require increased clearances (and hence greater pylon heights) dependent on where they intersect the proposed route alignment to allow vehicles to pass beneath while maintaining safe separation.

**Image 4.1: Components of a typical double circuit transmission connection**



**Image 4.2: Typical configuration of overhead line conductor fittings**



- 4.4.10 To a lesser extent, the overall pylon height will also be influenced by pylon types. The pylon illustrated in **Image 4.1** 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 (tension) 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 which are of greater bulk in order to ensure stability for counteracting out of balance loads.

### Proposed pylons

- 4.4.11 The main type of pylon used by National Grid on the NETS in England and Wales is the steel lattice pylon with three sets of cross arms (as shown in the first image of **Image 4.3**). Alternative pylon types, such as T-pylons (similar to a modern wind turbine), have been approved for use which may achieve the technical performance required for the Project; 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).
- 4.4.12 In previous projects, the visual benefits of utilising standard steel lattice pylons has 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 existing 132 kV or 275 kV overhead lines are present in the vicinity of both substations, around Pilsley, and between Locko Park and Dale Abbey.
- 4.4.13 The current assumption is to use steel lattice pylons. The type of pylons proposed for the Project will be determined through feedback from Stage 2 consultation, information from surveys and ongoing design studies and assessments.
- 4.4.14 **Image 4.3** illustrates the difference between the three main types of steel lattice pylon.

### Image 4.3: Suspension pylon (left), angle pylon (middle), and terminal pylon (right)



- 4.4.15 Alternative pylon designs may also be considered, where additional mitigation (for example for landscape and visual effects) is potentially required. The alternative designs which may be considered are:
- Low height steel lattice; and
  - T-pylon.

4.4.16 Alternative pylon designs are illustrated in **Image 4.4**.

**Image 4.4: Alternative pylon types – low height steel lattice (left), and T-ylon (right)**



### Limits of Deviation

4.4.17 The draft Order Limits include an indicative LoD. The LoD would represent the vertical and horizontal maximum parameters for the Project's permanent features, such as the overhead lines and pylons. The LoD would allow for adjustment of the design to account for unforeseen localised issues such as previously unidentified poor ground conditions, uncharted services or the identification of significant unrecorded archaeological remains.

### Horizontal

4.4.18 The horizontal LoD for the proposed route alignment is, in general, 100 m (50 m either side of the centre line). In some exceptional circumstances, the LoD is decreased to less than 100 m to avoid a particular receptor. Where the LoD is 100 m the extent of movement of any pylon is limited by the span length and conductor swing. At a maximum span length, the conductors would require a swing distance of around 30 m, resulting in a potential lateral movement from the centreline of approximately 20 m either side, subject to topography and local conditions.

4.4.19 There is no limit placed on the movement of a pylon along the centreline (longitudinal LoD). The horizontal movement along the proposed route alignment would be limited by the need to maintain appropriate span length between pylons, whilst still maintaining the statutory clearances and not exceeding the vertical LoD described below.

4.4.20 The horizontal LoD are illustrated on the drawing titled **Illustrative Overhead Line Limits of Deviation (LoD) (EDN2-WSP-ZZZZ-ZZZZZZ-DRW-OH-000001)**.

### Vertical

4.4.21 The upwards vertical LoD for a typical standard steel lattice pylon is 6 m which would allow for two extension panels (typically 3 m per extension panel but varies between pylon types). This is to provide design flexibility to ensure that vertical clearance distances can be maintained.

- 4.4.22 There is no limit placed on the maximum depth of below ground works. Whilst a standard below ground LoD is not proposed, the Project would never go deeper than necessary for technical or environmental reasons as this would add engineering operational complexity and cost.

## Chesterfield Substation

### Existing Chesterfield Substation

- 4.4.23 The existing Chesterfield Substation forms a connection between existing overhead lines running from Brinsworth and Chesterfield, and Chesterfield and High Marnham. Built in the mid-1960s these lines currently operate at a voltage of 275 kV; however, they are capable of operating at a higher voltage of 400 kV and have necessary consents to do so. Upgrading 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.
- 4.4.24 The National Electricity Service Operator (NESO)<sup>3</sup> has considered the potential consumer benefits of upgrading the Brinsworth to Chesterfield, and Chesterfield to High Marnham circuits, which form part of a separate National Grid Project. NESO has consequently recommended that the upgrading should proceed. This is explained in more detail in NESO's Network Options Assessment Refresh published in 2022 (Ref 4.37), where the separate Chesterfield to High Marnham project is referenced by the code 'EDEU'.
- 4.4.25 It is currently anticipated that the new Chesterfield Substation will be consented and delivered as part of this separate National Grid project, distinct from this Project. However, it is possible that it will be decided to also include the new Chesterfield Substation works as part of the DCO application for this Project to provide an alternative consenting mechanism to remove reliance on that separate planning application/consent and so mitigate against the risk of delay to the delivery of the Project.
- 4.4.26 In view of this potential inclusion, the new Chesterfield Substation and its potential environmental effects were considered within the PEIR and other relevant documents (where applicable) as part of this Stage 2 consultation. If the works are ultimately determined to be necessary to include as part of the Project, they will be considered as part of the ES.
- 4.4.27 Some design detail associated with the new Chesterfield Substation is still under consideration and therefore for the purposes of the Stage 2 consultation, the maximum extents have been assumed in order to assess a reasonable 'worst case' scenario as a precaution.
- 4.4.28 The works to construct the new Chesterfield Substation are described in the sections below.

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<sup>3</sup> The Energy Act 2023 set the legislative framework for an independent system planner and operator to help accelerate Great Britain's energy transition. Therefore, what was formerly known as the 'Energy System Operator' (ESO) is now called the 'National Energy System Operator' (NESO), taking a whole system view, beyond electricity, inclusive of all energy sources and uses.

## New Chesterfield Substation

- 4.4.29 It is the intention that the proposed substation will be a gas insulated switchgear substation rather than an air insulated switchgear substation.
- 4.4.30 The proposed substation would comprise a new 400 kV gas insulated switchgear substation and associated works, comprising:
- approximately 13 bays with spacing for four future bays;
  - approximately six overhead line gantries;
  - standard substation plant, including, but not limited to, circuit breakers, disconnectors, earth switches, instrument transformers, Cable Sealing End (CSE) Compounds, surge arrestors, and busbars;
  - three 400 kV/275 kV 1100 MVA Interbus transformers and 24 CSE cables on 275 kV side;
  - gas insulated switchgear Hall Building including the site office, welfare, portable relay room (PRR), telecoms room, Low Voltage Alternating Current (LVAC) room, workshop and battery room (with approximate dimensions of 76 m in length, 25 m width and 15 m height);
  - security fencing;
  - lighting columns;
  - Closed-Circuit Television (CCTV) surveillance;
  - a new permanent access route for vehicular traffic;
  - construction compounds, welfare and laydown areas; and
  - landscaping, drainage features and areas for BNG.
- 4.4.31 The new Chesterfield Substation is proposed to be accessed from the SRN via the nearest A roads (A617 and A632) on the Local Road Network (LRN).
- 4.4.32 To facilitate construction of the new Chesterfield Substation, works will involve temporary diversions of existing overhead lines to modify the configuration of the existing Brinsworth to Chesterfield and Chesterfield to High Marnham overhead electricity lines forming part of the 4ZV route, currently connecting to the existing Chesterfield Substation. A proposed uprating of the existing 4ZV (275 kV) overhead lines to facilitate a transmission load of 400 kV is being progressed as part of the Chesterfield to High Marnham project. As part of these works, three new terminal pylon structures would be constructed for termination of incoming overhead line circuits into the new Chesterfield Substation: two for the existing 4ZV route and another for connection of the new 400 kV overhead line proposed for this Project.
- 4.4.33 It is currently envisaged that temporary diversion for the 4ZV route will comprise of overhead line with a short section of underground cable due to existing constraints. This therefore would result in the need for two temporary single circuit CSE Compounds as part of the design to facilitate the transition between overhead line and underground cable. The proposed design of the temporary diversion has been optimised in a way that would also enable new terminal pylons for this Project to be used in a temporary condition for that arrangement as well as for the permanent connection of the new 400 kV overhead line into the new Chesterfield Substation. Modifications to the routing of existing 132 kV underground cables into the existing Chesterfield Substation are also considered necessary where they cross the footprint for the new Chesterfield Substation.

- 4.4.34 The construction works will involve the connection of the new overhead line proposed for this Project into the new Chesterfield Substation.

