

# HS2

## Grid Supply Point Connection at Parkgate - Addendum

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# 1 Summary

- 1.1.1 This is an addendum to the Grid Supply Point (GSP) Connection at Parkgate report published in February 2019. It provides a comparative appraisal of making the connection by overhead line (OHL), as proposed in Additional Provision 2 (AP2), to making a connection underground (UGC).
- 1.1.2 The use of an overhead line (OHL) connection between the National Grid Parkgate substation and the National Grid Newlands Lane substation, is accordance with government policy and statutory obligation and reflects National Grid's route selection guidance for development of UK wide infrastructure development. The approach to this scheme selection by National Grid was accepted by HS2 during the development of the Phase 2a scheme in promoting AP2.
- 1.1.3 For the purpose of this comparison, illustrative designs of an OHL and an UGC connections are located within the 200m-wide corridor defined in AP2 for the Parkgate GSP connection. Both are illustrations of how the respective schemes could be designed, within the assumptions set out in the Supplementary Environmental Statement 2 and Additional Provisions 2 Environmental Statement (SES2 and AP2 ES). These illustrative designs are not intended to represent detailed design of either option.
- 1.1.4 The illustrative OHL connection option (representing the baseline scheme):
- would require a temporary corridor of land required for construction of approximately 65m, however disturbance of land will be mostly limited to works to construct the pylon bases;
  - connects, via OHL, from the proposed National Grid Parkgate substation to the National Grid Newlands Lane substation; and
  - all land would be returned to its existing use, excluding the land required for the footings of pylons.
- 1.1.5 The illustrative UGC connection option:
- would require an approximately 65m wide temporary corridor of land required, all of which would be disturbed as a result of construction;
  - would require three UGC connection trenches to house the UGC connection, areas of land for storing excavated material, haul roads along the full length of the route;
  - would introduce four additional satellite construction compounds; and

- would return the land above ground to its existing use, subject to some restrictions, and with the exception of land permanently required for inspection boxes at approximately 600m intervals, which provide a location for monitoring the cables during operation and operational access.
- 1.1.6 The environmental comparison of the illustrative UGC connection to the illustrative OHL connection identifies for temporary impacts; a moderate worsening due to the greater scale of construction and land clearance, and for permanent effects; a moderate improvement due to the limited extent of above ground equipment.
- 1.1.7 The overall rating for construction complexity of an illustrative UGC connection is a moderate worsening due to relatively more complex construction and a minor worsening due to added disruption to existing roads and utility connections. In terms of safety there the comparison is neutral.
- 1.1.8 The capital cost of an illustrative UGC connection option is estimated to be £65million higher (see Appendix H) than for an illustrative OHL connection option. The operational costs for an illustrative UGC connection option are anticipated to be broadly similar to those for an illustrative OHL connection option.
- 1.1.9 In summary, the comparison of an illustrative UGC connection against the OHL connection using HS2 appraisal criteria has shown that the illustrative UGC connection would result in a significant cost increase, with no significant engineering or environmental benefit.
- 1.1.10 This appraisal conclusion is consistent with the initial policy appraisal by National Grid for connection selection between National Grid Parkgate substation and National Grid Newlands Lane substation, applying government policy and their own statutory obligations (on cost efficient delivery of infrastructure and adequate protection of the environment and amenity).

## 2 Introduction

### 2.1 Purpose of the Report

2.1.1 This report is provided as an addendum to the report 'Grid Supply Point Connection at Parkgate'<sup>1</sup>. This report sets out the outcome of an engineering, environmental and cost comparison between an illustrative overhead line (OHL) connection and an illustrative underground cable (UGC) connection to Parkgate. The OHL connection appraised in this report is an illustrative version of the design in the Additional Provision 2 (AP2) revised scheme, submitted to Parliament in February 2019<sup>2</sup>. Both the illustrative OHL and the illustrative UGC connections are located between the National Grid Parkgate substation and National Grid Newlands Lane substation.

2.1.2 The selection of an OHL connection and the route choice, as provided for in the AP2 scheme, were developed by National Grid in accordance with policy and statutory obligations for new infrastructure of this scale (i.e. infrastructure comprising 132kV electrical circuits or greater and over 2km in connection length).

2.1.3 The report sets out:

- a description of the illustrative OHL connection option and the illustrative UGC connection option;
- an engineering, environmental and cost comparison appraisal of the illustrative OHL connection option (representing the baseline scheme) and the illustrative UGC connection option.

### Limitations of the report

2.1.4 The illustrative OHL connection option and the illustrative UGC connection option detailed in this report have been developed for the purposes of this comparison appraisal only, and are not intended to represent the design development of any scheme once completed. A final alignment would be determined during detailed design.

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<sup>1</sup> HS2 Ltd (2019). *Policy Paper Parkgate Report: Grid Supply Point Connection*. Available online at: <https://www.gov.uk/government/publications/hs2-phase-2a-select-committee-grid-supply-point-connection-at-parkgate>

<sup>2</sup> HS2 Ltd (2018). *High Speed Rail (West Midlands - Crewe) Supplementary Environmental Statement 2 and Additional Provisions 2 Environmental Statement*, Volume 2: Fradley to Colton. Available online at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/775951/J10\\_HS2\\_Phase\\_2a\\_A\\_P2\\_ES\\_Volume\\_2\\_CA1\\_report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/775951/J10_HS2_Phase_2a_A_P2_ES_Volume_2_CA1_report.pdf)

- 2.1.5 High-level desk-based information has been used to inform these illustrative designs and the appraisal. No additional site visits have been undertaken with respect to the design of the illustrative UGC connection option. Various sources of information have been used as the basis for this appraisal including, in particular, the Supplementary Environmental Statement 2 (SES2) and Additional Provision 2 Environmental Statement (AP2 ES) Volume 2 Community Area report CA1: Fradley to Colton and, National Grid reference material and online mapping tools.
- 2.1.6 There are certain unknown variables that would affect the design, construction and cost of both the illustrative OHL and UGC connection. These include ground conditions, other service locations and routes, approvals, and environmental constraints. Where data is not available reasonable assumptions have been made, on a precautionary basis, for the purpose of the illustrative design and appraisal.
- 2.1.7 These are considered to be reasonable limitations and wouldn't contribute to the outcomes of the comparative analysis at this stage of design development.

## **2.2 Government policy and statutory obligations supporting the selection of the Parkgate GSP connection**

- 2.2.1 The OHL connection provided for in the AP2 revised scheme was developed by National Grid applying industry standards and the national planning policy for new infrastructure of this scale.
- 2.2.2 Government planning policy relating to electricity infrastructure can be found in two National Policy Statements (NPS) – the Overarching NPS for Energy (EN-1)<sup>3</sup> and, more specifically, the NPS for Electricity Networks Infrastructure (EN-5)<sup>4</sup>. These are the main documents that inform decision making on major energy infrastructure projects, including whether to adopt an OHL or UGC connection. The policy applies to infrastructure comprising 132kV electrical circuits or greater and for connections over 2km in length.

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<sup>3</sup> Department of Energy and Climate Change (2011). *Overarching National Policy Statement for Energy (EN-1)*. Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/47854/1938-overarching-nps-for-energy-en1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf)

<sup>4</sup> Department of Energy and Climate Change (2011). *National Policy Statement for Electricity Networks Infrastructure (EN-5)*. Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/37050/1942-national-policy-statement-electricity-networks.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37050/1942-national-policy-statement-electricity-networks.pdf)

- 2.2.3 National Grid has a statutory obligation under the Electricity Act 1989 to develop and maintain efficient, coordinated and economical systems of electricity transmission. National Grid also has a statutory obligation to have regard to the preservation of amenity when developing connections.
- 2.2.4 When deciding whether to implement an OHL or an UGC connection, National Grid must balance the reliability, capability, cost, construction impact and land use advantages of an OHL connection, against the reduction in visual impacts associated with an UGC connection. In general, UGC connections are implemented where;
- there is a densely populated area; or
  - where the proposed route alignment is within a protected area, for example an Area of Outstanding Natural Beauty (AONB) or a Site of Special Scientific Interest (SSSI).
- 2.2.5 The area within which the Parkgate GSP connection is proposed is not a protected area in planning terms, as it does not contain areas of a national interest or other protected features or landscapes, and it is not a densely populated area. Therefore, under the national planning policy approach, the visual impacts of the OHL connection should not outweigh other considerations of this connection selection, such as reliability, capability, cost, construction impacts and land use. Upon this basis, National Grid did not consider there to be a need for an UGC connection as part of the AP2 revised scheme. As such National Grid developed the OHL connection for the AP2 revised scheme guided by the Holford Rules<sup>5</sup> to minimise the effects of the OHL connection.
- 2.2.6 The approach to scheme selection by National Grid was endorsed by HS2 Ltd during the design development of the AP2 revised scheme. An UGC connection was not considered to be a reasonable alternative by HS2 Ltd to the OHL connection proposed by National Grid, given the policy framework, the disruptive nature of the construction works for the UGC connection and the likely very significant increased cost. The reason for not taking forward an UGC connection as part of the AP2 revised scheme was reported in the SES2 and AP2 ES Volume 2 CA1 report. This report considers the two options in more detail and confirms HS2's view that the OHL connection is the correct approach.

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<sup>5</sup> National Grid (unknown date) *The Holford Rules*. Available online at: <https://www.nationalgrid.com/sites/default/files/documents/13795-The%20Holford%20Rules.pdf>



## **3 Illustrative OHL connection option (baseline scheme)**

### **3.1 Summary of AP2 revised scheme - Parkgate GSP connection**

- 3.1.1 The illustrative overhead line (OHL) connection is based on the Additional Provision (AP) 2 revised scheme, providing for a connection to the grid supply point at a proposed permanent National Grid Parkgate substation located immediately south of the existing 400kV National Grid overhead power line. From the National Grid Parkgate substation, a 7.7km OHL connection will cross predominantly open agricultural land, to a proposed National Grid Newlands Lane substation, located adjacent to the Newlands Lane auto-transformer feeder station.
- 3.1.2 The OHL connection will consist of two parallel lines of steel lattice pylons, carrying three circuits, one carrying two circuits and the other carrying a single circuit. The proposed power lines will run in a generally south-west direction from the National Grid Parkgate substation towards the National Grid Newlands Lane substation.
- 3.1.3 The pylon line carrying two circuits will vary in height from 23m to 38m. The pylon line carrying a single circuit will vary in height from 23m to 35m. The height of the pylons will vary to take account of the topography, to maintain the required clearance beneath the 132kV overhead line.

### **3.2 Illustrative detail of the AP2 OHL connection to inform the comparison study**

- 3.2.1 The assumptions used for the illustrative OHL connection represent one way that the AP2 revised scheme could be built, but are not based on any additional design information. The flexibility provided for in the AP2 revised scheme is still required to enable achievement of a final design which minimises the adverse impacts and which will be reviewed and updated through the detailed design process.
- 3.2.2 For example, in the detailed design, localised constraints such as ground conditions may require the pylons proposed in the AP2 revised scheme to be repositioned. The environmental impact assessment approach used within the AP2 ES reports the effects arising from repositioning of pylons by up to 50m in either direction along the power line route, and/or laterally within the pylon construction corridor. To accommodate this need for flexibility, the AP2 revised scheme provides for an approximately 200m wide corridor of land required to construct an OHL

connection, and the SES2 and AP2 ES reports likely effects relating to this AP2 revised scheme. In practice, the final corridor of land needed to construct the OHL connection will be narrower, within the 200m width of land identified in the AP2 revised scheme and is likely to be a corridor approximately 65m in width.

Figure 1: An indicative example of two parallel lines of pylons at Shaw Lane, Kings Bromley



## Temporary land requirements

- 3.2.3 To be able to undertake a representative comparison between an OHL connection scheme and an UGC connection, for this report only, the AP2 revised scheme design has been refined and the land required to construct the OHL connection reduced to an approximately 65m wide corridor. The illustrative OHL connection option alignment used, is shown in Appendix A. This is indicative only, does not represent the final design and consequently does not fix the land that would not be required. This is referred to as the baseline scheme for the purposes of comparison analysis.
- 3.2.4 The majority of disturbance during the construction phase will be localised at the pylon locations. An area approximately 0.19ha has been assumed to be required for the construction of each pair of pylons, with additional land required for the pulling platforms and construction access roads.
- 3.2.5 Where possible, pylons have been placed at the edge of field boundaries, avoiding roads and crossings over watercourses to minimise impacts on agriculture, connectivity and water resources.

- 3.2.6 Typically, only areas where pylons are constructed will be fenced off during construction reducing the area of land being disrupted (in addition to road crossings and compounds).
- 3.2.7 The 65m corridor of land identified for the purposes of construction between the pylon locations would only be required temporarily for the pylon stringing and access. Disturbance of land and existing vegetation will be limited through the implementation of the Code of Construction Practice.

### Permanent land requirements

- 3.2.8 The size of pylon bases will vary with the height of the pylon ranging from 36m<sup>2</sup> for a 23m high pylon, to 81m<sup>2</sup>, for a 38m high pylon.
- 3.2.9 The environmental mitigation design shown in Appendix G, reflects the mitigation required for the illustrative OHL connection. This mitigation design takes into account the assumptions set out in Appendix F relating to avoidance of habitat removal. Mitigation is predominantly required to mitigate the loss of ecological habitats.