## Undergrounding

### Underground cables

- 4.4.35 The only location currently proposed for undergrounding of 400 kV lines due to existing constraints is at the new Chesterfield Substation. This is part of diversionary works required to the existing 4ZV route for construction of the new 400 kV substation. This would comprise approximately 0.5 km of ducted underground cables for a single circuit from the CSE Compounds forming part of the temporary diversion to the 4ZV route into the existing bays within the 275 kV substation. The exact number of cables and trenches needed would be subject to detailed design but is expected to be confined to land owned by National Grid around the existing Chesterfield Substation.

### Cable Sealing End Compounds

- 4.4.36 A CSE Compound is needed where a section of underground cable resurfaces to connect to an overhead line or vice versa. Within these secure compounds the buried cables are brought to the surface through vertical sealing end structures. These are connected horizontally at a height of approximately 10 m with a set of solid bars (referred to as 'busbars').
- 4.4.37 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 CSE Compound, 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.
- 4.4.38 An alternative configuration would be to use full line tension gantries. As opposed to standard gantries, these structures located within the CSE Compound 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 CSE Compound but would increase the size of infrastructure required within the compound.
- 4.4.39 CSE Compounds typically extend to around 50 m by 80 m for a double circuit 400 kV transmission, but this will vary dependent upon local considerations.
- 4.4.40 It is envisaged that CSE Compounds will be required only temporarily during the construction phase as part of the design for temporary diversion of the existing 4ZV route overhead line required for construction of the new 400 kV substation due to existing constraints. Modifications to existing 132 kV overhead lines required to facilitate construction of the Project would also require CSE structures for transition into underground cables for termination into the existing 132 kV substation at Chesterfield.
- 4.4.41 **Image 4.5** presents an example of a double circuit 400 kV CSE Compound.

**Image 4.5: Example of a double circuit 400 kV CSE Compound**



## Existing Willington Substation

- 4.4.42 National Grid operates an existing 400 kV substation east of Willington adjacent to the former Willington power station. An existing 132 kV substation is also operated in this location by NGED. Of relevance to this Project, the 400 kV substation was built in the 1990s and will form the southern connection point for the Project.
- 4.4.43 It is noteworthy that separate from the Project, National Grid Customer and Network Development (CND) is developing plans for an extension to the existing substation to facilitate new customer connections. It is anticipated that these extension works would be delivered via permitted development rights and are expected to be completed by 2029. If confirmed, this development will be considered as part of the Project's cumulative effects assessment within the ES.
- 4.4.44 Likely bay locations for connection of the new overhead line associated with this Project into the 400 kV Willington Substation site are anticipated to be on the north side of the substation based on early design proposals. However, design development and co-ordination with National Grid CND is required to confirm this together with the scope of interactions with existing overhead lines as part of ongoing studies. It is not envisaged that there would be an extension to the existing substation land boundary.

## Other Modifications

- 4.4.45 Associated temporary and permanent works would need to be carried out to facilitate the construction of the Project. Such modifications would be to the transmission system and electricity distribution networks operated by NGET and NGED, as well as other services including telecommunication, water and gas lines.
- 4.4.46 The main elements of these works are described below.

### Local modifications to third-party services

- 4.4.47 In order to construct the new 400 kV overhead line connection safely and efficiently, sections of existing overhead or underground third-party services (for example distribution network operators (DNOs) low voltage power lines, or telecommunication lines) would be modified (undergrounded, protected or relocated).

4.4.48 There are multiple instances along the proposed route alignment for the new 400 kV overhead line where there are interactions with existing lattice pylon overhead line routes on the local distribution network. A summary of these can be found in **Table 4.5** and indicative land takes for diversion and undergrounding of these have been factored into the draft Order Limits.

**Table 4.5: Existing lattice pylon overhead line route interactions**

Existing Route and Voltage	Route Section(s)	Distance Affected (km)
132 kV Overhead Line CH Route (Chesterfield to Alfreton)	1 and 2	1.8
132 kV Overhead Line HR Route (Chesterfield to Pinxton)	1	2.2
132 kV Overhead Line CS Route (Chesterfield to Mansfield)	1	3.9
33 kV Overhead Line (Belper to Morley)	3	3.5
132 kV Overhead Line CL and HM Routes (Spondon Peaking to Loscoe)	4	1.3
132 kV Overhead Line HY Route (Spondon Peaking to Willington Tee)	6	1.4

4.4.49 The proposed route alignment for the new 400 kV overhead line also interfaces with five existing 132 kV lattice pylon overhead lines on entry into Willington where it passes the 132 kV substation site to terminate into the 400 kV substation site on the northern side. These would require short sections of undergrounding, less than 0.5 km for each, and have been excluded from **Table 4.5** above because this work is proposed to be included within a programme of network reinforcements carried out by NGED separate to this Project (which includes re-build of the existing 132 kV Substation at Willington).

4.4.50 Akin with electricity transmission lines, new structures are required to underground sections of existing overhead lines on the distribution network, albeit smaller in scale. For lattice pylon overhead lines, this typically involves constructing new pylons at either end of the section subject to modification with CSE platforms/baskets which the overhead line conductors terminate into for transition to underground cables. By contrast for woodpole overhead lines, new terminal poles are installed at either end of the section subject to modification which the tail(s) of the underground cable are connected to and typically have stays fixed to restrain the pole. Examples are shown below in **Image 4.6**.

**Image 4.6: Typical 132 kV CSE pylon (left) and terminal woodpole (right)**



- 4.4.51 For the removal, undergrounding and diversion of existing DNO lattice pylon overhead lines, works would typically include site set up and access requirements similar to the construction of the new 400 kV overhead line but reduced in scope due to the smaller scale of the assets.
- 4.4.52 For the removal, undergrounding and diversion of existing DNO woodpole overhead lines or existing woodpole telecommunications infrastructure, this would typically be completed using a combination of civils, reinstatement and electrical/communication crews generally working on-site with support from a central depot.
- 4.4.53 Detailed design for the DNO diversionary works required for the Project is still under consideration; as such the exact extent is yet to be confirmed. Therefore, for the purposes of this PEIR, proposed envelopes for these works are illustrated as 'indicative statutory undertaker diversion works' in the Route Section Plans separate to the core construction activities and works associated with the 'main Project'.
- 4.4.54 Third-party mitigation works would most likely be undertaken by the asset owners prior to construction of the relevant section of the Project; however, the DCO application would include powers for National Grid to undertake this work subject to agreement with the asset owner. As such, where practicable, land is provided for third-party overhead line asset mitigation/clearance within the draft Order Limits.
- 4.4.55 Further details of the required third-party mitigation works will be included within the ES.

## DNO mitigation works

- 4.4.56 In Route Sections 3 and 4 of the Project there is an existing 33 kV overhead line installed on 132 kV lattice pylons that is operated by the DNO and NGED. NGED distributes electricity at lower voltages to industrial, commercial and domestic users. Discussions are ongoing with the DNO regarding potential mitigation in the form of undergrounding a portion of existing 33 kV overhead line in this section. Unlike necessary diversion works associated with the DNO, these works are in part considered mitigation for the impact of the Project by exploring routeing via existing overhead line corridors where practicable, and the extent to which this would be carried out is still under review. Additionally, discussions are ongoing with the DNO and the industry regulator, the Office of Gas and Electricity Markets (Ofgem). Notwithstanding this, it is anticipated that the Project will involve the removal and undergrounding of a section of the existing 33 kV overhead line in this area. The full extent of potential works is still being assessed and therefore they have been included in their entirety within the draft Order Limits on a 'fallback basis' to assess a reasonable 'worst case' scenario to mitigate against the risk of delay to the delivery of the Project.

## 4.5 Construction

- 4.5.1 This section describes how the Project and the new Chesterfield Substation would be constructed, including the temporary construction features such as construction compounds and temporary access.
- 4.5.2 It should be noted that National Grid may undertake preliminary works between the DCO coming into effect and commencement of construction. These preliminary works will be defined at the ES stage and within the draft DCO. The preliminary works would be undertaken in accordance with the relevant commitments of the Outline CoCP, which will be submitted with the DCO application.

## Construction Programme

### Proposed 400 kV overhead line

- 4.5.3 Construction is expected to begin in 2029, subject to obtaining development consent, with the Project infrastructure anticipated to be operational by the end of 2031. Reinstatement works would likely continue beyond that. Prior to the construction phase, certain advanced activities, such as archaeological investigations and/or environmental mitigation, may be carried out.
- 4.5.4 The construction programme will be refined as the Project progresses, with consideration given to seasonal limitations, such as breeding or hibernation periods for protected species; reducing impacts associated with working within flood-prone areas; and network outage availability.
- 4.5.5 Given the linear configuration of the Project, construction activities are expected to progress in fronts sequentially along the route, resulting in relatively short durations of work within any specific location compared to the overall programme. Additional information regarding the phasing of construction will be provided in the ES. An indicative schedule outlining the proposed construction timeline is shown in **Table 4.6**.

**Table 4.6: Indicative construction programme for overhead line works**

Activity	2029				2030				2031				2032			
	Q1	Q2	Q3	Q4												
Site Mobilisation	█															
Enabling Works	█															
Foundations			█													
Pylon Assembly & Erection			█													
Stringing Works							█									
Commissioning											█					
Project Operational												█				
Reinstatement												█				

## **New Chesterfield Substation**

- 4.5.6 It is currently anticipated that the new Chesterfield Substation would be consented and delivered as part of a separate National Grid project, Chesterfield to High Marnham, distinct from this Project. However, it is possible that it will be decided to also include the new Chesterfield Substation works as part of the DCO application for this Project to provide an alternative consenting mechanism to remove reliance on that separate planning application/consent and so mitigate against the risk of delay to the delivery of the Project. The following construction programme is currently anticipated for the new Chesterfield Substation.
- 4.5.7 Pre-commencement construction works would be expected to start in 2026, and demobilisation works are to be completed at the end of 2031. An indicative schedule outlining the proposed construction timeline is shown in **Table 4.7**.

**Table 4.7: Indicative construction programme for the new Chesterfield Substation**

Activity	2026		2027		2028				2029				2030				2031					
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	
Site Establishment	■	■																				
Construction Works (including drainage, foundations and substation building construction)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Substation Works (Plant Installation)								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Commissioning of Substation															■	■						
Cabling Works (including CSE Compounds)			■	■	■	■											■	■	■	■	■	■
Overhead Line Modifications (including foundations, pylon erection, commissioning and demolition)		■	■	■	■	■											■	■	■	■	■	■
Demobilisation																						■

\* Gap between Q3 2027 and Q2 2030 in the cabling works and overhead line modifications is a result of other outage works on the National Electricity Transmission System and associated modification to other existing overhead lines and equipment into the Brinsworth and High Marnham substations associated with the Chesterfield to High Marnham project.

## Construction Workforce

### Proposed 400 kV overhead line

- 4.5.8 The overhead line elements of the Project are expected to require a peak construction workforce of approximately 480 individuals. The number of workers will be reviewed as part of the ongoing design work and any final updates will be presented in the ES.
- 4.5.9 Anticipated workforce roles include construction workers and supervisors, project managers, construction managers, site managers, engineers, health, safety, environment and quality advisors, and security guards. Given the transient and sequential nature of the Project, there will be movement and variation in the location of the workforce for the duration of the construction phase to complement the programme of works (i.e. the workforce will work throughout the draft Order Limits, rather than in the same location for the whole duration of construction).

### New Chesterfield Substation

- 4.5.10 The construction of the new Chesterfield Substation is expected to require a peak construction workforce of approximately 160 individuals.
- 4.5.11 It is anticipated that the roles required for the construction of the new Chesterfield Substation will be similar to the roles required for the proposed overhead line. The number of workers will be reviewed as part of the ongoing design work and any final updates will be presented in the ES.

## Construction Working Hours

- 4.5.12 The core construction working hours would exclude start up and close down activities which would take up to one hour before or after the core construction working hours. The construction working hours will be included within the Outline CoCP. **Appendix 4A** presents the Draft Outline CoCP.

### Proposed 400 kV overhead line

- 4.5.13 The proposed core construction working hours for the overhead elements are:
- 7am to 7pm on Monday to Friday; and
  - 8am to 5pm on Saturday, Sunday and Bank Holidays.
- 4.5.14 No piling operations would take place between 7pm and 7am, or on Sundays, Bank Holidays or other public holidays, unless otherwise agreed with the local planning authority. In addition, no Heavy Goods Vehicle (HGV) deliveries would be made to site between 7pm and 7am or on Sundays, Bank Holidays or other public holidays.
- 4.5.15 Deviations from the proposed core construction working hours may be required for some activities and these would be agreed with the local planning authority. The following typical operations proposed may take place outside of the proposed core working hours:
- trenchless and overhead line crossing operations including beneath and over highways, railway lines, woodlands or watercourses;

- the installation and removal of conductors and pilot wires, including the utilisation of drones and/or helicopters;
- the installation and removal of protective netting across highways, railway lines, watercourses and other assets, including the utilisation of drones;
- pylon construction or demolition, and conductor and pilot installation or removal works that impact statutory bodies such as the Environment Agency, Network Rail, National Highways, the Canal and River Trust, or similar organisations, will likely be requested to be undertaken on a Saturday, Sunday, Bank Holiday, or outside core working hours;
- the jointing of underground cables (save for the cutting of underground cables);
- the continuation of operations commenced during the core working hours to a point where they can be safely paused;
- any highway works or movements requested by the relevant highway authority or National Highways to be undertaken on a Saturday, Sunday or a Bank Holiday or outside the core working hours;
- the testing or commissioning of any electrical plant installed as part of the authorised development;
- the completion of works delayed or held up by severe weather conditions which disrupted or interrupted normal construction activities that the undertaker and its contractor agree forms the critical path for the accepted construction programme; in such cases, the Project will, as soon as practicable, notify the relevant local planning authority of the disruption or interruption and explain why that work could not be completed within the core working hours;
- activity necessary in the instance of an emergency where there is a risk to persons or property or following a request made by the relevant planning authority;
- security monitoring;
- non-intrusive surveys;
- intrusive surveys, in the instance of an emergency, where there is a risk to persons or property or following a request made by the relevant planning authority; and
- delivery of Abnormal Indivisible Loads (AILs), for example the cable drums and switchgear equipment which would be delivered outside of core working hours to reduce the impact on the highway network.

### **New Chesterfield Substation**

4.5.16 The proposed standard construction working hours for the new Chesterfield Substation are:

- 7am to 7pm on Monday to Friday; and
- 8am to 1pm on Saturday, with no works on Sunday and Bank Holidays.

4.5.17 Deviations from the proposed standard construction working hours may be required for some activities and these would be agreed with the local planning authority.

- 4.5.18 Systems outages may take place outside of these hours. Typically system outages take place during the clock change periods for standard summer working (end of March to end of October), but at times they may be needed over the winter period. During outages, some weekend working may be required.

## Construction Compounds

- 4.5.19 Enabling Works would include the preparation and installation of construction compounds and associated access roads. Construction compounds will consist of main construction compounds and satellite construction compounds. Main construction compounds will be primary hubs for facilitating construction of the Project where possible and are typically proposed to be approximately 200 m by 250 m in size and comprise essential facilities such as welfare, office space, material laydown/storage and car parking. Smaller scale satellite construction compounds are proposed to be approximately 130 m by 110 m in size and would be sited discretely to serve more localised sections of the route with suitable welfare provision, parking and areas for laydown and storage of some material and equipment.
- 4.5.20 A typical layout of a main and satellite construction compound is illustrated on **EDN2-WSP-ZZZZ-ZZZZZZ-DRW-CE-000001 Illustrative Construction Compound (Main and Satellite)**.
- 4.5.21 The location of the proposed construction compounds is shown on drawing **National Grid Chesterfield to Willington S.42 Route Section Plans**.
- 4.5.22 Main construction compounds would typically include the following:
- security gate house and CCTV;
  - plant storage and construction vehicle parking;
  - site offices, parking area and welfare facilities;
  - fencing and lighting;
  - laydown and storage area;
  - maintenance/assembly of plant and equipment;
  - wheel wash facility;
  - collection, storage and disposal of surface water, in addition to water from within the compound including grey and foul water (where feasible and practicable, connecting to the local sewer network);
  - soil bund(s);
  - waste management areas;
  - utility connections including power supplies, water and telecoms (where feasible to do so, alternatively a local grid connection and/or fuelled generators will be used); and
  - fuel and lubricants storage including pollution prevention measures and spill kits.

## Proposed 400 kV Overhead Line Construction

- 4.5.23 The following sections outline the activities associated with the construction of the 400 kV overhead line element of the Project. Controls on how construction would be carried out will be set out in the CoCP and secured by the DCO.