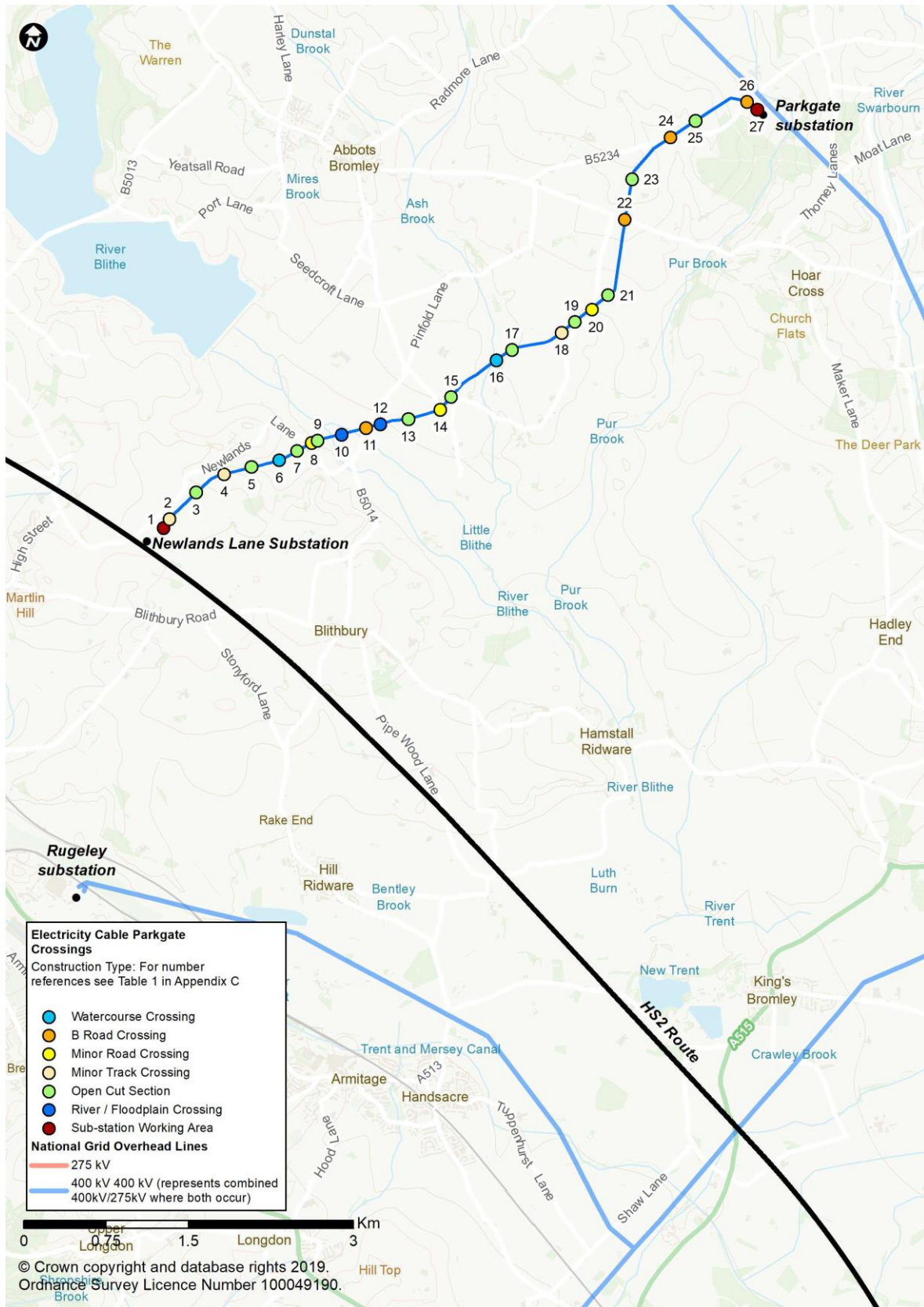
## 4 Alternative UGC connection option

### 4.1 Overview of the option

- 4.1.1 The extent of the illustrative UGC connection option is shown in Figure . The assumed route of the alternative UGC connection runs from the proposed National Grid Parkgate substation (connecting to the existing 400kV overhead power line at Parkgate) to the proposed National Grid Newlands Lane substation and Newlands Lane auto-transformer feeder station. The illustrative UGC connection option has been based on using the land required for the OHL connection in the AP2 revised scheme. The UGC connection alignment is illustrated in Appendix B.
- 4.1.2 The illustrative UGC connection option, like the illustrative OHL connection option, is predominantly located within agricultural land with crossings of watercourses, B roads, minor roads/access tracks and existing utilities. These crossings are detailed in Figure and presented in Appendix C. A number of Public Right of Way diversions would be required with both options during construction. The detail of these diversions will differ with each option but would be able to be accommodated within normal working practices during construction.
- 4.1.3 As with the illustrative OHL connection option, wherever possible, the illustrative UGC connection option has been designed to avoid existing features, such as ponds or woodland, and avoids residential properties.

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Figure 2: Key crossings associated with the Parkgate UGC connection



## 4.2 Description of the illustrative UGC connection

### UGC connection installation methodology

- 4.2.1 The details provided in this section set out the current working assumptions for a UGC connection for the purposes of comparison and agree these will be subject to potential change in the detailed design.
- 4.2.2 To maintain a resilient power supply to HS2 there is a requirement for three 132kV circuits between the proposed National Grid Parkgate substation and the proposed National Grid Newlands Lane substation. For each circuit, three cables would need to be laid along the full length of the route as shown in Figure 2. These would need to be laid in a horizontal formation in three separate 1.2m-wide trenches, as shown in Figure 3 (i.e. nine cables in total).

Figure 3: Typical detail of a cable trench for one 132kV circuit (Detail X in Figure 3) (dimensions in mm)

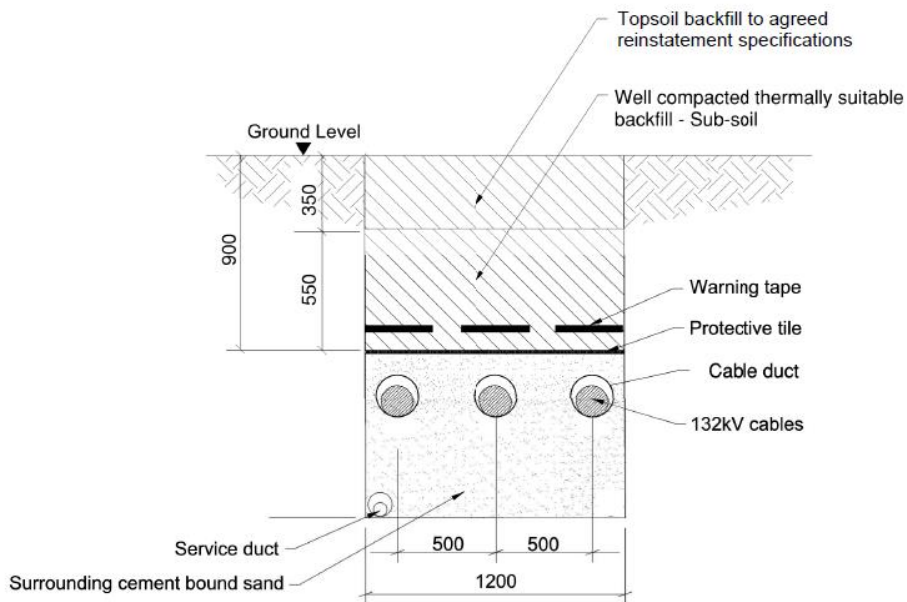
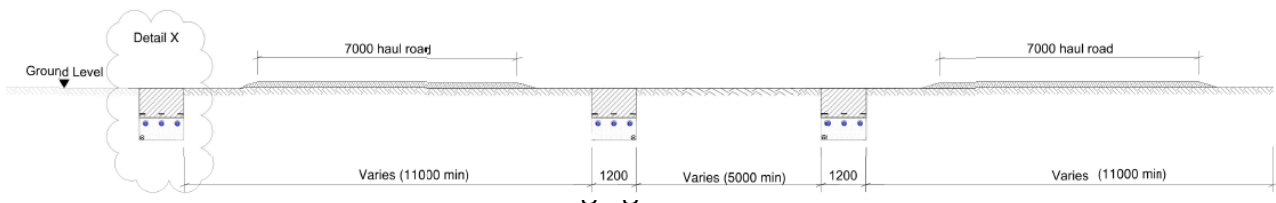


Figure 4: Illustrative cross section showing typical layout of trench provision for all three circuits forming UGC connection (dimensions in mm)



- 4.2.4 The cables would need to be laid beneath a layer of warning tape and protective tiles. The protective tiles would be buried to a minimum depth of 900mm. The tiles and tape would reduce the risk of accidental damage from unauthorised excavations.
- 4.2.5 A cross section of a standard 65m-wide UGC connection construction area is provided in Appendix D. This incorporates the three open cut trenches carrying each circuit, in addition to site haul roads and associated topsoil and subsoil spoil storage and temporary drainage.
- 4.2.6 The proposed site haul roads would run along the full length of the open cut sections and be approximately 7m wide. The site haul roads would be accessed from the public highway in six separate locations. Satellite compounds proposed in the AP2 revised scheme would be located at either end of the UGC connection with four additional satellite construction compounds located at intervals in between. These would provide locations for storing materials, site offices and welfare facilities.
- 4.2.7 There is a requirement to join the cables at approximately 600m intervals (limited by cable drum delivery length). At these locations an underground joint bay would need to be constructed with an above ground inspection box.
- 4.2.8 For all road crossings, with the exception of the B5014 Lichfield Road crossing, trenches would be dug across the road, ducts laid within protective material and the road surface reinstated. This would require short term, temporary road closures during the period of construction. Where the site haul road crosses the public highway, traffic management measures would be implemented to segregate construction traffic from local traffic.
- 4.2.9 This open cut technique would also be adopted for minor watercourse crossings, with temporary dewatering and over-pumping of the watercourse adopted during the excavation activities. The site haul roads, which would be in operation throughout the construction period, would cross the watercourse through the temporary installation of a culvert/pipe.
- 4.2.10 For a 500m section where the route passes under the River Blithe, the B5014 Lichfield Road and the Little Blithe, it is proposed to lay the ducts using non-dig methodologies, such as horizontal directional drilling (HDD). In this location a launch pit would be constructed at one end of the bore, from which the drilling would commence. A receiving pit would be constructed at the other end. No construction activities would be needed above ground between these points, therefore avoiding any disturbance to the watercourses and their floodplains, and the B5014 Lichfield Road. The site haul road would not be provided at this location,

instead the local road system would be used for construction traffic either side of the HDD site.

- 4.2.11 A non-dig method would also have to be used for the crossing of Ash Brook to avoid any open excavation in the floodplain. However, in this location it would be necessary to maintain a site haul road crossing of the brook through temporary installation of a culvert/pipe. At this stage of design this is considered feasible due to the size of the watercourse to deal with the impact of vehicle movements on the local road network.
- 4.2.12 It should be noted that non-dig methods, such as HDD, introduce additional costs and construction complexity when compared to open cut techniques. They are therefore not a generally preferred method, unless required due to site specific constraints.

### Temporary land requirements

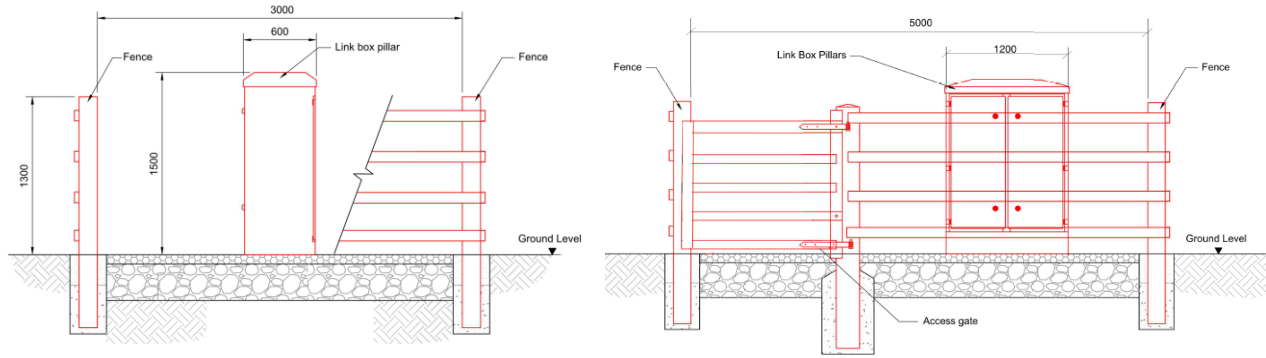
- 4.2.13 Approximately 206ha of land would be required to construct the illustrative UGC connection. The open cut sections, would be approximately 65m-wide as a construction area along the full length of the route. Within this area, topsoil would be stripped and locally stored for reinstatement. Subsoil would be excavated, stored in segregated spoil heaps and, where in excess, would be removed from site for disposal.
- 4.2.14 The illustrative UGC connection would require four new construction satellite compounds, located along the line of the UGC connection. Within these areas, topsoil would be stripped and locally stored for reinstatement.
- 4.2.15 Temporary working areas would be fenced off to restrict unauthorised access. No current land use activity would be available in these areas for the full duration of the construction works (assumed to be two years) and until full land reinstatement has been successfully completed.

### Permanent land requirements

- 4.2.16 The permanent land required would be for inspection boxes enclosed within cabinets, located at approximately 600m intervals along the route, above the underground joint bays. These cabinets provide a location for monitoring the cables during operation and would require an area of land to be fenced off. There would be a permanent requirement for operational access to these locations. The inspection boxes would require an area approximately 15m<sup>2</sup>. Figure 4 illustrates a typical inspection box structure.



Figure 5: Typical inspection box structure elevations (dimensions in mm)



- 4.2.17 On completion of construction, reinstatement works would be undertaken to return the land to its existing use. Generally, there are restrictions placed on land use above and adjacent to buried cables in order to reduce the risk of damage and to avoid reducing the capacity of the cable system. These restrictions include avoiding planting trees directly above the cables to avoid root damage. There may also be restrictions on the use of deep cultivating equipment and future development.

### Operation, maintenance and refurbishment

- 4.2.18 Cables have an asset life of around 60 years. During their lifetime regular inspection and testing is carried out to ensure that cable insulation and joints are operating correctly. Over the lifetime of a cable, refurbishment and repairs to ancillary equipment may be required.
- 4.2.19 Vehicular access to strategic areas of the cable route, such as the inspection boxes, would be required at all times.

# 5 Comparison analysis

## 5.1 Introduction

5.1.1 This section outlines a comparative appraisal between the illustrative OHL connection option (baseline scheme) and an illustrative UGC connection option. The full environmental and engineering appraisals (the review matrices) are presented in Appendix E and F, and the cost appraisal is presented in Appendix H.

## 5.2 Policy appraisal

5.2.1 Referring to NPS EN-1<sup>3</sup> Section 5.9 and NPS EN-5<sup>6</sup> Section 8.8.8., Government expects that in fulfilling the need of new electricity lines of 132kV and above, the development of overhead lines will often be appropriate. However, it is recognised that there will be cases where OHL is not appropriate due to serious concerns about the potential adverse landscape and visual effects of a proposed overhead line in areas such as in National Parks, AONB and residential areas.