### Overview of construction activities

- 4.5.24 The construction of the 400 kV overhead line would generally follow the sequence outlined below as work progresses along the Project's proposed route alignment:

- Site Mobilisation;
- Enabling Works (including but not limited to):
  - surveys;
  - ground investigation;
  - enabling works such as ecological and archaeological mitigation, highways improvements and vegetation clearance;
  - installation of access points (bellmouths) and creation of visibility splays for construction access;
  - installation of stock proof fencing and gates or equivalent;
  - earthworks, including temporary drainage installation where required;
  - establishment of construction compounds; and
  - installation of temporary access (haul roads including culverts and bridges) and demarcated pylon working platforms.
- Foundations:
  - installation of pylon foundations (pad and column, piled or bespoke).
- Pylon Assembly and Erection:
  - working area and layout of steelwork in preparation for erection; and
  - assembly of steelwork (painting if required) and erection of pylon structures.
- Stringing Works:
  - installation of temporary works (including scaffolding, traffic management) where the proposed route alignment intersects existing infrastructure (e.g. highway or railways) for protection to allow the continued safe operation of those assets during stringing of conductors;
  - installation of insulator assemblies and ancillary equipment for conductor stringing on suspension pylons;
  - establishment of machine sites for conductor stringing;
  - temporary earthing;
  - conductor stringing;
  - installation of insulator assemblies on tension and terminal pylons; and

- installation of pylon furniture including safety notice plates and anti-climbing devices.
  - Commissioning; and
  - Reinstatement:
    - removal of construction equipment and temporary works;
    - removal of temporary access (access points and haul roads);
    - removal of construction compounds; and
    - reinstatement of ground and restoration of soils.
- 4.5.25 Activities such as surveys, ecological mitigation, archaeological investigation, highways improvements, ground investigation, construction of access points and access tracks could commence without the construction compounds in place. Nominal serviced office and welfare facilities would suffice for an initial period until the full construction compounds are established.
- 4.5.26 Dependent on local conditions, access roads may be required to be established from suitable access points from the existing road network in the area.
- 4.5.27 At times construction activities may result in disruption to land owners by restricting access to areas of their land, although this will be coordinated and communicated as required through the Project to ensure impact is kept to a minimum.

#### **Vegetation clearance assumptions**

- 4.5.28 Vegetation clearance may be undertaken prior to or during any of the activities identified above; this would be in accordance with any ecological requirements identified through the EIA and secured through the DCO. In addition, it is likely that vegetation clearance works may be undertaken as part of the preliminary works which would be undertaken between the DCO coming into effect and the start of construction. These preliminary works will be further defined at the ES stage.
- 4.5.29 Vegetation clearance is required to ensure the safe construction of the Project. For the purposes of the Project, vegetation has been separated into four categories:
- removed;
  - affected and requiring management;
  - potentially affected; and
  - not affected.
- 4.5.30 These areas would be shown on plans submitted as part of the application for the DCO and assessed within the relevant chapters of the ES.
- 4.5.31 For the purpose of the preliminary assessment the following assumptions have been applied:
- vegetation within 25 m either side of the overhead line centreline would require removal;
  - vegetation between 25 m and 33 m of the overhead line centreline would be affected and require management;

- vegetation between 33 m and 55 m of the overhead line centreline would be potentially affected; and
- vegetation beyond 55 m would not be affected.

4.5.32 Vegetation would also be removed in the following areas:

- construction compounds;
- access tracks, including culverts;
- access points and visibility splays;
- pylon working areas;
- crossing protection working areas;
- highway passing places; and
- third-party works (including utility diversions).

4.5.33 Vegetation would be affected and would require management in the following areas:

- overhanging of accesses and access points;
- trackway access and panel working areas;
- operational and third-party accesses;
- stringing areas and between crossing protection for netting (if netted area overlaps with larger mature trees, they will need removal);
- vegetation will be trimmed rather than cleared, with cut lines created only where necessary to pull catenary wires or ropes; and
- proposed temporary drainage areas.

4.5.34 During construction, vegetation which will be retained would be protected in accordance with the principles set out within BS 5837:2012: Trees in relation to design, demolition, and construction (Ref 4.9). Further details on the protection of vegetation during construction are presented in **Chapter 7 Ecology and Biodiversity**.

4.5.35 Unless otherwise stated it is assumed that vegetation within the draft Order Limits (but outside one of the areas listed above) could be potentially affected by the Project when taking into account the flexibility afforded.

#### **Installation of access points and creation of visibility splays**

4.5.36 Access points (also known as bellmouths) would be constructed at the proposed new access points for haul roads and substations. These would be designed in compliance with relevant highway standards and approved by the relevant highway authority where required.

4.5.37 The Project has sought to locate access points as close to the proposed works as possible to seek to reduce where possible the overall distance travelled along the LRN, and amount of land taken during the construction phase. Siting has also been informed by highway safety considerations, including distance from bends and junctions, visibility splay requirements, environmental and socio-economic considerations. Where possible, proposed access points would use or widen existing

gates or target gaps in boundary vegetation and seek to minimise effects on other existing or proposed land-use activities.

- 4.5.38 The installation of access points may require realignment of existing underground services, surface water drainage and the creation of visibility splays to create a line of sight for the safe use of the access points when accessing and egressing the Project. Within the visibility splay, vegetation would need to be cut to a specified height, or visual obstacles removed depending on local conditions, the speed rating of the road and whether traffic management or calming measures were in place. A typical access point is illustrated in drawing **EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000001 Illustrative Bellmouth and Visibility Splay**.
- 4.5.39 The above would also apply at crossovers. These are installed where the local roads are considered unsuitable for access and enable construction traffic to cross directly over surrounding local roads from one section of haul road to another to reach successive worksites along that section of the route served by the access point(s) off the Primary Access Route(s) (PAR(s)) on the LRN. A typical crossover is illustrated in drawing **EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000002 Illustrative Crossroad and Visibility Splay**.
- 4.5.40 Several considerations have influenced the siting of access points, including but not limited to, where practicable:
- use of existing field boundary entrances;
  - use of existing watercourse crossing points;
  - topographical constraints;
  - the existing geometry of the LRN and visibility considerations;
  - limiting sharp bends in the haul road route;
  - the proposed route alignment;
  - existing vegetation to minimise removal or clearance;
  - proximity to adjacent receptors and existing infrastructure; and
  - specification of HGVs and other mobile plant required for construction.
- 4.5.41 Where the LRN is not appropriate for the use of HGVs, crossover points (with associated access points) will be provided whereby construction vehicles will use haul roads on either side of the road along the proposed route alignment by crossing directly over the road with priority given to road users on the LRN.
- 4.5.42 Road Safety Audits would be carried out to inform the detailed design and subsequent technical approvals prior to installation.

### **Construction traffic routes and highway improvements**

- 4.5.43 The linear nature of the Project and limitations of the local road network create challenges for HGV movements, including narrow carriageways, tight geometry, weak bridges, and other physical constraints. To address this, a series of PARs connecting the SRN to site access points and off-highway haul roads has been identified, with secondary routes as contingency options. Routes have been selected to avoid sensitive receptors such as settlements and hospitals, and to minimise travel distances where practicable. Temporary highway improvements, such as

carriageway widening and visibility enhancements, may be required at certain locations, particularly where roads are less than 6 m wide. Passing places have been identified on narrow sections, subject to further technical evaluation and agreement with the local highway authority.

- 4.5.44 In addition, improvement works to public highways may be required in specific locations to facilitate construction access which could include surface upgrades, widening of carriageways, installation of passing places, signage and enhancing visibility for road safety. Passing places are most likely required at intervals along the LRN where carriageways are less than 6 m width as mentioned above. Technical evaluation is still ongoing, and further details will be discussed and agreed with the relevant local highway authority. A typical highways passing place is illustrated in **EDN2-WSP-ZZZZ-ZZZZZZ-DRW-HT-000003 Illustrative Highways Passing Place**.
- 4.5.45 Bridges with weight restrictions or height restrictions have been avoided where practicable. Where existing bridges are proposed to be used within the PARs, further assessments may be required to establish if there is a need to avoid, widen or strengthen, before they are used by HGVs and AILs.

### **Fencing**

- 4.5.46 Temporary fencing would be installed to encapsulate and delineate the construction swathe. The type of fencing adopted would vary depending on the site location and land usage type, for example palisade or mesh security fencing or hoarding is likely to be used at construction compound locations, whereas stockproof fencing is commonly used in pastoral agricultural areas for segregation of livestock away from construction activities. Post and rope would typically be used across arable land. Where practicable, the construction swathe would be sited in the immediate vicinity of unbroken natural land boundaries, and these would be used to reduce the extent of fencing works.
- 4.5.47 Fencing can often also be used as an environmental mitigation measure, including for screening receptors from view of construction works. The specific requirements would be defined as the Project develops and would be subject to further survey, design development works and assessments.

### **Earthworks**

- 4.5.48 The topsoil is likely to need to be stripped from access points, haul roads, construction compounds, and pylon and substation working areas. Once removed, the topsoil would be stored carefully to one side, typically in bunds to prevent erosion and contamination.
- 4.5.49 In addition to topsoil, the storage of subsoil is also likely to be necessary. This material may need to be placed on geotextile membranes to maintain separation from the ground and prevent contamination. Another method to prevent cross-contamination, involves stripping of additional areas of topsoil within the construction swathe to enable direct placement of subsoil on subsoil. These measures ensure that soil resources are preserved for reinstatement and that environmental impacts are effectively managed throughout the construction process. Where relevant, a MMP would be produced in accordance with CL:AIRE protocols (Ref 4.21) by the Main Works Contractor which would outline how earthwork materials would be managed to ensure that they are not treated as waste.

## Drainage

- 4.5.50 Temporary drainage may be required to help manage and control surface water during the construction phase. These would be designed and installed in accordance with SuDS principles, taking account of the reduced natural drainage as a result of the impermeable temporary construction areas installed, such as temporary access (access points and haul roads), construction compounds and stone working areas. Permanent drainage strategies are not being provided for pylon foundations and bases on the assumption that the area will be less than 50 m<sup>2</sup>.
- 4.5.51 Additional mitigation measures, such as silt fencing, may be installed subject to site conditions to minimise sediment runoff and protect surrounding watercourses and habitats.

## Installation of access tracks (including culverts and bridges)

- 4.5.52 For the temporary access design, 9 m wide haul roads are proposed. However, the typical haul road swathe, including haul road surface, demarcation, drainage, and soil storage would be around 21 m in width. In agricultural areas, demarcation around the construction swathe typically consists of stockproof fencing (post and wire or mesh) in pastoral areas and demarcation (post and rope) in arable areas. Where practicable, existing natural field boundaries, such as hedgerows or pre-existing fencing, would be used to minimise the need for additional fencing. An illustrative layout of a typical haul road is shown on **EDN2-WSP-ZZZZ-ZZZZZZ-DRW-CE-000002 Illustrative Haulage Road**.
- 4.5.53 Typical installation would involve stone laid on geotextile membrane. Another methodology that may also be used comprises of temporary matting, depending on ground conditions and the duration and type of use. Soil stabilisation<sup>4</sup> techniques could be considered, subject to local conditions in an effort to optimise construction techniques to reduce aggregate quantities.
- 4.5.54 The stone access tracks would be constructed using secondary or primary aggregates. The total amount of aggregate material that would be needed for the construction of the stone haul roads, access points and pylon working areas will be determined through the development of the Project and reported in the ES. On completion of construction, the access tracks would be removed, and aggregates taken to an appropriate facility which could include recycling, or onward use, for example as secondary aggregate in the construction industry.
- 4.5.55 Temporary culvert installations would be required for haul roads to cross watercourses. The size and depth of a culvert is dependent upon the dimensions of the crossing, sensitivity, and importance of the watercourse. If required, to maintain the flow of a watercourse during installation of the culvert, a pump maybe used on-site. Once the temporary culvert is installed, the area above the temporary culvert structure would be backfilled with suitable engineering material, such as construction mats or engineered fill, placed over the backfilled area to permit the passage of plant, equipment, materials, and people. Temporary culverts would be sized to reflect the span width, profile and the estimated flow characteristics of the watercourse under peak flow conditions and kept free from debris. Sensitivity, and importance of the watercourse would be considered in conjunction with design and constructability. An illustrative layout for a typical culvert is presented in **EDN2-WSP-ZZZZ-ZZZZZZ-**

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<sup>4</sup> Soil stabilisation is the process of altering the physical or chemical properties of soil to enhance its engineering performance.

**DRW-CE-000003 Illustrative Typical Culvert Arrangement.** A summary of the indicative watercourse crossings is presented in **Appendix 4C Indicative Bridge and Culvert Schedule**.

- 4.5.56 In cases where culverts are deemed not to be suitable for a particular crossing, due to the size and sensitivity of the watercourse or engineering requirements, a temporary bridge would be installed.
- 4.5.57 The design and type of temporary bridges may be either bespoke or proprietary and would be subject to use, site conditions, size of the crossing and constructability. Temporary abutments (foundations) may be required and would be assessed on a site-by-site basis to inform the design. It is anticipated that most bridge crossings would be of a short span and flat deck construction; however, Bailey style bridges may also be used. All bridges would be clear span, and the abutments (if required) positioned clear of the main channel of the watercourse, where practicable.

### **Pylon working areas**

- 4.5.58 Pylon working areas would typically range in size from 60 m by 60 m to 80 m by 80 m. They are required for the installation of foundations, assembly and erection of the overhead line pylons and subsequent stringing works. Typically, they would either be stone laid on a geotextile membrane, or formed of temporary matting, depending on ground conditions and the duration and type of use. Soil stabilisation techniques could be considered subject to local conditions. Areas and the locations of the pylon working areas are shown on **Figure 4.1 Proposed Project Design**.

### **Installation of pylon foundation**

- 4.5.59 The foundations for the pylons would either be pad and column, piled or bespoke if required. The design and selection of foundation type would depend upon the conditions encountered during ground investigation and pylon type. Foundation works typically involve breaking ground/excavation activities with temporary works including proprietary equipment for temporary access, formwork and falsework (shoring) to enable construction of the steel reinforced concrete foundations. Piling works are undertaken using specialist plant (rigs) to bore (drill) or drive (via a percussive hammer) piles into the ground to the desired embedment depth. For the purposes of assessments in this PEIR, it has been assumed that percussive driven piles would be utilised where a piled foundation solution is anticipated to represent a reasonable worst-case scenario.

### **Assembly and erection of pylon structures**

- 4.5.60 Lattice pylons comprise of many separate steel members. These would be delivered to site in bundles. The pylons would be erected in sections beginning with each leg being fastened to the foundation stubs and working from the ground level upwards with subsequent sections of pylon being bolted on top of the last. Lower sections are typically erected using a telehandler, whereas upper sections of the pylon are lifted by mobile crane with a typical capacity of up to 250 tonnes (although larger capacity cranes may be required in certain locations). Linesmen help guide the sections into place during erection and bolt the pylon together. Pylon furniture such as anti-climbing devices, and safety signage would be installed post erection during the checking of the pylons once erection has been completed.

## **Crossing protection**

- 4.5.61 Temporary scaffolding (mechanical/netted) would typically be installed during construction where required as a safety measure to provide protection to features such as roads, railways, navigable watercourses and third-party overhead lines (where not already diverted or undergrounded) which would be crossed by the proposed route alignment. This is required to protect these features during conductor stringing from the accidental dropping of conductors and any of the associated equipment in the event of malfunction. Temporary closures or suspension of some affected assets, such as roads, would likely be required during these works to install and remove the protective netting with those for crossing of major transport networks, such as motorways and dual carriageways or railway lines usually conducted overnight.
- 4.5.62 The temporary protection materials would be transported to site using suitable vehicles and assembled either side of the feature being protected.
- 4.5.63 Alternative methods such as catenary support systems or temporary traffic management may be used instead of scaffolding, where practicable and use of scaffolds is not technically viable due to existing constraints or where their use would give rise to particularly significant effects.
- 4.5.64 Where field boundaries including hedgerows are crossed by the proposed 400 kV overhead line, trestles are typically placed either side to traverse them, if required, whilst running out the pilot wires.
- 4.5.65 Interactions with buried utilities would be managed in accordance with Health and Safety Guidance Note No. 47 (HS(G)47) - Avoiding Danger from Underground Services (Ref 4.38). During design development service records would be obtained from statutory undertakers and permanent works (i.e. new pylon structures) sited to avoid buried assets as far as reasonably practicable. Utility surveys including ground penetrating radar and trial holes would be used to ascertain the positioning and depth of recorded services. Where temporary haul roads intersect the route of buried services temporary protection slabs may be installed if required.

## **Temporary traffic management**

- 4.5.66 The use of temporary traffic management on both the LRN and SRN is essential to facilitate construction of the new overhead line apparatus as well as associated temporary works. Examples include surveys, deployment of highways signage, installation of access points (bellmouths), highway improvements, vegetation clearance adjacent to highway, installation and removal of crossing protection third-party service diversions where installed in carriageway, and reinstatement works.
- 4.5.67 All traffic management activities would be carried out by specialist contractors in accordance with relevant codes of practice under the New Roads and Street Works Act 1991 (Ref 4.8).
- 4.5.68 The type of traffic management is dependent on various factors including location, road type, the activity, phasing and extent of works, duration and timing. Provision for temporary traffic management is intended to be included within the DCO application and activities co-ordinated with the relevant highway authority.
- 4.5.69 Where road closures are required, the period of the closure would be kept to a minimum, and diversions would be via the most appropriate alternative route. Access to properties would be maintained at all times where practical. Any route diversions or closures will be discussed and agreed with the relevant highway authority and would be set out in the CTMP.