5.2.2 The AP2 Parkgate GSP connection scheme has been reviewed in line with the above and Section 2.8.9 of EN-5. Section 2.8.9 of EN-5 provides the specific policy guidance that *"the IPC (Infrastructure Planning Commission) should, however only refuse consent for overhead line proposals in favour of an underground or sub-sea line if it is satisfied that the benefits from the non-overhead line alternative will clearly outweigh any extra economic, social and environmental impacts and the technical difficulties are surmountable."*

5.2.3 In addition, National Grid have published guidance<sup>7</sup> in terms of reliability, capability, cost, construction impacts and land use of OHL compared to UGC, informing likely impact. Considering this National Grid guidance, EN-1 and EN5, there is no policy requirement to consider an UGC connection in the Parkgate location. The area in which the proposed AP2 Parkgate connection line is proposed is sparsely populated with no notable residential areas, and it is not within a National Park or an AONB<sup>3</sup>. Considering the guidance in implementing the Parkgate GSP connection, the benefits from an UGC connection would not be outweighed by economic, social and environmental impacts, including a greater level of land disruption, disturbance to biodiversity and archaeological sites.

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<sup>6</sup> National Policy Statement for Electricity Networks Infrastructure (EN-5)

<sup>7</sup> [https://www.nationalgrid.com/sites/default/files/documents/45349-Undergrounding\\_high\\_voltage\\_electricity\\_transmission\\_lines\\_The\\_technical\\_issues\\_INT.pdf](https://www.nationalgrid.com/sites/default/files/documents/45349-Undergrounding_high_voltage_electricity_transmission_lines_The_technical_issues_INT.pdf)

5.2.4 A comprehensive environmental, engineering and cost appraisal with respect to both OHL and UGC connection for the Parkgate GSP connection is set out in the following sections. In summary the appraisal also concludes that the permanent environmental benefits of an UGC connection, do not outweigh the significant additional cost, additional construction complexities, and additional temporary environmental impacts of an UGC connection for the Parkgate GSP connection.

## 5.3 Engineering appraisal

5.3.1 The engineering comparison between the illustrative OHL connection option and the illustrative UGC connection option is summarised below. It sets out the key differences in construction and operation between the two options. The detailed impact appraisal is set out in Appendix E.

### Construction complexity

5.3.2 The relative greater complexity of construction adds both cost and programme risks, due to possible unknown constraints resulting from, amongst other things:

- the interface with requirements for directional drilling under the River Blithe in the central section of the route results in additional construction complexity for the illustrative UGC connection option as compared to the illustrative OHL connection option due to jointing arrangements and potential project risk due to adverse ground conditions;
- the underground cables along the route will have an increased impact on existing buried services, including an existing high pressure gas pipeline, crossing perpendicular to the Parkgate corridor, requiring greater levels of design and supervision;
- the requirement for inspection boxes adds additional design and construction complexity for the illustrative UGC connection compared to the illustrative OHL connection option which does not have such requirements. Underground joint bays require deep excavations and controlled conditions in the working areas during jointing operations; and
- there is additional complexity in the construction of the illustrative UGC connection option, due to the need for cable sealing ends at the proposed National Grid Newlands Lane and Parkgate substations, compared with no such requirement for the illustrative OHL connection option.

5.3.3 The construction complexity rating therefore involves a moderate worsening compared with the illustrative UGC connection option due to the potential for changing ground conditions, the interface with non-dig construction methods, a requirement for additional cable jointing and the need to cross existing services.

## Disruption to existing infrastructure

5.3.4 There is the potential for added disruption to existing infrastructure for the UGC connection as compared to the OHL connection baseline scheme due to:

- several road crossing closure requirements and/or associated traffic management;
- the necessary management of the interface between the local traffic network and construction site haul roads; and
- the need for access points from the public highway for the construction of the UGC connection, whereas access for the installation of the OHL connection baseline scheme is more flexible and generally across existing farm accesses.

5.3.5 The disruption to existing infrastructure therefore involves a minor worsening with the illustrative UGC connection option due to increases in heavy goods vehicle (HGV) movements and greater numbers of interactions between construction traffic and local roads.

## Safety

### Construction

5.3.6 The main differences in safety between the illustrative UGC connection and the illustrative OHL connection option in construction are:

- reduced requirements for working at height or major lifting requirements for the illustrative UGC connection compared to illustrative OHL connection option;
- increased HGV movements would be required for the illustrative UGC connection option due to the increase in excavation and the need for disposal of materials offsite; and
- areas of deeper excavation for the underground joint bays and long sections of open trench are needed for the illustrative UGC connection option.

5.3.7 The safety rating comparison is neutral compared with the illustrative OHL connection option as the reduction in risks from working at height is balanced against the increased risk associated with working within areas of deep excavation and the increase in HGV movements.

## Operation

- 5.3.8 Safety during operation, maintenance and decommissioning, and emergency access is similar for both options. Underground cables pose a similar risk of contact compared to overhead lines.

## Maintenance and renewal

- 5.3.9 Whilst maintenance and operational access is needed to inspection boxes only, in the event of cable failure, cables would need to be exposed and removed. This would be more difficult and poses increased operational risks for underground cables compared with overhead lines.

## 5.4 Environmental appraisal

### Introduction

- 5.4.1 The appraisal compares the likely impacts from the illustrative OHL connection option (representing the baseline scheme) and the illustrative UGC connection option. The impact appraisal is set out in Appendix F and has been undertaken in line with the Scope and Methodology Report (SMR)<sup>8</sup>, SMR addendum<sup>9</sup> and SMR addendum 2<sup>10</sup>. Assumptions and limitations which have been used to inform the appraisal are also set out in Appendix F.
- 5.4.2 The appraisal has concluded that the temporary impacts of the illustrative UGC connection option (impacts during construction) are moderately worse overall than the illustrative OHL connection option. For the permanent impacts (impacts following completion of construction) the appraisal concluded the illustrative UGC connection would represent a moderate improvement compared to the illustrative OHL connection. A summary of the key differences from the appraisal is presented below.

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<sup>8</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report (Appendix CT-001-001). Available online at: <https://www.gov.uk/government/publications/scope-andmethodology-report-for-hs2-phase-2a>

<sup>9</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report Addendum (Appendix CT-001-002). Available online at: <https://www.gov.uk/government/publications/scope-and-methodology-report-for-hs2-phase-2a>

<sup>10</sup> HS2 Ltd (2018). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report Addendum 2 (Appendix CT-001-000). Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/775959/j21\\_HS2\\_Phase\\_2a\\_A\\_P2\\_ES\\_Volume\\_5\\_SMR\\_Addendum\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/775959/j21_HS2_Phase_2a_A_P2_ES_Volume_5_SMR_Addendum_2.pdf)

- 5.4.3 Where it is considered that impacts could be avoided, as reported in the assumptions in Appendix F, then these have informed the appraisal. Where required, the appraisal identifies mitigation measures which could be applied to mitigate the impacts, and the rating is based on these mitigation measures being applied. This includes the indicative mitigation design measures, shown in Appendix G, such as bird deflectors, and measures detailed in the HS2 Phase 2a draft Code of Construction Practice (CoCP)<sup>11</sup>.
- 5.4.4 Also provided in Appendix G is an illustrative comparable plan for the mitigation presented in the AP2 revised scheme.

## Temporary impacts

- 5.4.5 The construction of the illustrative UGC connection option would require a greater scale of excavation and vegetation clearance across a larger area compared to the illustrative OHL connection option. This would result in a worsening of impacts over the two-year construction period, when compared against the illustrative OHL connection option, on the rural and historical landscape, visual receptors and the setting of built heritage assets. These impacts would mostly be temporary and reversible.
- 5.4.6 Excavation of trenches would result in a greater level of physical disturbance to agricultural land during construction. This would be temporary and appropriate material handling measures would minimise long term impacts. Excavation would result in increased risks of temporary localised flooding and disruption to land drainage and the groundwater regime.
- 5.4.7 Construction of the illustrative UGC connection option would also require greater numbers of HGV movements, due to the increase in material to construct the site haul road and the increase in surplus material for disposal. The increase in HGVs would increase the level of traffic on the local road network and result in localised impacts on a limited number of residential properties in terms of increased noise and reduced air quality.
- 5.4.8 Overall, the illustrative UGC connection option would result in a moderate worsening in construction compared to the illustrative OHL connection option due to the increased scale and disruption during construction.

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<sup>11</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, draft Code of Construction Practice (CT-003-000). Available online at <https://www.gov.uk/government/publications/draft-code-of-construction-practice-for-hs2-phase-2a>

## Permanent impacts

- 5.4.9 The permanent impacts of the illustrative UGC connection option would be mostly limited to the presence of a number of inspection boxes, which provide maintenance access to the joint bays along the route (located approximately every 600m along the route). The absence of pylons would reduce the permanent impacts on views from the small number of residential properties and PRow located within the area. It will also reduce the permanent impacts on the rural and historic landscape character and remove impacts on the setting of historic structures.
- 5.4.10 Less agricultural land would be required permanently in the illustrative UGC connection option, however as the position of pylons in the illustrative OHL connection option has limited impact on the function of farm holdings the difference between the two options would be minimal. There would be farm management and land use restrictions imposed on the land above the cables for the illustrative UGC connection option.
- 5.4.11 Vegetation clearance and excavation would permanently impact on buried archaeology and local/regional value ecological receptors, including hedgerow, floodplain grazing marsh, terrestrial habitat associated with ponds and woodland. Habitat creation would, however, mitigate the ecological impacts.
- 5.4.12 The illustrative OHL connection option would introduce a potential national level risk of mortality of individual birds through collision with the OHL, as it is located within the Impact Risk Zone for Blithfield Reservoir SSSI. However, this could be mitigated through the use of measures such as bird diverters if detailed field surveys within the area identify any important bird flight lines and foraging areas. The illustrative UGC connection option would be an improvement on this, as it would remove the collision risk.
- 5.4.13 Therefore, the balance of greater vegetation clearance and against the removal of the bird mortality risk impact would represent a neutral change for biodiversity.
- 5.4.14 The permanent presence of the illustrative UGC connection would result in a greater extent of permanent sterilisation of a designated sand and gravel Mineral Safeguarded Area (MSA), however this would be limited to only a small area of the MSA. In addition, the trench and underground cables could permanently disrupt land drainage and the groundwater regime.
- 5.4.15 Overall, the illustrative UGC connection would result in a moderate improvement compared to the illustrative OHL connection option due to the removal of large permanent structures and their associated permanent impacts.

## 5.5 Cost appraisal

### Overview

- 5.5.1 The capital cost of the illustrative UGC connection option is estimated to be significantly higher than for the illustrative OHL connection option.
- 5.5.2 The operational costs for the illustrative UGC connection option are anticipated to be broadly similar to those for the illustrative OHL connection option<sup>7</sup>.

### Estimated construction cost summary

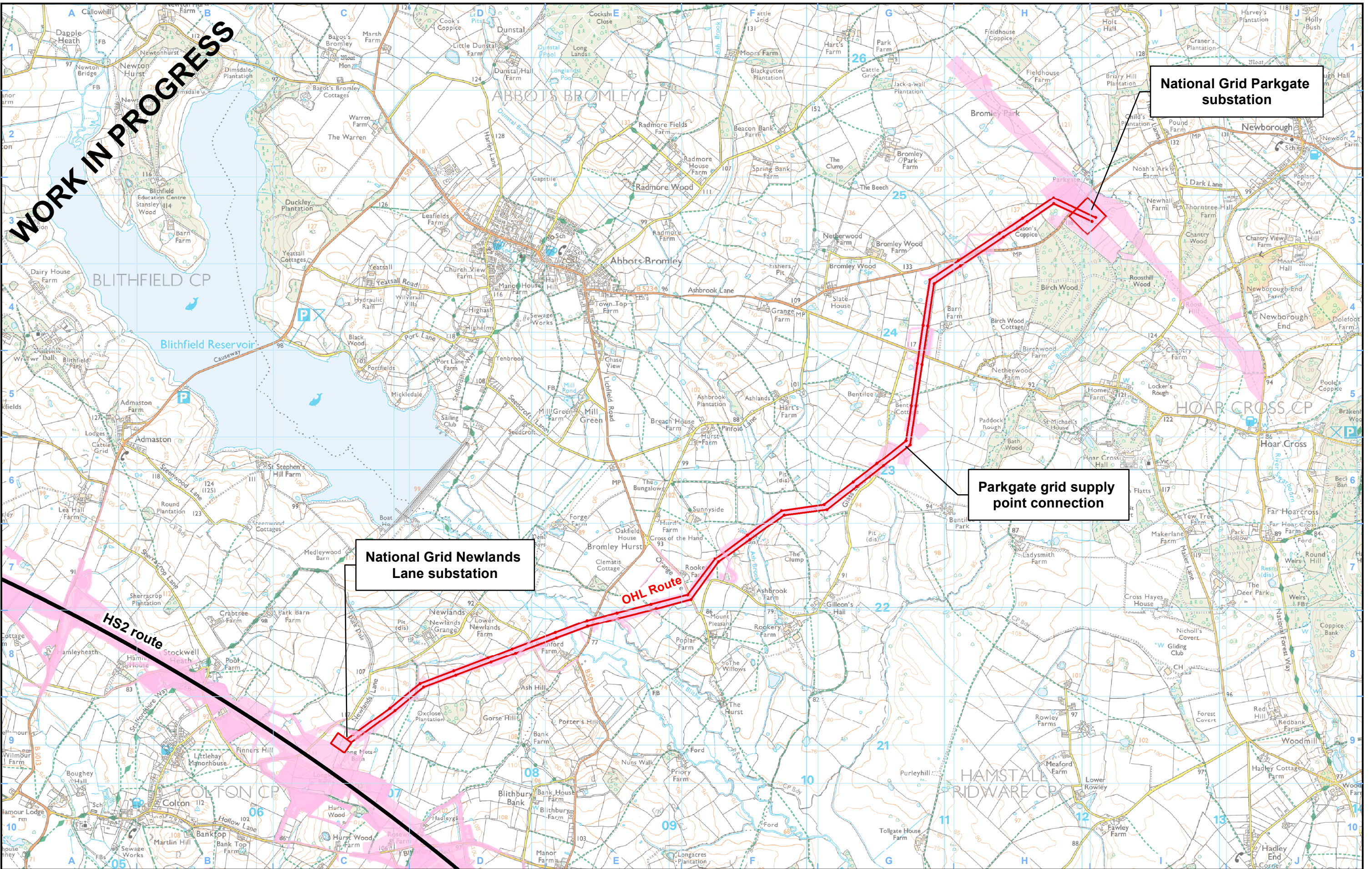
- 5.5.3 The estimated construction cost of the illustrative OHL connection option is: £105million (at 2015 prices). The estimated construction cost of the illustrative UGC connection option is: £170million (at 2015 prices). Both costs include contingency. The cost differential of £65million is due to a number of factors including additional site workers required to construct an UGC connection, increased costs of cables and materials, more expensive methods required such as HDD, and additional exposure to unknown ground conditions.
- 5.5.4 A summary, breakdown of the construction costs for the illustrative OHL and UGC connection options is provided in Appendix H.



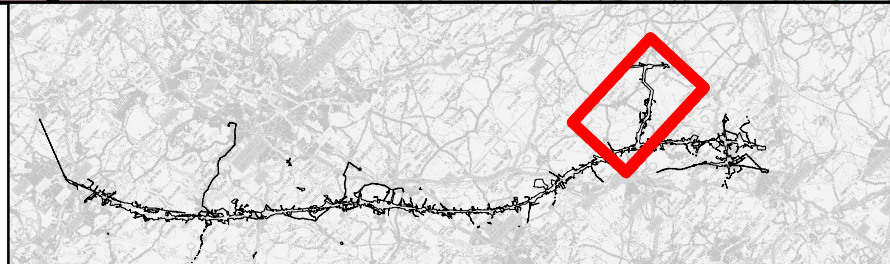
## Appendix A - Illustrative OHL connection corridor

- A.1.1 The following drawing presents an illustrative alignment and area of land for construction of the OHL connection option (within the land required to construct the AP2 Parkgate GSP connection)





- Legend**
- Illustrative Parkgate OHL baseline connection scheme
  - Illustrative land required for construction



Map Number  
 Map Name  
**Assumed alignment for the illustrative OHL baseline connection scheme**

Community Area  
 CA1 Fradley to Colton

**HS2**

Registered in England. Registration number 06791686.  
 Registered office: 2 Snowhill, Queensway, Birmingham B4 6GA.

Scale at A3: 1:25,000

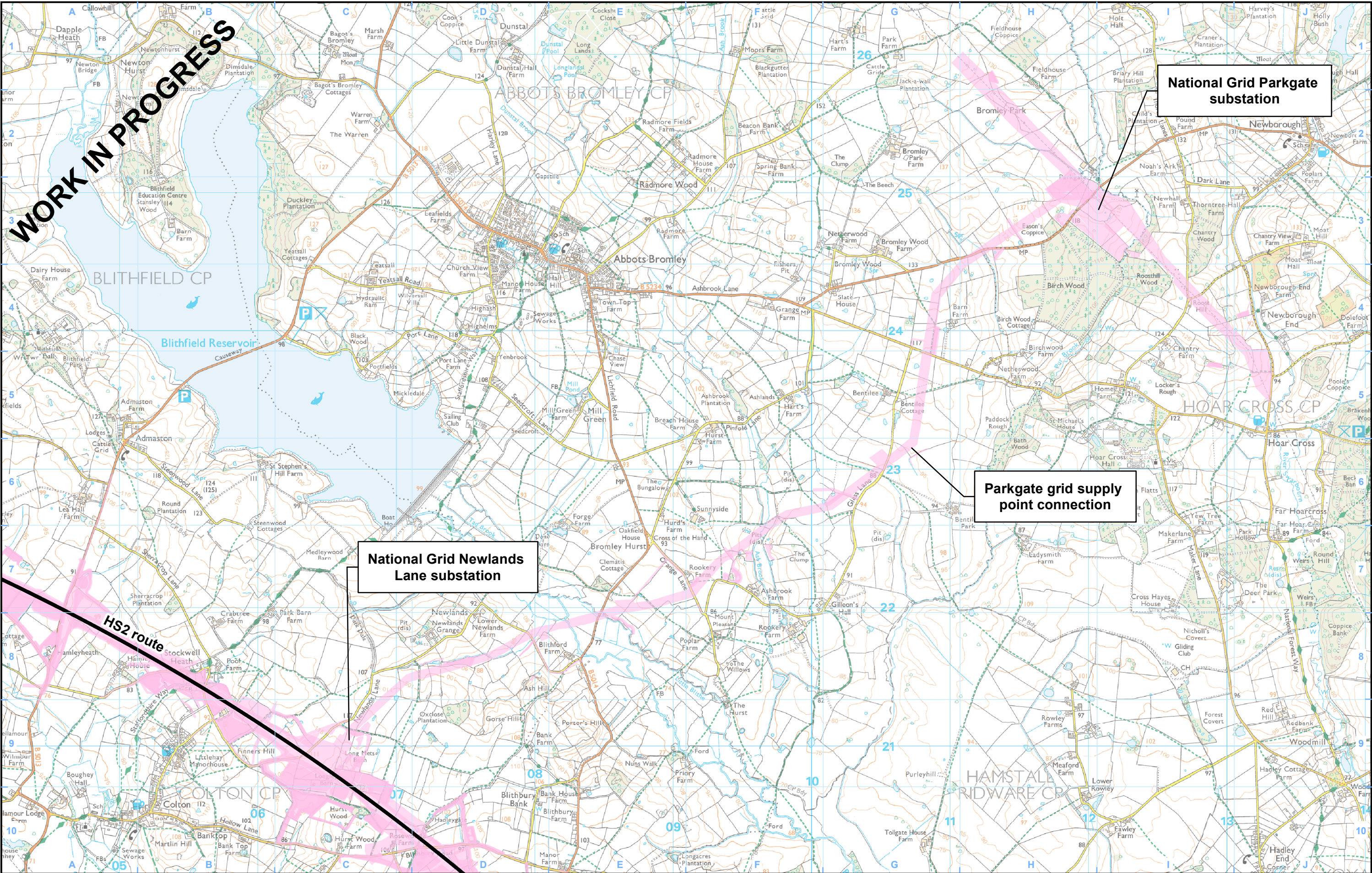
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Doc Number: Date: 26/03/19

## Appendix B - Illustrative UGC connection corridor

B.1.1 The following drawing illustrates the alignment of the illustrative UGC connection option considered in the appraisal





**WORK IN PROGRESS**

**National Grid Parkgate substation**

**Parkgate grid supply point connection**

**National Grid Newlands Lane substation**

**HS2 route**

**Legend**  
 Illustrative Land Required for Construction



Map Number  
 Map Name  
**Assumed alignment for the illustrative UGC connection option**

Community Area  
 CA1 Fradley to Colton

**HS2**

Registered in England. Registration number 06791686.  
 Registered office: 2 Snowhill, Queensway, Birmingham B4 6GA.

Scale at A3: 1:25,000

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Doc Number: Date: 26/03/19

## Appendix C - Illustrative UGC connection option key crossings

C.1.1 The crossings that need to be considered along the route are four watercourses, six minor roads/access tracks and three 'B' roads. In addition, there are a number of existing utilities that also need to be considered. Locations are shown in Figure 1 in Section 4.

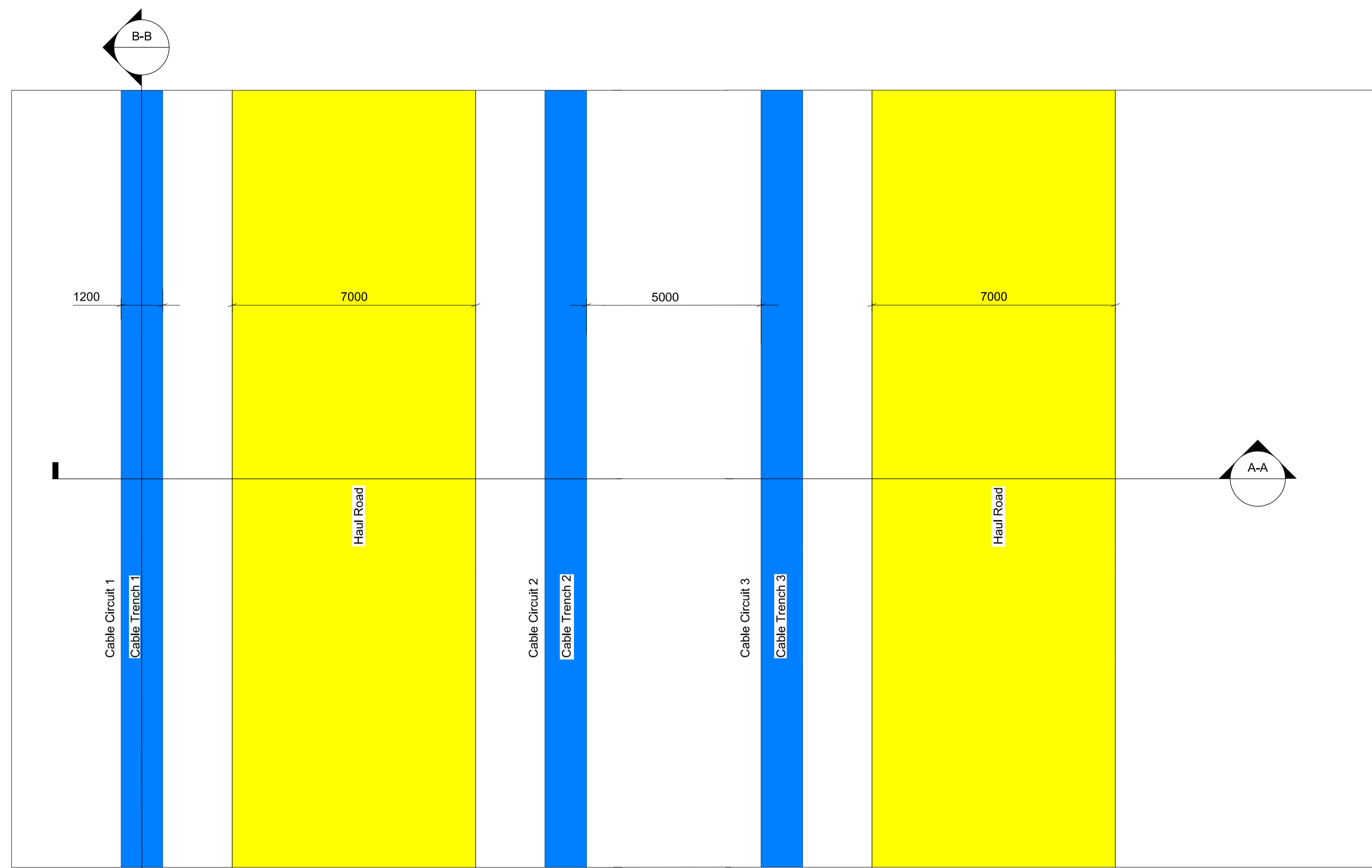
Table 1: Overview of route, crossings and chainage

Section Ref	Construction Type	Description	Chainage (m)	
			Start	End
1	Sub-station working area		0	50
2	Minor Track Crossing	Crossing of realigned access track	50	100
3	Open Cut Section		100	675
4	Minor Track Crossing	Crossing of existing farm track	675	750
5	Open Cut Section		750	1200
6	Brook Crossing	Crossing of a minor brook	1200	1275
7	Open Cut Section		1275	1525
8	Minor Road Crossing	Crossing of Newlands Lane	1525	1600
9	Open Cut Section		1600	1725
10	River / Floodplain crossing	Crossing of the River Blithe channel & floodplain	1725	2225*
11	Medium Road Crossing	Crossing of the B5014 Lichfield Road		
12	River / Floodplain crossing	Crossing of the Little Blithe channel & floodplain		
13	Open Cut Section		2225	2750
14	Minor Road Crossing	Crossing of Orange Lane	2750	2825
15	Open Cut Section		2825	3375
16	Brook Crossing	Crossing of Ash Brook	3375	3575
17	Open Cut Section		3575	4100
18	Minor Track Crossing	Crossing of private access road	4100	4175
19	Open Cut Section		4175	4450
20	Minor Road Crossing	Crossing of Glass Lane	4450	4575
21	Open Cut Section		4575	5375
22	Medium Road Crossing	Crossing of Abbots Bromley Road	5375	5475
23	Open Cut Section		5475	6150
24	Medium Road Crossing	Crossing of B5234 Abbots Bromley Road	6150	6425
25	Open Cut Section		6425	7100
26	Medium Road Crossing	Crossing of B5234 Abbots Bromley Road	7100	7175
27	Sub-station working area	400kV Sub-station	7175	7200