## Temporary Public Right of Way management

- 4.5.70 Public Rights of Way (PRoWs) affected by the works have been assessed within **Chapter 12 Traffic and Transport**. In addition, the Preliminary Public Rights of Way Management Plan (PRoWMP) (**Appendix 12B Preliminary Public Rights of Way Management Plan**) sets out approaches to manage interactions of the Project with PRoWs (and other routes), such as gates and crossing points, to segregate PRoW users from the construction works. The safest option for both PRoW users and construction workers would be considered at each location.
- 4.5.71 Any potential temporary closures or diversions would be detailed in the Outline PRoWMP, which will be updated based on the Preliminary PRoWMP (**Appendix 12B Preliminary Public Rights of Way Management Plan**) and submitted with the DCO application. Any required temporary diversions would be clearly marked at both ends with signage explaining the diversion and the expected duration.

## Installation of insulators

- 4.5.72 The insulators would be fastened to the pylon cross-arms with running wheels attached in preparation for pulling the conductors.

## Establishment of machine sites for conductor stringing

- 4.5.73 The conductors would typically be installed in sections between tension pylons, where the line changes direction. Pulling positions would be established at tension pylons either end of the section(s) being strung for running out the conductors. These are typically, set back a distance of twice the pylon height from the pylon centre (1:2 ratio) and established on an area of, typically, temporary matting for storage of plant, equipment, materials and welfare cabins. One end would be comprised of a winch site for pulling the conductors through. The opposing site at the other end would comprise a tensioning machine to keep the wires off the ground, and full conductor drums. Positions and the proposed locations are shown on the **National Grid Chesterfield to Willington S.42 Route Section Plans**.

## Conductor stringing

- 4.5.74 The conductors would be delivered to pulling positions on large cable drums and, depending on the conductor type, each completed drum could weigh up to 8 tonnes, although larger and heavier drums are possible depending on the supplier and the length of conductor. The drums containing the conductors would typically be delivered to the construction compound, or satellite compound, first, and would be distributed from there as required.
- 4.5.75 Light pilot wires would be laid at ground level (and across temporary scaffolding protecting assets such as roads and railway lines) along the length of the section between the pulling positions. The pilot wires would be raised and fed through running wheels on the cross arms of all the pylons in the section and then fed around the winch at the pulling site.
- 4.5.76 The pilot wires would then be used to pull the conductors between pylons. This process is repeated throughout all wiring sections until the entire route has been wired. Additional fittings, such as spacers (to prevent the conductors from touching each other) and vibration dampers (to control oscillations in the overhead line), would then be fitted to the conductors. An earth wire would run along the top of the pylons containing optical fibres to allow transmission of data around the system and provide shielding for protection from lightning strikes.

- 4.5.77 Pylons at either end of a pulling section may feature stay arrangements which will be removed as the stringing progresses. These would usually consist of concrete blocks on sledges or ground anchors attached to the pylon via steel ropes. Temporary stay arrangements may be required at other locations such as when the new conductors are connected to existing conductors, in areas of temporary diversions, and at temporary spans on overhead line circuits.
- 4.5.78 Drones and helicopters may be utilised in the construction of the overhead line, and/or for transportation of equipment during the construction phase.

### **Removal of construction equipment, reinstatement of ground and restoration of soils**

- 4.5.79 Once the 400 kV overhead line is constructed, the construction compounds, equipment/plant, access tracks and working areas at the pylon site would be removed and the ground reinstated. Other surfaces would be reinstated, and access points would be restored to the condition they were in at the commencement of the works, unless agreed otherwise.

### **Anticipated construction plant requirements**

- 4.5.80 The requirements for construction plant would continue to evolve as the design of the Project develops. However, for the purposes of the PEIR assessments, the anticipated requirements for construction plant for the key stages of construction of the 400 kV overhead line are presented in **Table 4.8**. It should be noted that the list presented below is not exhaustive and has only been presented for those construction elements where information was available at the time of writing.

**Table 4.8: Anticipated construction plant requirements**

<b>Construction Element</b>	<b>Anticipated Plant Requirements</b>
Vegetation Clearance	<ul style="list-style-type: none"> <li>• tracked excavator with tree shear attachment;</li> <li>• chipping machine with mulcher attachment;</li> <li>• chainsaw;</li> <li>• strimmer;</li> <li>• generator*;</li> <li>• dumper; and</li> <li>• vegetation clearance truck.</li> </ul>
Installation of Access Points and Creation of Visibility Splays	<ul style="list-style-type: none"> <li>• vacuum excavator;</li> <li>• tracked Mini digger;</li> <li>• tracked excavator;</li> <li>• smooth drum roller;</li> <li>• dumper;</li> <li>• telehandler and mechanical kerb lifter;</li> <li>• disc cutter(s);</li> <li>• submersible water pump;</li> <li>• generator*;</li> </ul>

Construction Element	Anticipated Plant Requirements
	<ul style="list-style-type: none"> <li>• pylon lights;</li> <li>• skid steer loader;</li> <li>• bulldozer;</li> <li>• planer;</li> <li>• paver; and</li> <li>• tipper trucks.</li> </ul>
Construction of temporary Haul Roads and Pylon Working Areas	<ul style="list-style-type: none"> <li>• tracked excavator;</li> <li>• articulated tipper truck;</li> <li>• smooth drum roller;</li> <li>• dumper truck;</li> <li>• telehandler and mechanical kerb lifter;</li> <li>• submersible water pump;</li> <li>• generator*;</li> <li>• pylon lights;</li> <li>• skid steer loader;</li> <li>• bulldozer;</li> <li>• planar;</li> <li>• paver; and</li> <li>• tipper trucks.</li> </ul>
Installation of Pylon Foundations (non-piled and piled)	<ul style="list-style-type: none"> <li>• tracked mini digger;</li> <li>• tracked excavator;</li> <li>• rollers;</li> <li>• dumper;</li> <li>• telehandler;</li> <li>• submersible water pump;</li> <li>• generator*;</li> <li>• pylon lights;</li> <li>• poker vibrators;</li> <li>• piling rig;</li> <li>• attendance crane;</li> <li>• concrete wagons/mixers; and</li> <li>• concrete pump.</li> </ul>
Assembly and Erection of Pylon Structures	<ul style="list-style-type: none"> <li>• mobile crane(s);</li> <li>• tipper truck;</li> <li>• telehandler(s);</li> <li>• pylon lights;</li> <li>• draw bar drag trailer; and</li> <li>• generator* .</li> </ul>

Construction Element	Anticipated Plant Requirements
Establishment and Removal of Machine Sites for Conductor Stringing	<ul style="list-style-type: none"> <li>• tipper truck;</li> <li>• telehandler;</li> <li>• pylon lights;</li> <li>• tracked excavator;</li> <li>• draw bar drag trailer;</li> <li>• tractor and trailer;</li> <li>• quad puller/tensioner;</li> <li>• tractor winch;</li> <li>• drum stands;</li> <li>• sledge anchors; and</li> <li>• generator.</li> </ul>
Conductor Stringing	<ul style="list-style-type: none"> <li>• tipper truck;</li> <li>• telehandler;</li> <li>• erection winch;</li> <li>• tractor winch;</li> <li>• generator*;</li> <li>• sagging tractor;</li> <li>• access platform;</li> <li>• mobile elevated working platform (MEWP);</li> <li>• spacing trolleys;</li> <li>• crane;</li> <li>• all-terrain vehicle and trailer; and</li> <li>• draw bar drag trailer.</li> </ul>

\* For the purposes of assessment within the PEIR, it has been assumed that up to 10 kVA generators would be used.

## Construction Works Associated with the New Chesterfield Substation

- 4.5.81 The construction of the new Chesterfield Substation is anticipated to comprise the following:
- Site Establishment:
    - site preparation including vegetation clearance, setting up the temporary accommodation, parking and laydown areas; and
    - installation of a permanent security fence around its perimeter; the fence is anticipated to comprise a 2.4 m high palisade security fence with an electric pulse fence installed behind the palisade fence.
  - Construction Works (including drainage, foundations and substation building construction):
    - installation of a permanent access road from Calow Lane to the north of the substation site;

- earthworks to reprofile the existing ground, and laying of a granular fill capping layer to provide a clean and stable working platform;
  - creation of an earth mat to distribute any charge transferred to the ground by earthed equipment and infrastructure; the earth mat would comprise a series of copper earth tapes which would be installed below the ground level;
  - installation of foundations and steel supports would be installed for the electrical equipment and gantries; and
  - installation of permanent foul, oily water, including below ground oil separator, and surface water drainage systems which would incorporate pollution prevention measures and the use of SuDS, as far as practicable.
- Substation Works:
    - installation of gas insulated switchgear plant within substation buildings.
  - Commissioning of the Substation;
  - Cabling Works (including CSE Compounds);
  - Overhead Line Modifications:
    - reconfiguration of the existing 4ZV route between existing pylons 4ZV120 to 4ZV125 through temporary diversions and a series of phased outage works; the proposed works includes the construction of three new pylons for termination of incoming overhead line circuits into the new substation, alterations to pylon 4ZV124, one temporary pylon and removal of three existing pylons.
  - Demobilisation.