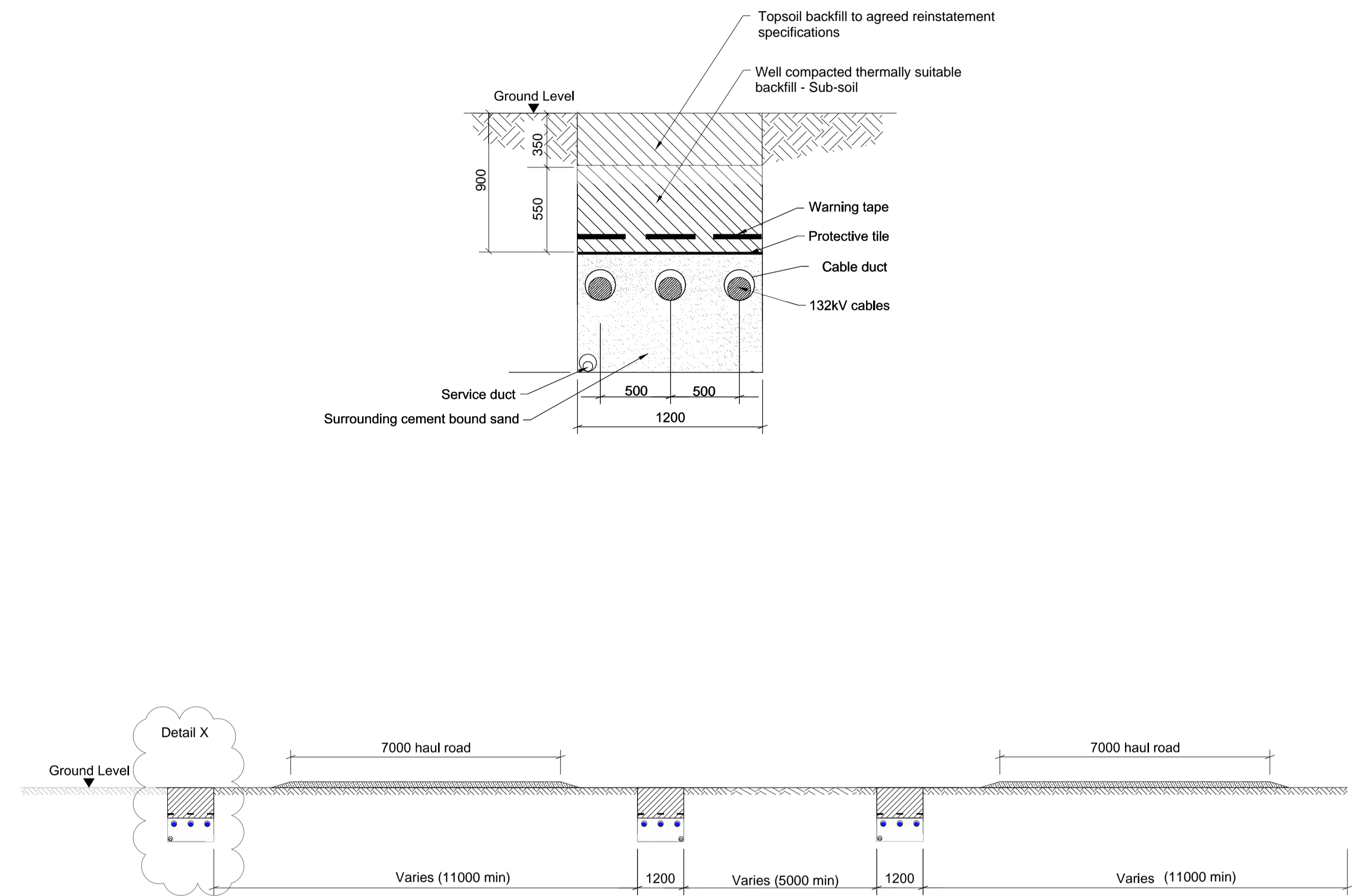
\* The crossing of the River Blithe, Little Blithe and B5014 have been considered as a single crossing

## **Appendix D- Illustrative UGC connection cross-sections and plans**

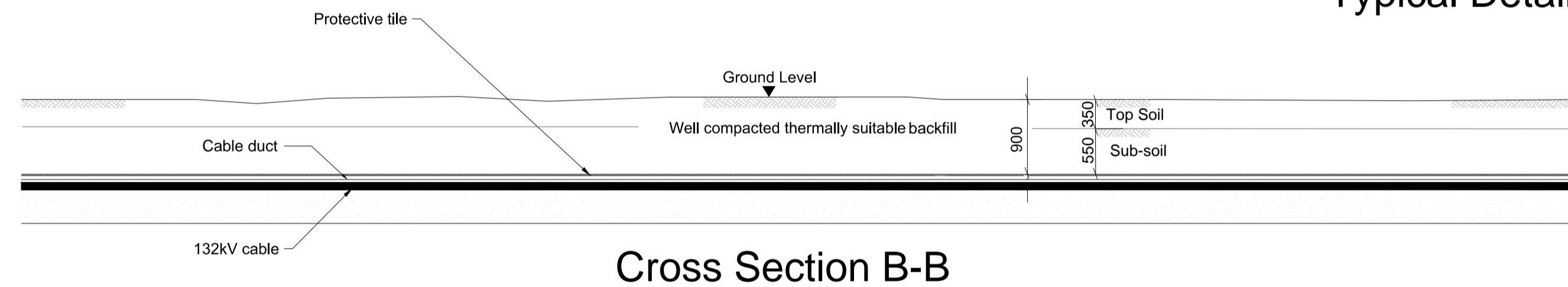




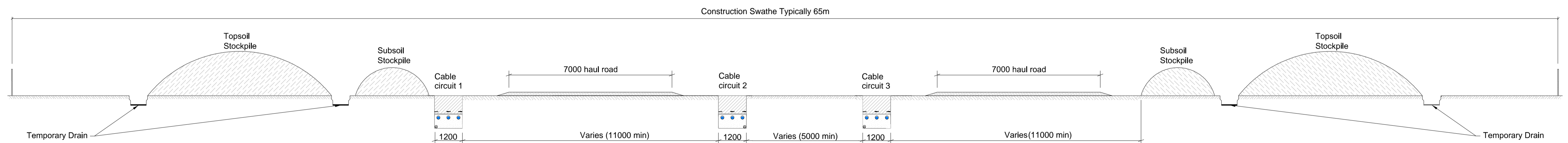
Typical Plan View of Cable Trenches / Haul Road  
1:100



Cross Section A-A  
Typical Details - Cable Trenches with Cables Laid in Ducts  
1:100



Cross Section B-B



Typical Swathe - Open Cut Construction for 132kV Cable Installation  
1:100

**Work-in-progress**

P00.1					HS2 accepts no responsibility for any circumstances which arise from the reproduction of this document after alteration, amendment or abbreviation or if it is issued in part or issued incompletely in any way.
P00.2	Cable ducts added. Dimensions updated				© Crown Copyright and database right 2018. All rights reserved. Ordnance Survey Licence number 100049190
P00.3	Detail X - wording revised				© Crown Copyright material is reproduced with the permission of Land Registry under delegated authority from the Controller of HMSO.
P00.4	Detail X - dimensions revised				This material was last updated on 2018 and may not be copied, distributed, sold or published without the formal permission of Land Registry. Only an official copy of a title plan or register obtained from the Land Registry may be used for legal or other official purposes.
P00.5	Typical plan title change. Additional note added.				
Rev	Description	Drawn	Checked	Con App	HS2 App

Legends/Notes:					
1. The proposed arrangement in this drawing is indicative only. Dimensions may vary depending on site conditions construction methodology.					
2. All dimensions are in mm unless otherwise stated					

**HS2**

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Registered office:  
2 Snow Hill, Queensway,  
Birmingham, B4 6GA

Creator/Originator  
**Ove Arup & Partners International Ltd**

Zone	Route Wide			Project/Contract	C861 Hybrid Bill Additional Provision 2 AP2				
Design Stage	Designs for Petition			Discipline/Function	Petitions				
Drawing Title	Parkgate 132kV Underground Cable Typical Details - Cables Laid in Buried Ducts			Drawn	BPR	Checked	MA	Approved	JRM
	Date	25/01/2019	Scale	AS SHOWN	Size	A1			
	Drawing No.	2PT02-ARP-PT-DPP-000-010010			Rev.	P00.5			

## Appendix E- Engineering Appraisal Comparison Table





C861

## **HS2 Phase 2a West Midlands to Crewe**

**Traction Power Sift (Parkgate  
overground and underground) -  
Engineering Matrix**

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## Engineering Option Comparison Matrix

### Notes on this appraisal

#### Approach

This appraisal assesses likely impacts from the illustrative OHL baseline connection and considers whether the alternative UGC connection option would be better, worse or neutral when compared against the baseline design.

The appraisal considers the temporary and permanent impacts from the construction and operation of the power connection between the National Grid Parkgate substation and National Grid Newlands Lane substation.

#### Limitations

##### General

- no geotechnical or topographic survey data is available to inform the engineering assessment; and
- access routes from local roads have not been assessed in detail and assumptions from the AP2 revised scheme have been used for the assessment.

#### Assumptions

##### General

- all works to the existing 400kV overhead power line and transformation of power into the National Grid Parkgate substation would be the same with both options, and is excluded from the appraisal;
- construction and operation of the National Grid Parkgate and National Grid Newlands Lane substations would be the same with both options, and are discussed for context only;
- construction of both options is assumed to take two years to complete, the works associated with the underground option would be more intense than the overground option during this period;
- the bridge over the Little Blithe river (FRC277) would not be physically impacted by either option;
- a number of localised temporary crossings of watercourses would be required for construction traffic, to avoid or reduce impacts on local roads;
- the appraisal assumes no permanent access tracks;
- main and satellite construction compounds would be in place throughout the whole two-year construction period;
- a site haul road would be provided alongside each underground trench across the whole route, with the exception of the horizontal directional drilling (HDD) sections within the River Blithe and Little Blithe floodplain;
- access to the site compounds would be via site haul roads for cable works (no additional site haul roads required);
- the directional drill (non-dig) sections would be at a sufficient depth to not interfere with the existing surface structures, buried utilities or watercourses;
- in areas of open cut, the typical depth of excavation would be 1.5m, with 300mm thick cement bound sand surrounding the cables.

Option Appraisal

---	Major worsening on the Comparator Scheme
--	Moderate worsening on the Comparator Scheme
-	Minor worsening on Comparator Scheme
0	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
++	Moderate improvement on Comparator Scheme
+++	Major improvement on Comparator Scheme
N/A	Not applicable

Community Area and location:		Fradley to Colton, CA1			
Option name and description:		Parkgate Over or Underground			
OPTIONS CONSIDERED:		Baseline design – Overground		Option Underground	
OPTION DESCRIPTION		Illustrative connection from the proposed National Grid Parkgate substation to National Grid Newlands Lane sub-station via OHL, removing flexibility		Illustrative connection from proposed substation at Parkgate to Newlands Lane auto-transformer feeder station via underground cables.	
Key Issue	Appraisal criteria	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING
Strategic Fit	Capture whether an option meets the Project Specification	The route provides traction power to HS2 Phase 2A. For power supply resilience, three 132kV circuits are to be provided. The power supply route is independent of the HS2 route.	0	This option meets the same requirements as the baseline design and is therefore a neutral change.	0

Construction Feasibility	Assess the relative complexity of construction	<p>The electrical connection is formed of a 132kV OHL direct connection into National Grid Newlands Lane substation and on to Newlands Lane auto-transformer feeder station. The baseline design is a mix of double circuit and single circuit pylons.</p> <p>The construction of a new 400kV substation (National Grid Parkgate substation) is required to connect to the national electricity transmission grid.</p>	0	<p>As with the baseline design a 3 circuit 132kV direct connection into National Grid Newlands Lane substation is required. This would include construction of a new 400kV substation (National Grid Parkgate substation). The connection would be made via underground cables rather than overhead line.</p> <p>There is additional complexity in the construction of the UGC connection, due to the need for cable sealing ends at the proposed National Grid Newlands Lane and Parkgate substations, compared with no such requirement for the OHL connection baseline scheme</p> <p>No assessment of ground conditions has been undertaken and therefore the final design solution along the full distance of the route would need to be assessed during a feasibility stage. Assumptions have been made to inform the design however these may be incorrect leading to additional construction complexity compared with the baseline design.</p> <p>An interface is required with the directional drill (non-dig solution) methodology under the River Blithe in the central section. This adds minor complexity in terms of different construction methods, jointing arrangements and the susceptibility of the technique to adverse ground conditions.</p> <p>Inspection box and joint bay design and construction works add complexity in terms of the need for deeper excavations and controlled conditions in the working areas during jointing operations.</p> <p>The design and construction of crossing points at existing services, particularly the crossing of an existing high pressure gas pipeline, requires more detailed construction planning to mitigate risks.</p> <p><u>Summary</u></p> <p>Overall, this has been assessed to be a moderate worsening due to the potential for changing ground conditions, the interface with no dig solutions, a requirement for additional cable jointing and the need to cross existing services. .</p>	--
	Assess the relative disruption to existing infrastructure, e.g. rail, highways etc.	<p>The baseline design follows a new alignment, perpendicular to the HS2 route.</p> <p>The works involve 'Green field' construction with a limited interface with the main construction works of HS2.</p> <p>There is a risk of construction problems associated with soft ground such as trafficking, thick working platforms and routeways to sites of construction. This could change the type of vehicles that need to access the site.</p> <p>Road crossings could be constructed using scaffolding techniques, minimising the need for extensive road closures.</p> <p>Localised access points and short sections of construction site haul roads limit the number of construction access points from public highway.</p> <p>Utility crossings, such as the crossing of existing gas mains, would be designed to minimise impact. Overhead lines have minimal impact on buried services subject to the location of the pylons.</p>	0	<p>The proposed cable option follows a new alignment, perpendicular to the HS2 route.</p> <p>The works involve 'Green field' construction with a limited interface with the main construction works of HS2.</p> <p>There is a risk of construction problems associated with unforeseen ground conditions, including contamination. This could change the type of vehicles that need to access the site increasing the impact compared with the baseline design.</p> <p>Several local road crossings would need road closures and/or extensive traffic management for the duration of the works increasing the impact compared with the baseline design.</p> <p>There would be an interface between local traffic and construction traffic where the site haul roads cross public highway increasing the impact compared with the baseline design.</p> <p>Site haul roads limit the number of construction access points from public highway to a level broadly similar to the baseline design. However, due to increase volumes of imported fill and material to be exported, this option requires increases in overall Heavy Goods Vehicle (HGV) movements.</p> <p>Utility crossings, such as the crossing of existing gas pipeline, would be designed to minimise impact. Underground cables have an increased impact on buried services requiring greater levels of design and supervision.</p> <p><u>Summary</u></p> <p>Overall, this has been assessed as a minor worsening due to increases in HGV movements and greater numbers of interactions between construction traffic and local roads.</p>	-

HS2 Operation Feasibility – Trains (HS2 and Network Rail)	Assess the relative flexibility and reliability of the track layout	-	N/A		N/A
	Assess the relative train maintenance and servicing arrangements	-	N/A		N/A
HS2 Operation Feasibility – Operations (Stations, Depots etc.)	Assess the effectiveness of:	-	N/A		N/A
	Location and space for station control	-	N/A		N/A
	Location and space for accommodating staff, catering, transport police and other “back of house” activities	-	N/A		N/A
	Location and space for passenger facilities such as ticket office, travel information, toilets, left luggage etc.	-	N/A		N/A
	Location of ticket barriers	-	N/A		N/A
HS2 Operation Feasibility - Passengers	Assess Passenger Dispersal covering road (right of way), rail and public transport	-	N/A		N/A
	Assess the relative Passenger Connectivity at stations between high speed rail, classic rail, bus, coach, car, taxi, bicycle and pedestrians	-	N/A		N/A
	Assess the relative passenger flow characteristics during emergency evacuation and normal operation at stations	-	N/A		N/A
	Assess the relative ‘Way Finding’ of station layouts i.e. logical flow	-	N/A		N/A
	Assess the relative security or perception of security of station layouts	-	N/A		N/A
Demand	Likely Relative Passenger Numbers	-	N/A		N/A
	Likely Journey Times	-	N/A		N/A
	Likely Demand	-	N/A		N/A
Costs	Estimated whole life cycle costs to give relative assessment <i>(Appraisal considers operational costs as capital costs are considered separately below.)</i>	Steel pylons should require limited operating costs.	0	Operational costs for this option are anticipated to be broadly similar to the baseline design. In the event of a fault, costs to fix the UGC are likely to be higher than the baseline scheme.	-

	Estimated initial capital costs to give relative assessment (The capital costs include construction, land and compensation costs)	A cost estimate has been developed which includes enabling works, preliminaries, contractor's design and contractor overheads.	0	<p>The cost of constructing this option is significantly higher than the overhead alternative. This is because of many factors including more expensive cables, additional workers being required to deliver the solution, additional costs of materials, more expensive methods required like HDD and additional exposure to unknown ground conditions.</p> <p><u>Summary</u></p> <p>Overall, this has been assessed as a major worsening compared with the baseline design, due to the significant additional construction costs and risks.</p>	---
Safety	Assess the relative safety during construction	Works to the baseline design introduces hazards such as working at height, craneage, working with high tension conductors and breaking ground.	0	<p>This option avoids the requirement for the most working at height and major lifting requirements however, it should be noted that some working at height would be needed for the cable sealing ends and around excavated joint bays.</p> <p>Significant increases in traffic movements would be needed due to the increase in excavation and disposal of materials offsite.</p> <p>Areas of deeper excavation for the joint bays and long sections of shallow open trench (up to 1.5m deep) would be needed to install the cables.</p> <p>A greater focus on health and safety risk reduction is needed at service crossings, particularly the existing high pressure gas pipeline.</p> <p>This option requires a greater number of haul roads crossing public roads introducing additional risks to the public.</p> <p><u>Summary</u></p> <p>Overall, this has been assessed as neutral change compared with the baseline design as the reduction in risks from working at height is balanced against increases in risks from other activities.</p>	0
	Assess the relative safety during operations, maintenance and decommissioning, and emergency access	<p>Pylon design would allow sufficient height clearances at road crossings all but exceptionally tall vehicles.</p> <p>Maintenance access to pylons would be from agreed routes.</p>	0	<p>Underground cables pose a similar risk of contact with live cables compared with the baseline design (major excavations on the line of cable through protective tiles, compared with irresponsible vehicles operating under cables).</p> <p>During maintenance works minimal working at height would be needed to maintain cables.</p> <p>Maintenance and operational access is needed to inspection boxes only, which carries a low risk compared to inspecting pylons and overhead lines.</p> <p>In the event of cable failure, cables would need to be exposed and removed. This would be more difficult and poses increased risks for underground cables compared with the baseline design.</p> <p><u>Summary</u></p> <p>Overall, this has been assessed as neutral change compared with the baseline design.</p>	0
Commitments	Previous explicit or implicit public assurances or commitments to third parties		N/A		N/A
Commercial Development	Does the option provide opportunities for development, in particular for over station development		N/A		N/A

---

Overall rating

**Moderate worsening on the Comparator Scheme**

This option would result in a moderate worsening compared to the baseline design due to a large increase in capital cost compared with the baseline design, more challenging construction methods (due to directional drill sections, jointing and interaction with existing services), and disruptions from road closures and increased HGV movements.

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## Appendix F- Environmental Sift Comparison Table





C861

## **HS2 Phase 2a West Midlands to Crewe**

**Traction Power Sift (Parkgate  
overground and underground) -  
Environmental Matrix**

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## Environmental Option Comparison Matrix

### Notes on this appraisal

#### Approach

This sift appraises likely impacts from the illustrative OHL baseline connection and considers whether the alternative UGC connection option would be better, worse or neutral when compared against the than the baseline design. The impact appraisal is undertaken in line with the HS2 Phase 2a Scope and Methodology Report (SMR)<sup>1</sup> and SMR addendum<sup>2</sup>, included in the main ES, and the SMR addendum 2<sup>3</sup>, included in the SES2 and AP2 ES.

The appraisal considers the temporary and permanent impacts from the construction and operation of the power connection between the National Grid Parkgate substation and National Grid Newlands Lane substation. This appraisal has not considered the ongoing maintenance of the connection following construction, or replacement work at the end of the connection's design life.

The sift considers impacts from the construction and operation of both options, where required the appraisal identifies mitigation measures which could be applied to mitigate the impacts and the rating is based on these mitigation measures being applied. This includes the indicative mitigation prepared to inform the baseline design and alternative design and non-design mitigation measures (such as bird deflectors and the HS2 Phase 2a draft Code of Construction Practice (CoCP)<sup>4</sup>).

#### Limitations

##### General

- no habitat or species survey data is available to inform the biodiversity appraisal; and
- no surveys on watercourses have been undertaken to inform the water resources and flood risk appraisal;

##### OHL baseline connection specific (baseline design)

- no additional limitations.

##### Alternative UGC option specific (alternative design)

- no abstraction data is available for the northernmost 1.5km of the underground connection to inform the water resources and flood risk appraisal.

#### Assumptions

##### General

- all works to the existing 400kV overhead power line and transformation of power into the National Grid Parkgate substation would be the same with both options, and is excluded from the appraisal;
- construction and operation of the National Grid Parkgate and National Grid Newlands Lane substations would be the same with both options, and are discussed for context only;
- construction of both options is assumed to take two years to complete, the works associated with the underground option would be more intense than the overground option during this period;
- the Bridge over the Little Blithe river (FRC277) would not be physically impacted by either option;
- a number of localised temporary crossings of watercourses would be required for construction traffic, and to avoid or reduce impacts on local roads;
- vegetation required to be removed for construction, for example hedgerows and trees affected by access tracks, would be reinstated after works are completed;
- construction traffic to the National Grid Parkgate satellite compound and Blithbury Central cutting satellite compound would be the same with both options; and
- the appraisal assumes no permanent access tracks.

##### Overground specific (baseline design)

- works would be undertaken sequentially, so that receptors in one area are not impacted for the full two years of construction;

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<sup>1</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report (Appendix CT-001-001). Available online at: <https://www.gov.uk/government/publications/scope-and-methodology-report-for-hs2-phase-2a>

<sup>2</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report Addendum (Appendix CT-001-002). Available online at: <https://www.gov.uk/government/publications/scope-and-methodology-report-for-hs2-phase-2a>

<sup>3</sup> HS2 Ltd (2018). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, Environmental Impact Assessment Scope and Methodology Report Addendum 2 (Appendix CT-001-000). Available online at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/775959/J21\\_HS2\\_Phase\\_2a\\_AP2\\_ES\\_Volume\\_5\\_SMR\\_Addendum\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/775959/J21_HS2_Phase_2a_AP2_ES_Volume_5_SMR_Addendum_2.pdf)

<sup>4</sup> HS2 Ltd (2017). High Speed Rail (West Midlands - Crewe) Environmental Statement, Volume 5: Technical appendices, draft Code of Construction Practice (CT-003-000). Available online at <https://www.gov.uk/government/publications/draft-code-of-construction-practice-for-hs2-phase-2a>

- temporary diversions or realignments of Abbots Bromley Footpaths 29, 30, 38, 39, 46 and 49 would be required for up to three months each to ensure the safety of non-motorised users;
- Colton Footpath 79 and Abbots Bromley Footpath 26 would be diverted parallel to their existing routes for one year during construction, to separate non-motorised users from construction vehicles accessing the pylon route;
- all land for the power line not required for a pylon base would be returned to existing use following completion of construction;
- the detailed design process would aim to avoid or minimise the loss of ecologically valuable habitat features, including woodland, floodplain grazing marsh, species-rich hedgerows, watercourses and ponds;
- the methods for stringing overhead power lines would not require the complete removal of all habitats in between the pylons. Removal of habitat features, such as ponds that are located in between pylons, but outside of pylon construction areas, would be avoided;
- no permanent works would take place within watercourses;
- roads would remain open to highways traffic throughout construction and netting arrangements over roads would be provided to protect traffic underneath, where required;
- woodland habitat creation cannot be planted beneath overhead power lines; and
- pylons bases would be constructed with piled foundations.

#### Underground specific (alternative design)

- all four additional satellite compounds would be in place throughout the whole two-year construction period;
- a site haul road would be provided alongside each underground trench across the whole route, with the exception of the horizontal directional drilling (HDD) sections within the River Blithe and Little Blithe floodplain;
- access to the site compounds would be via site haul roads for cable works (no additional site haul roads required);
- impacts on groundwater abstraction and surface water abstractions are excluded from the appraisal due to an absence of information relating to the northern part of both connections;
- the HDD sections would be at a sufficient depth to not interfere with the baseflow or hyporheic zone where these are located underneath watercourses;
- HDD under rivers would be followed by grouting of the ground around the cables to prevent erosion;
- temporary diversions or realignments of Colton Footpath 79 and Abbots Bromley Footpaths 26, 29, 30, 38, 39, 46 and 49 would be required to ensure the safety of non-motorised users. Footpath 43 would also require a diversion, which was not required for the baseline design. Colton Footpath 79 may need to be diverted for longer than in the baseline design;
- all land for the power line not required for an inspection box (assumed to measure 10m long x 2.5m wide x 2m deep, with a 2m transition section at either end) would be returned to existing use following completion of construction;
- temporary road closures for constructing underground diversion would be limited and during this time local traffic management would be in place and access to properties maintained;
- land would be reinstated following construction. Vegetation required to be removed for construction, for example hedgerows and grassland affected by the underground works, would be reinstated after works are completed;
- woodland habitat creation cannot be planted over underground cables;
- all ecologically valuable habitat features, including woodland, floodplain grazing marsh, species-rich hedgerows, watercourses and ponds, would be removed where they are in an area of open cut construction. These features would not be removed where horizontal directional drilling is used; and
- in areas of open cut, the typical depth of excavation would be 1.5m, with cement bound sand surrounding the cables 300mm thick.

#### Option Appraisal

---	Major worsening on the Comparator Scheme
--	Moderate worsening on the Comparator Scheme
-	Minor worsening on Comparator Scheme
0	Neutral / no change to Comparator Scheme
+	Minor improvement on Comparator Scheme
++	Moderate improvement on Comparator Scheme
+++	Major improvement on Comparator Scheme
N/A	Not applicable

Community Area and location:				Fradley to Colton, CA1			
Option name and description:				Parkgate Over or Underground			
OPTIONS CONSIDERED:				Baseline design – Overground		Option Underground	
OPTION DESCRIPTION				Illustrative connection from the proposed National Grid Parkgate substation to National Grid Newlands Lane sub-station via OHL, removing flexibility		Illustrative connection from proposed National Grid Parkgate substation to National Grid Newlands Lane sub-station via underground cables.	
Key Sustainability Issue	Topic	STAGE: Construction or Operation	Environmental Design Aim considered (incl. Topic and Ref no.)	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING	QUALITATIVE IMPACT DESCRIPTION and/or QUANTITATIVE ASSESSMENT	RATING
Greenhouse gas emissions and climate change	Climate adaptability	Const	CC-8	The climate change resilience assessment and the in-combination climate change impacts assessment are undertaken at a route-wide level, with any impact/effects and mitigation measures identified at the route-wide level. Climate change resilience associated with autotransformer feeder stations, overhead line equipment and utilities would be at low risk. No significant in-combination climate change impacts/effects for the area around the Parkgate substation and Newlands Lane autotransformer feeder station/substation during construction anticipated.	N/A	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any impacts/effects and mitigation measures also identified at the route-wide level, modifications to the traction power connection is not considered to affect the outcome of either assessment.	O
		Op		The climate change resilience assessment and the in-combination climate change impacts assessment are undertaken at a route-wide level, with any impacts/effects and mitigation measures identified at the route-wide level. Climate change resilience associated with autotransformer feeder stations, overhead line equipment and utilities would be at low risk. No significant in-combination climate change impacts/effects for the area around the Parkgate substation and Newlands Lane autotransformer feeder station/substation during operation anticipated.	N/A	As the climate change resilience assessment and the in-combination climate change impacts assessment are both undertaken at a route-wide level, with any impacts/effects and mitigation measures also identified at the route-wide level, modifications to the traction power connection is not considered to affect the outcome of either assessment.	O
	Greenhouse gas emissions	Const	CC-8	The baseline design includes the construction of overhead power lines and pylons and their associated piling and concrete foundations.  The construction of the baseline design is expected to generate greenhouse gas emissions associated with the embodied impact of steel use for pylon construction and concrete use for piling and foundations, transport of construction material to site and energy use during construction installation processes.	N/A	Based on advice from National Grid, underground cables have the potential to result in significantly more capital carbon compared to the baseline design of overhead power lines and pylons.  <u>Summary</u> Overall, this option would result in a moderate worsening compared to the baseline design.	--
		Op		The GHG assessment of operational (non-traction) emissions is assessed at a route-wide level and includes signalling and telecommunication. Non-traction emissions are expected to account for approximately 7% of total operational GHG emissions across the entire scheme.	N/A	Based on advice from National Grid, GHG emissions during operation are dependent on line losses. Typically, underground cables result in less line losses during their lifetime compared to the baseline design of overhead power lines and pylons.  <u>Summary</u> Overall, this option would result in a minor improvement compared to the baseline design.	+
	Energy use	Const	CC-8	Energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption would result in an increase in carbon emissions. Hence the conclusions in the GHG assessment stand for energy use as well.	N/A	Energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption would result in an increase in carbon emissions. Hence the conclusions in the GHG assessment stand for energy use as well.  <u>Summary</u> Overall, this option would result in a moderate worsening compared to the baseline design.	--
		Op		Energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption would result in an increase in carbon emissions. Hence the conclusions in the GHG assessment stand for energy use as well.	N/A	Energy consumption and carbon emissions are closely linked. An increase in fuel or electricity consumption would result in an increase in carbon emissions. Hence the conclusions in the GHG assessment stand for energy use as well.	+