4.5.82 There are three permanent buildings proposed as part of the new Chesterfield Substation; these are as follows:

- A new 400 kV gas insulated switchgear building (non-SF6) would be located in the eastern part of the proposed substation site. The gas insulated switchgear building would be of steel frame construction with complete metal cladding. Site offices, welfare facilities including toilets, showers and changing rooms, control room, PRR, telecoms room, LVAC room, battery room and maintenance bays would be located within the gas insulated switchgear building. The gas insulated switchgear building would house approximately 13 gas insulated switchgear bays (with spacing for four future bays), each connected to the wider substation through a series of overground cables.
- A small workshop unit.
- A small storage unit.

4.5.83 Other permanent features include parking for operational staff and visitors, with provision for Electric Vehicle parking as well as a diesel generator for use as a back-up power supply in the event of an emergency. Both would be located adjacent to the gas insulated switchgear building.

- 4.5.84 Once the equipment is installed, commissioning tests would be undertaken to check that the individual items of plant, and the system as a whole, work as required. Following successful testing, the proposed new Chesterfield Substation would be connected to the electricity transmission system ready for operation. Following commissioning, demobilisation works would be undertaken to remove temporary construction compounds and plant.

### **Undergrounding associated with the new Chesterfield Substation**

- 4.5.85 Temporary diversion of the existing 4ZV overhead line route is required to maintain continued operation of the transmission system in the area during construction of the new 400 kV substation site and new pylons 4ZV0A and 4ZV122A for reconfiguration of the 4ZV route. It is currently proposed that the temporary diversion would comprise of overhead line connected into temporary CSE Compounds (approximately 30 m x 40 m in size) with short sections of underground cable into the existing 275 kV substation due to existing site constraints. In the north west corner of the site the existing overhead line circuit on pylon 4ZV124 would be connected into a temporary CSE Compound and routed approximately 140 m via underground cables into the existing bay in the 275 kV substation. On the southern side of the site, the existing overhead line circuit from pylon 4ZV120 would be transferred onto a new pylon 4CW1 (constructed for termination of the new overhead line required for this Project), as well as a temporary pylon 4ZV120T2 to form a temporary arrangement over a distance of 525 m into a temporary CSE Compound and then routed approximately 282 m via underground cables into the existing bay in the 275 kV substation.

### **Cable Sealing End Compounds**

- 4.5.86 Construction would begin with the preparation and installation of the temporary haul roads for the CSE Compounds, which would also be used to enable construction access to the other areas of the site where needed. Following this, the working areas would be stripped of soil, and a stone pad would be installed for the mobile crane. The temporary pylons required would be constructed in a similar way to the overhead line pylon construction noted previously, with a concrete foundation and the pylon steelwork assembled before being lifted into position by mobile crane. The cable trenches would also be excavated, and the underground cables and/or ducts would be run along these and then channelled through troughs onto the CSE Compound structures.
- 4.5.87 The CSE Compounds require a clean and controlled environment whilst being installed. Therefore, a weatherproof covered scaffold structure would be erected over the CSE Compounds during installation. Once constructed, the cables would be tested.
- 4.5.88 Percussive driven piling may be required at the CSE Compound. This would be confirmed through a programme of ground investigations which would in turn inform the foundation designs. The PEIR assessments assume that piling is required at all CSE Compounds. Further details on the need for piling and specific locations will be set out within the ES.

### **Underground cables**

- 4.5.89 It is currently envisaged that only short sections of underground cabling will be required for construction of the new 400 kV substation. There are two standard techniques that could be adopted to install underground cables – standard open cut

and trenchless. Methods adopted would be determined based on ground conditions, technical and environmental features present. Jointing is required where two adjacent sections of cable meet. This requires clean and dry conditions, so enclosures would be temporarily erected at joint bay locations. Due to the precise nature of engineering works undertaken, joint bays could remain open for several weeks to allow for trench and joint bay excavation, ducting, cable pulling, jointing and reinstatement. To install sections of underground cable there would be a requirement to establish temporary construction facilities, including suitable locations for cable drum storage and areas for dewatering, temporary and permanent land drainage and temporary access (access points and haul roads), which are described above under overhead line construction. The following section provides a typical description of the works required to construct and install underground cables. Where ducting is proposed as an alternative to direct lay, the ducts would need bedding in with Cement Bound Sand (CBS) and the trench backfilled. Joint bays would be excavated along the route (typically between 800 m and 1,000 m, dependent on detailed design) which would act as pulling locations for the cables and then the cables would be installed in the ducts by pulling from the cable drum between joint bays.

4.5.90 Underground cable installation would typically be undertaken in the following sequence:

- survey and ground investigations;
- site clearance;
- installation of access points and creation of visibility splays;
- installation of stock proof fencing and gates or equivalent;
- earthworks including temporary drainage installation where required;
- installation of access tracks (including culverts and bridges);
- cable trenches dug utilising excavators (or by hand in areas of known buried utilities); excavated subsoil will be stockpiled separately from the top soil;
- installation of a base layer of CBS, or suitable alternative material, into the cable trench;
- cables directly laid in trench by 'pulling' from cable drum, with the aid of rollers placed within the trench;
- cables are bedded in with CBS;
- protective tiles are placed along the width of the trench;
- warning tapes will be placed above the protective tiles;
- trench is back filled with excavated subsoil or thermally suitable material where required (to avoid the alteration of local environmental temperatures around the cables); and
- topsoil will be reinstated to original soil profile and land re-seeded or released to the farmer for cultivation as it was found.

4.5.91 Alternatively, cable ducting may be installed with cable pull through taking place following the backfill of the trench. This method would follow similar steps to direct laid cable installation and would include the installation of protective tiles and warning tape.

## Standard open cut installation

4.5.92 Standard open cut installation typically involves the following processes:

- vegetation would be removed where necessary and topsoil would be stripped and stored for reuse;
- a temporary haul route would be installed along the length of each cable section to provide access for construction vehicles to the working areas; and
- a number of open trenches (typically six trenches each accommodating three cables) would be excavated for cabling to be installed and covered.

## Trenchless installation

4.5.93 Trenchless crossings may be necessary for example when crossing rivers, roads and rail.

4.5.94 The underground cable would be installed using a drilling or boring method to pass beneath features. There are different trenchless methods that could be used, and each method would have a different construction footprint required for the drill launching/receiving sites or drill pits. Depending on the technique, the drill may need to undertake a number of passes to make the hole wide enough to allow the ducts (pipes) to be pulled through. The cables would be pulled through the ducts using a cable pulling rig.

## Construction Works Associated with Third-Party Services

4.5.95 To enable the construction of the Project, there is a need to remove, replace or divert some existing third-party services. The methods for diverting third-party services would be agreed with the relevant third party in advance of works commencing.

4.5.96 Where the existing overhead lines and pylons are to be diverted and placed on pylons, the proposed pylon dimensions are anticipated to be approximately 32 m in height and generally have base dimensions of 9 m x 9 m.

4.5.97 Where the existing assets are to be diverted and placed on wood poles, the wood poles would be installed using primarily blind augering techniques; however, excavation and installation of stay-blocks would be utilised where required. The proposed wood poles are anticipated to be up to 18 m in height.

4.5.98 Where undergrounding of existing assets is proposed, these works would be undertaken primarily utilising open-cut trenches; however, specialist trenching techniques (e.g. horizontal directional drilling or vacuum excavation) would be utilised where required. During construction, trenches are anticipated to be up to approximately 1.1 m in depth, and 0.85 m wide. Trenches would be backfilled and reinstated following the installation of the assets.

4.5.99 Following the undergrounding and diversion of existing DNO lines, the removal of redundant overhead lines typically involves lowering, cutting and clearing of conductors, pylon removal via felling (pulling over by winch tractor) or by crane and foundation removal typically to 1 m below ground level.

4.5.100 Fittings, such as dampers and spacers, would be removed and the conductors would be winched onto drums in a reverse of the process described for the construction of pylons. The fittings would be removed from the pylons and lowered to the ground.

## 4.6 Operation

- 4.6.1 During operation the Project would transmit electricity between the new Chesterfield Substation and the existing Willington Substation and onto the remainder of the national transmission system.
- 4.6.2 The Project would be operated remotely in the same way as National Grid operates the rest of the network.