						use as well.  <u>Summary</u> Overall, this option would result in a minor improvement compared to the baseline design.	
Natural and cultural resource protection and environmental enhancement	Landscape/townscape	Const	HL-4, HL-5, HL-6, HL-9, HL-10, LV-1, LV-2, LV-3, LV-9	<u>Landscape character</u> Construction activities, including presence of access tracks and cranes, tree and vegetation removal, and construction traffic movement would have adverse impacts on the landscape within Blithfield Reservoir and Settled Farmland Landscape Character Area (LCA), Blithe Alluvial Farmland LCA, Bromley Settled Farmland LCA, Pur Brook Farmland LCA, Hoar Cross Estate Woodlands LCA and Bromley Park Plateau Farmland LCA. This would reduce scenic quality and tranquillity, although impacts would be localised.  <u>Visual</u> The area is sparsely populated, predominantly made up of a small number of isolated rural farm dwellings. Construction activities, including presence of access tracks and cranes, tree and vegetation removal, and construction traffic movement would have adverse impacts on small number of residential and recreational receptors along Newlands Lane, Blunts Hollow Road, Thorley Lanes and the B5234 Bromley Lane. As the construction activity is relatively localised, these impacts are limited to those receptors with close to middle distance views towards the baseline design.	N/A	<u>Landscape character</u> This option would lead to a substantial increase in construction impacts on the character of the landscape within all the same LCAs as the baseline design due to greater land take for construction, greater vegetation removal, and increased construction activities, including additional construction compounds.  <u>Visual</u> The area is sparsely populated, predominantly made up of a small number of isolated rural farm dwellings. This option would lead to an increase in construction impacts on the limited number of residential and recreational visual receptors due to increased construction activities required for underground works, the width of the construction corridor along the full length of the grid supply point connection, and the increase in tree and hedgerow removal which would open up views of construction.  <u>Summary</u> Overall, this option would result in a major worsening compared to the baseline design due to more vegetation clearance and more intrusive works, across a larger area, particularly on the landscape character.	---
		Op		<u>Landscape character</u> During operation there would be adverse impacts on Blithe Alluvial Farmland LCA, Bromley Settled Farmland LCA and Bromley Park Plateau Farmland LCA due to the presence of new infrastructure within rural landscapes, which would reduce scenic quality, and the permanent loss of trees to maintain clearances to conductors.  <u>Visual</u> This option would have impacts on a small number of residential and recreational receptors due to the introduction of uncharacteristic infrastructure within rural views with relatively few detractors. The pylons would break the skylines and would be in close proximity to some receptors making them prominent in views. However, as the area is sparsely populated, this would result in a reduction in scenic quality for a limited number of residential and recreational receptors.	N/A	<u>Landscape character</u> This option would substantially reduce the impacts on landscape character and scenic quality due to the absence of pylons. Vertical above ground structures would be limited to inspection boxes which are smaller and would not impact wider landscape character. There would be continued tree loss along the cable route, but these impacts would be localised.  Bromley Park Plateau Farmland LCA would continue to experience impacts from the presence of the National Grid Parkgate substation, however impacts on scenic quality would be slightly reduced compared to the baseline design due to the absence of additional pylons within the LCA.  <u>Visual</u> This option would remove most of the operational impacts on visual receptors as there would be no above ground structures other than the smaller inspection boxes which would only be noticeable when at close range.  Visual impacts on receptors on the B5234 Bromley Lane and Thorley Lanes, would be reduced but remain due to the National Grid Parkgate substation, however these would be localised due to landform and existing woodland belts which would limit views.  <u>Summary</u> Overall, this option would result in a major improvement compared to the baseline design due to the limited nature of permanent structures, reducing landscape and visual impacts.	+++
	Cultural heritage	Const	CH-1, CH-2, CH-4, CH-5, CH-7, CH-8	Visual impacts from the construction and permanent presence of overhead power lines and pylons would impact the historic rural settings of five listed buildings (FRC131, FRC348, FRC332, FRC333 and FRC316) and three other historic structures (FRC347, FRC361 and FRC319).  Intrusive works to construct the pylon bases and track marks of construction	N/A	Impacts on the historic rural setting of five listed buildings (FRC131, FRC348, FRC332, FRC333 and FRC316) and three other historic structures (FRC347, FRC361 and FRC319) would be reduced with this option. Impacts on setting would be temporary during the period of construction. There would be no permanent impacts on setting with this option.	++

				<p>vehicles would physically impact five buried archaeological assets (FRC369, FRC364, FRC366, FRC336 and FRC024). These assets are of lower value than the listed buildings.</p> <p>The Historic Landscape Character Areas (HLCAs) contain relatively little modern infrastructure and retain many elements of historic forest and parkland. Construction would involve construction of access tracks, movement of construction vehicles and erection of pylons and power lines, which would introduce temporary noise and visual impacts in the rural setting, while the pylons and would introduce permanent visual impacts on the rural setting of the landscape.</p>		<p>This option is likely to completely remove three buried archaeological assets (FRC024, FRC369 and FRC364). These assets are of lower value than the listed buildings.</p> <p>Construction of this option would introduce temporary noise and visual impacts in the rural setting of the HLCAs, however these are reversible and would be for the duration of construction only. There would be no permanent impacts on setting of the HLCA with this option</p> <p><u>Summary</u> Overall, this option would result in a moderate improvement compared to the baseline design due to the limited nature of permanent structures reducing impacts on the setting of heritage structures and HLCAs.</p>	
		Op		No operational impacts.	N/A	No operational impacts.	O
	Biodiversity	Const	EC-1, EC-2 EC-3 EC-4 EC-5 EC-6	<p>This option would cause adverse impacts on ecological features as described below.</p> <p><u>Designated sites</u></p> <ul style="list-style-type: none"> <li>• Blithfield Reservoir Special Site of Scientific Interest (SSSI) – mortality of qualifying bird species due to collision with overhead power lines.</li> <li>• Newlands Lane (Hedge 6) Local Wildlife Site (LWS) - loss of approximately 50m (approximately 4%) of hedgerow.</li> <li>• Long Mets Lane (Hedge 1) Biodiversity Alert Site (BAS) – loss of approximately 170m (approximately 65%) of hedgerow.</li> <li>• Lower Birches Plantation/Titler's Plantation - damage of up to 0.2ha (5%) of potential ancient woodland.</li> </ul> <p>Mitigation provided in the form of woodland, hedgerow, grassland and wet grassland habitat creation and the installation of bird diverters on the new power lines would be sufficient to mitigate impacts on the habitats and species for which the above sites are designated for, with the exception of the damage of potential ancient woodland at Lower Birches Plantation/Titler's Plantation which cannot be mitigated. In addition, notable hedgerows at Newlands Lane (Hedge 6) LWS and Long Mets Lane (Hedge 1) BAS would be relocated where practicable.</p> <p><u>Habitats</u></p> <ul style="list-style-type: none"> <li>• Floodplain grazing marsh – direct loss of habitat for pylon construction.</li> <li>• Hedgerow - Loss of up to 2.2km of hedgerow. Most hedgerows beneath overhead power lines would not be impacted.</li> </ul> <p>Mitigation provided in the form of wet grassland and hedgerow habitat creation and restoration of floodplain grazing marsh is sufficient to mitigate the impacts on floodplain grazing marsh within the Parkgate corridor. Following mitigation there would remain a negative impact on hedgerow habitat.</p> <p><u>Species</u></p> <ul style="list-style-type: none"> <li>• Wintering bird assemblage – mortality of birds through collision with overhead power lines and loss of foraging habitat.</li> <li>• Bat assemblages – loss of foraging and commuting habitats in terms of hedgerow and floodplain grazing marsh. Potential roost loss through reduction or removal of mature trees beneath overhead power lines.</li> <li>• Great crested newts – All ponds are assumed to support great crested newt on a precautionary basis in absence of survey information. The ponds are assumed to be retained, however terrestrial habitat in close proximity to ponds would be lost.</li> </ul>	N/A	<p>The impacts of this option upon ecological features would differ to the baseline design as described below.</p> <p><u>Designated sites</u></p> <ul style="list-style-type: none"> <li>• Blithfield Reservoir SSSI – the adverse impact is largely removed as no collision risk remains. A small impact remains due to slight increase in loss of foraging habitat.</li> <li>• Newlands Lane (Hedge 6) LWS – the adverse impact is removed as loss of hedgerow is avoided because access road from Newlands Lane is not required.</li> <li>• Newlands Lane Track (Hedge 1) BAS – new impacts as approximately 65m of hedgerow along a minor track would be lost.</li> <li>• Newlands Lane (Hedge 7) LWS – new impacts as approximately 65m of hedgerow along Newlands Lane would be lost.</li> <li>• Lower Birches Plantation/Titler's Plantation – impact unchanged from baseline.</li> </ul> <p>Mitigation provided in the form of woodland, hedgerow, grassland and wet grassland habitat creation is sufficient to mitigate impacts on the habitats and species for which the above sites are designated for, with the exception of the damage of potential ancient woodland at Lower Birches Plantation/Titler's Plantation which cannot be mitigated. In addition, notable hedgerows at Newlands Lane (Hedge 6) LWS and Long Mets Lane (Hedge 1) BAS would be relocated where practicable.</p> <p><u>Habitats</u></p> <ul style="list-style-type: none"> <li>• Floodplain grazing marsh – impact increased due to additional loss of habitat for open cut section across floodplain.</li> <li>• Hedgerow – increased impact due to substantial additional loss of hedgerow for open cut sections.</li> </ul> <p>Mitigation provided in the form of wet grassland habitat creation and restoration of floodplain grazing marsh is sufficient to mitigate the impacts on floodplain grazing marsh within the Parkgate corridor. Following mitigation there would remain a negative impact on hedgerow habitat.</p> <p><u>Species</u></p> <ul style="list-style-type: none"> <li>• Wintering bird assemblage – the adverse impact is greatly reduced as mortality of birds through collision with overhead power lines is removed. A small impact remains due to slight increase in loss of foraging habitat.</li> <li>• Bat assemblages – increased impacts due to additional loss of foraging and commuting habitats in terms of hedgerow and floodplain grazing marsh. Potential additional roost loss as open cut</li> </ul>	O

				Mitigation provided in the form of woodland, hedgerow, grassland and wet grassland habitat creation and the installation of bird diverters on the new power lines is sufficient to mitigate impacts on the above species.		<p>sections are likely to impact more trees than reduction of trees for overhead power lines.</p> <ul style="list-style-type: none"> <li>Great crested newts – increased impacts due to additional loss of terrestrial habitats in proximity to ponds. All ponds are assumed to support great crested newt on a precautionary basis in absence of survey information. The ponds are assumed to be retained under this option.</li> </ul> <p>Mitigation provided in the form of woodland, hedgerow, grassland and wet grassland habitat creation is sufficient to mitigate impacts on the above species.</p> <p><b>Summary</b> After mitigation, residual impacts are as follows:</p> <ul style="list-style-type: none"> <li>damage to potential ancient woodland at Lower Birches Plantation/ Titler's Plantation – impacts are the same in the baseline and the underground option, i.e. a neutral change.</li> <li>loss of hedgerow habitat which is not fully mitigated by new hedgerow planting – there is a minor increase in the loss of hedgerow with this option.</li> </ul> <p>As a result, taking account of mitigation, this option would result in a neutral impact compared to the baseline design.</p>	
		Op		No operational impacts.	N/A	No operational impacts.	O
	Water and flood risk	Const	WR-1 WR-4 WR-9	<p><u>Flood risk</u> There is the potential for temporary, small/localised increases in flood level due to temporary working within the River Blithe, Little Blithe and River Ash floodplains with this option. Temporary laydown areas and access roads may impact the volume of floodplain storage and may lead to surface water accumulation due to compaction over time. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p>Pylons would be located within the Blithe/Little Blithe floodplain permanently. The establishment of pylon foundations can disrupt local land drainage system leading to areas of waterlogging.</p> <p>There is a small risk due to the overhead power line (classified as essential infrastructure in National Planning Policy Framework Guidance) being located within the area that would likely be inundated in the event of a breach of the Blithfield Reservoir dam.</p> <p><u>Water Quality</u> During the stripping of top soil and earthworks operations to construct the pylon bases, silt and other polluting matter could potentially be washed into the local watercourses, when undertaken in close proximity to a watercourse. This could have minor impact on water quality. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p><u>Groundwater/water resources</u> One spring (east of Bromley Wood Farm) and a potential spring and a large pond (north of Ashford Brook Farm) are within the path of the overhead power lines, and close to or within the footprint of the pylons. Therefore, there is a potential impact to these receptors.</p> <p>This option would not impact the underlying aquifers, as underground works are</p>	N/A	<p><u>Flood Risk</u> The underground nature of this option has greater potential to disrupt local land drainage and impeding existing surface water flow paths. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p>The implementation of a construction site haul route along the entire connection would have a greater temporary impact on flood risk, specifically at the River Blithe, Little Blithe and River Ash crossings. The temporary bridge/culverts would likely change local hydraulic conditions leading to increases in flood risk. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p><u>Water Quality</u> Additional soil stripping and earthworks with this option increase the risk that pollution could be washed into watercourses. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p><u>Groundwater/water resources</u> The spring east of Bromley Wood Farm is outside of the land required to construct this option and is unlikely to be impacted due to the underlying geology (underlain by Mercia Mudstone Group, no superficial deposits). Therefore, this option is likely to avoid an impact on the spring.</p> <p>The potential spring to the north of Ashford Brook Farm is in an area of alluvium and therefore may be impacted by dewatering during construction, or by contamination during or after construction, resulting in a minor temporary and permanent impact.</p> <p>As this option requires more earthworks compared to the baseline design, excavation of the cable trenches may allow leakage of contaminants into the underlying groundwater during construction. The application of the measures</p>	-