## 4.7 Maintenance

### Proposed 400 kV Overhead Line

#### Routine maintenance

- 4.7.1 The overhead line would be subject to annual inspection from the ground by engineers on foot, small vans, or by air using drone/helicopter to check for visible faults or signs of wear. The inspections would also indicate if plant/tree growth or third-party developments were at risk of affecting safety clearances. Inspections would provide input as to when refurbishment works are required.
- 4.7.2 The overhead line could support telecommunication equipment such as small mobile telephone antennae and would contain optical fibres within the earthwire. Access would be required for independent companies for maintenance purposes. Access for the optical fibres would usually be required at the joint box positions, which are usually located on tension or terminal pylons just above the anticlimbing devices on the pylon structure. However, the exact position and frequency of joint boxes is subject to detailed design. Access by maintenance staff would be using pickup trucks and vans.
- 4.7.3 Access for vegetation management, telecommunications and fibre optic maintenance would be along routes agreed with the landowners and may require interlocking trackway panels.

#### Repairs and refurbishment

- 4.7.4 A number of materials, including concrete and steel for the foundations, steelwork for the pylon and composite conductors would be used in the construction of the Project. All these materials would have an expected lifespan, which would vary depending on the locations of the overhead line and how it was operated.
- 4.7.5 Typically, pylon steelwork and foundations have a life expectancy of approximately 80 years, the conductors have a life expectancy of approximately 40 to 60 years, and the insulators and fittings have a life expectancy of approximately 25 to 40 years. Theoretically, it may be possible for the lifespan of the overhead line components to extend beyond the anticipated service life, depending on their condition, the environment to which they are exposed, and refurbishments and transmission system requirements. Given the overhead conductors and fittings have a shorter life expectancy than the pylon structures themselves, reconductoring would be required during the overall lifespan of the Project infrastructure.

- 4.7.6 Minor repairs or modifications may be required from time to time for local earthwire damage, addition of jumper weights, local conductor damage, broken insulator units, damaged or broken spacers, broken or damaged vibration dampers, or damaged or broken anti climbing guards. Minor repairs would be programmed locally by a maintenance team using suitable vehicles (such as pickup trucks and vans) to access specific locations along the route, as agreed with landowners. Access may require interlocking trackway panels.
- 4.7.7 Refurbishment work is more substantial and could involve:
- the replacement of conductors and earth wires;
  - the replacement of insulators and steelwork that holds the conductors and insulators in place, insulator fittings, conductor fittings, pylon furniture and signage;
  - painting or replacement of the pylon steelwork;
  - replacement of telecommunication equipment (by separate companies); and
  - foundation repairs/upgrades.
- 4.7.8 Refurbishment would usually be carried out in two stages because the overhead line has two circuits, one on each side of the pylon. This means that work can be undertaken on one side only, so that the other side can be kept 'live'. Once all the work has been completed on the first side, the circuit would be re-energised, and the opposite side switched off, so that the work could be carried out on the other side.
- 4.7.9 The refurbishment works would require temporary access tracks, a small compound and potentially crossing protection (as described in the sections above) to protect roads and other features during the works.
- 4.7.10 All lattice pylons on the network are climbable so many activities can be carried out without heavier duty equipment such as specialised MEWPs or mobile cranes.
- 4.7.11 Suitable vehicles (such as pickup trucks and vans) would be used to carry workers in and out of site and HGVs would be used to bring new materials and equipment and to remove old equipment. Temporary works including installation of access routes and installation of scaffolding to protect roads, railways and footpaths would be required as necessary for the overhead line refurbishment (similar to the initial construction requirements).

## New Chesterfield Substation

- 4.7.12 The new Chesterfield Substation would be typically unmanned during operation; however, operational requirements may require the substation to be manned permanently or temporarily. Routine visits would be required to visually inspect the condition of equipment, structures, and buildings for signs of damage or wear. The routine maintenance would be carried out in line with maintenance policies and procedures.
- 4.7.13 During operation, lighting would be required at the substation sites to allow for safe movement and the operation of equipment. Security lighting would also be required. All lighting would be designed in accordance with the appropriate design standards and National Grid technical specifications. For the purpose of the PEIR, it is assumed that the security lighting would be event activated (i.e. would not be continuous) and would be designed to be environmentally sensitive (e.g. directional and low luminance). Further information regarding substation lighting design will be provided within the Project description within the ES.

## **Cable Sealing End Compounds**

- 4.7.14 Maintenance activities would include infrequent visits to the CSE Compounds to monitor the outdoor sealing end terminations and carry out periodic maintenance and checks on electrical equipment within the compound.
- 4.7.15 When the CSE Compounds require refurbishment and/or replacement works, vans would be used to carry workers in and out of the area and larger vehicles (possibly HGVs and small mobile cranes) would be used to bring new materials and equipment in and to remove old equipment. Temporary scaffolding may be required to protect any infrastructure within the compound whilst remedial work is carried out.

## **Underground cables**

- 4.7.16 Maintenance activity along sections of cable would generally be limited to non-intrusive inspections and cable repairs. The latter would only be required in the unlikely event of a cable fault. Where a fault does occur the location of the fault would be identified, and the faulty section of cable replaced. The activities involved in cable repair would be similar to those outlined above for construction, albeit over a much smaller area and scale.

## **4.8 Decommissioning**

- 4.8.1 NPS EN-1 (Ref 4.15) paragraph 4.3.5 requires the ES to address the decommissioning of a Project; however, this is not specifically covered for electricity networks in NPS EN-5 (Ref 4.4). Paragraph 2.1.4 of EN-5 does make it clear that nationally significant electricity networks are expected to have an ongoing function, supported by maintenance and reinforcement works, with assets replaced at the end of their lifespan. Electricity transmission is anticipated to continue for as long as it remains commercially viable, meaning any decommissioning would likely occur many decades in the future. Since the major expansion of infrastructure in the 1950s and 1960s, very few transmission projects have been decommissioned, as assets on the national transmission system are typically replaced under National Grid's permitted development rights.
- 4.8.2 The design life of the Project is at least 80 years but with regular maintenance it is possible to extend further. Decommissioning would only be undertaken if assets have passed their service life or if there were substantial changes to how electricity is transmitted around the country, or significant changes to the sources of generation and areas of demand. At the time that decommissioning would take place, the regulatory framework, good industry practices and the future baseline could have altered. If the Project, or any part of it requires decommissioning, National Grid would consider and implement an appropriate decommissioning strategy for approval by the relevant planning authorities. This would take into account latest industry best practice, its obligations to landowners and stakeholders alike under the relevant agreements and all relevant statutory requirements.
- 4.8.3 There are currently no specific plans to decommission the Project. As such, decommissioning is excluded from the environmental assessment. Instead, the ES would include a high-level description of likely methods for decommissioning and summarise potential effects from decommissioning for each environmental topic within an appendix to the description of the Project chapter of the ES, in line with comments made by the Planning Inspectorate in section 3 (comment ID 3.0.1) of the Scoping Opinion (Ref 4.2).

## Proposed 400 kV Overhead Line

- 4.8.4 If the overhead line associated with the Project, or sections of it were decommissioned in the future, dismantlement and removal of any redundant apparatus would first require de-energisation and disconnection from the national electricity transmission system via the substations at either end.
- 4.8.5 Access to the existing pylons would then be taken using agreed maintenance routes. Temporary matting may be necessary to facilitate access, subject to time of year and ground conditions. Working areas around each pylon would be established, any vegetation surrounding the pylon based cleared for access to the structure and, where appropriate, fenced to keep the public and any livestock away.
- 4.8.6 Fittings such as dampers and spacers would be removed from the overhead line conductors before they are lowered from the pylons to ground level. Crossing protection measures such as temporary scaffolding and/or traffic management would be implemented during the operation, after which the conductors would be cut into manageable lengths or would be winched onto drums in a reverse process to that described for construction. Insulator sets would then be lowered from the pylon cross-arms. All conductors and fittings would then be removed for recycling.
- 4.8.7 Following this, the pylons would likely be removed either by felling (typically involving pulling over the structure with a winch tractor) or dismantled by crane which would involve splitting the structure into sections and lowering them to the ground for further disassembly. The selected methodology would be dependent on access, constraints and space available. Felling is usually undertaken in agricultural areas, whilst crane dismantlement is more suitable in urban settings or where specific restrictions are present. The pylon steelwork and furniture would then be cut into sections at ground level and the material removed for recycling.
- 4.8.8 Unless there was a compelling need for removal of the entire pylon foundation, these would typically be removed to 1 m depth below ground level, sufficient for safe agricultural use of the land and the surrounding subsoil and topsoil reinstated.

## New Chesterfield Substation

- 4.8.9 Typically, the above ground features of the substations would be removed (unless otherwise agreed). Any above ground buildings would be demolished and taken off-site for suitable disposal along with any other above ground features such as electrical equipment. Any temporary access tracks and working areas required would be removed and the site reinstated to an appropriate end use.

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