				<p>limited to the pylon bases.</p> <p><u>WFD</u> This option would cross over the following watercourses, which fall within the 'Blithe – Tad Bk to R Trent' Water Framework Directive (WFD) water body:</p> <ul style="list-style-type: none"> <li>• Unnamed tributary of River Blithe (near Lower Newlands Farm).</li> <li>• River Blithe (near Blithford Farm).</li> <li>• Little Blithe (adjacent to the B5014 crossing).</li> <li>• Ash Brook (north of Ashbrook Farm).</li> <li>• Catch drain/possible unnamed tributary of Ash Brook (north of Ashbrook Farm).</li> <li>• Unnamed tributary of Pur Brook (north of South Hill Farm and adjacent to Glass Lane).</li> <li>• Unnamed tributary of Pur Brook (near Bromley Wood Farm to the north of the B5234) – spring present at this location.</li> </ul> <p>This option would cross the 'Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures' WFD Groundwater Body. The works are not anticipated to have any significant impacts on the quality elements of this water body. There is potential for a minor impact on the morphology of the Little Blithe due to the close proximity of a pylon and associated foundations and a laydown area to this watercourse.</p>	<p>set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts. Furthermore, groundwater levels are assumed to be below the trench excavation depth, and much of the trench footprint is underlain by Glacial till superficial deposits which would limit any impacts on groundwater.</p> <p>There are three areas, where the line of the trench crosses Secondary A aquifers, where there is the potential for additional minor impacts compared to the baseline design due to the likely presence of groundwater in the superficial deposits, where they are likely to provide some baseflow to the surface water courses. Where the superficial deposits consist of Alluvium or Glacial Fluvial Deposits, dewatering may be required and a temporary minor impact to groundwater flow is likely.</p> <p>Construction of the trench for this option may result in additional temporary minor impacts on the Alluvium and Glacial Fluvial Deposits Secondary A aquifers and the groundwater-surface water interaction between the groundwater and surface waters crossed by the trench, due to the direction of assumed groundwater flow.</p> <p>Once installed, and depending on its construction, the trench and cables may act as a preferential pathway for shallow groundwater flow and contaminant migration may occur resulting in a permanent minor impact to the Alluvium and Glacial Fluvial Deposit Secondary A aquifers and the surface water courses crossed by the trench.</p> <p><u>WFD</u> This option would involve buried cables crossing beneath the same watercourses as the baseline design, which fall within the 'Blithe – Tad Bk to R Trent' WFD water body.</p> <p>Cables would be drilled at depth beneath the river channels, with no permanent direct impacts on the channel or riparian zones. Therefore, this option is not anticipated to have any impacts on WFD surface water bodies. However, there is a risk of indirect, permanent impacts on WFD surface water bodies as a result of the trench excavations and below ground joint bays causing potential changes to shallow groundwater-surface water interactions (with potential impacts on watercourse baseflow regimes).</p> <p>This option would have a greater impact on the 'Staffordshire Trent Valley - Mercia Mudstone East and Coal Measures' WFD groundwater body, but only upon shallow groundwater, and not the underlying aquifers. This option is therefore not anticipated to have any significant permanent impacts on the WFD groundwater bodies.</p> <p>The temporary watercourse crossing would have a temporary impact on channel hydromorphology. The application of the measures set out in the draft CoCP are considered sufficient to mitigate any significant adverse impacts.</p> <p><u>Summary</u> This option has the potential to have a minor impact on:</p> <ul style="list-style-type: none"> <li>• land drainage due to excavation and trenching that is likely to be mitigated by the measures outlined in the draft CoCP.</li> <li>• flood risk and hydro morphology due to the need to provide temporary crossings across the Blithe/Little Blithe, River Ash and other minor watercourses that is likely to be mitigated by the measures outlined in the draft CoCP.</li> <li>• groundwater flow paths and waterbodies that are likely to be</li> </ul>
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						mitigated by the measures outlined in the draft CoCP.		
		Op		No operational impacts.	N/A	<b>Summary</b> Overall most impacts can be mitigated through the application of measures outlined in the draft CoCP. This option would result in a minor worsening of impacts compared to the baseline design due to a potential increase in localised flooding and disruption to land drainage compared to the baseline design and disruption to the groundwater regime.	O	
Creating sustainable communities	Air quality	Const	AQ-1, AQ-2 and AQ-4	Discrete residential properties may be affected by dust generation during the construction works for this option, however these impacts would be temporary in nature and unlikely to cause significant adverse impacts during construction. As required the application of the measures set out in the draft CoCP would mitigate any significant adverse impacts.  The assumed number of Heavy Good Vehicles (HGVs) is up to 38 HGVs per day as a maximum which is much lower than the 200 HGVs per day assessment criterion, and therefore impacts from traffic associated with construction of this option are not anticipated.	N/A	Dust generation during construction of this option is likely to be larger compared to the baseline design due to greater excavation activities. However, the levels would be well below the relevant air quality standards. As with the baseline design these impacts would be temporary in nature and unlikely to cause significant adverse impacts during construction. As required the application of the measures set out in the draft CoCP would mitigate any significant adverse impacts.  This option includes increased traffic on the road network compared to the baseline design. Construction of the site haul route is expected to substantially increase HGV movements on the local road network to bring in the material required to construct the site haul route. There would also be an increase in HGV movements on the local road network, as there would be surplus material which would need to be disposed off-site, and there is potential for road closures and diversions where the scheme crosses local roads. Construction traffic emissions for this option are likely to be larger and at a wider spatial extent compared to the baseline design.  <b>Summary</b> Overall, this option would result in a minor worsening compared to the baseline design as there would be increases in construction traffic air quality impacts, however there are very limited receptors to experience this increase and the levels would be well below the relevant air quality standards. Whilst there would be an increase in construction dust this would be mitigated by the application of the measures set out in the draft CoCP.	O	
		Op		No operational impacts.	N/A	No operational impacts.	O	
		Const	SV-01, SV-02, SV-04	Considering construction activities associated with this option and distance separation between the route corridor and nearby residential properties, impacts at nearby residential properties are unlikely. As required the application of the measures set out in the draft CoCP would mitigate any significant adverse impacts.  Construction traffic related to this option is relatively low and impacts on residential properties which adjacent to construction traffic routes is unlikely.	N/A	Noise from the construction of this option is considered to be slightly worse than the baseline design due to the greater extent of work, however the distance between the nearby residential properties and the land required for construction (mostly more than 100m except a single property on Orange Lane), mean that impacts are unlikely to be disruptive to the majority of nearby residential properties. As required the application of the measures set out in the draft CoCP would mitigate any significant adverse impacts.  This option includes increased traffic on the road network compared to the baseline design. Construction of the site haul route is expected to substantially increase HGV movements on the local road network to bring in the material required to construct the site haul route. There would also be an increase in HGV movements on the local road network, as there would be surplus material which would need to be disposed off-site. Construction traffic has the potential to cause adverse noise impacts on occupants of residential properties adjacent to the construction traffic routes.  <b>Summary</b> Overall, this option would result in a minor worsening compared to the baseline design as noise impacts from construction traffic are likely to be greater, however there are very limited receptors to experience this increase.	-	
		Op		No operational impacts.	N/A	No operational impacts.	O	
		Community integrity	Const	CO-1, CO-2,	The nearest community resources in this option are residential properties along	N/A	This option would introduce a new construction compound within close	-

	(inc disproportionate impacts)		CO-6, CO-9, CO-12	Newlands Lane/Lichfield Road/Orange Lane. Four residential properties would be adjacent to proposed access roads, however no land is required from the residential curtilage of these properties.		<p>proximity to Blithford Farm and has the potential to increase HGV traffic along the site haul route near to Blithford Farm and Lower Sunnyside. Construction of this option would also lead to an increase in construction impacts on visual receptors, as well as potential increases in noise and air quality impacts at the closest properties. These works could therefore result in potential in-combination or isolation impacts on the nearest residential properties.</p> <p>The Rugeley to Colton Circular Walk (a promoted Public Right of Way (PRoW)) follows Colton Footpath 19 along Longley Lane where a minor track crossing is required for the cable sealing end. It is assumed that no diversions would be required for Colton Footpath 19 therefore no significant impacts are likely.</p> <p><u>Summary</u> Overall, this option would result in a minor worsening compared to the baseline design as there is the potential for additional temporary in-combination impacts from views, noise, air quality and HGVs during construction on a limited number of nearby residential properties.</p>	
		Op		No operational impacts	N/A	No operational impacts	O
	Transport accessibility / severance	Const	TT-1 TT-3 TT-4 TT-7 TT-10	<p>Construction access for this option is from the B5234 Duffield Lane via the B5017 Henhurst Hill, the B5017 Forest Road and onto the A5121 Wellington Road. The construction compound is active for four years, starting in January 2021, with a three-month busy period associated with site set up and a peak of 38 two-way HGV's. Post site set-up, the daily traffic generation would not be substantial.</p> <p>The construction traffic levels would have an impact on traffic severance on the B5017 Henhurst Hill and the B5234 Bromley Lane.</p> <p>This option crosses six additional roads, however as the scheme is for overhead power line provision, the crossing of these roads should have minimal impact on users.</p> <p>This option also crosses 10 PRoW, where there would be disruption to users of these footpaths, however disruption would be limited to short term diversions and/or closures wherever possible.</p>		<p>This option introduces an additional four construction compounds, which would result in increased/additional impacts from construction traffic on the following roads:</p> <ul style="list-style-type: none"> <li>• B5017 Henhurst Hill.</li> <li>• B5234 Bromley Lane.</li> <li>• Blunts' Hollow.</li> <li>• Glass Lane.</li> <li>• Orange Lane.</li> <li>• Newlands Lane (from the B5014 Lichfield Road to the construction compound).</li> <li>• B5014 Lichfield Road.</li> <li>• Blithbury Road (from the B5014 Lichfield Road to the A51 Stafford Road).</li> </ul> <p>This option includes a new site haul route. Construction of the site haul route is expected to substantially increase HGV movements on the local road network to bring in the material required to construct the site haul route.</p> <p>This option would also generate surplus material which would need to be disposed off-site via the road network.</p> <p>This option requires temporary closures or traffic management on six local roads which would not be required with the baseline design.</p> <p>The same 10 PRoW as stated in the baseline design would be disrupted by this option and require diversions or closures. In addition, users may also be required to cross the site haul route and crossing of these would need to be managed.</p> <p><u>Summary</u> Overall, this option would result in a moderate worsening compared to the baseline design as additional HGV movements would be required to set up of four additional construction compounds, construction of the site haul route, and to transport surplus material off-site. In addition, there may be more inconvenience to PRoW users.</p>	--
			Op		No operational impacts.	N/A	No operational impacts.
		Health & wellbeing	Const	HL-5	No construction impacts with the potential to lead to health impacts identified for this option.	N/A	This option requires a trench, which would increase the level of noise, construction plant and vehicle movements associated with construction. This

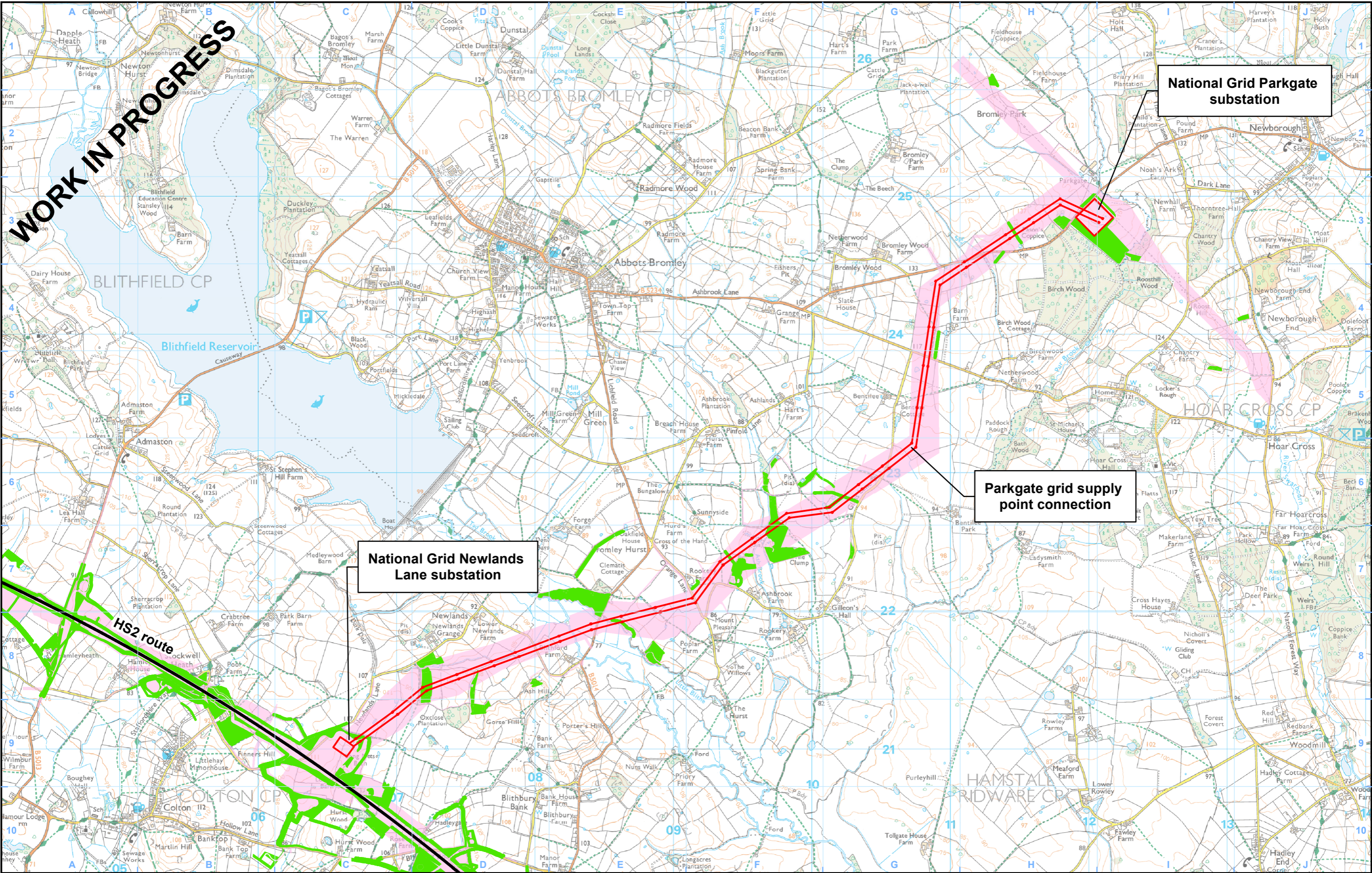
						would take place in the vicinity of a number of scattered rural properties. Due to the temporary nature of these impacts and the very low population density, no additional health impacts are anticipated.	
		Op		No operational impacts.	N/A	No operational impacts.	O
	Socio-economic factors	Const	SE-1, SE-2	There are no socio-economic receptors within the area relevant to this option, therefore there are no construction impacts.	N/A	There are no socio-economic receptors within the area relevant to this option, therefore there are no construction impacts.	O
		Op		No operational impacts.	N/A	No operational impacts.	O
Sustainable consumption and production	Agriculture, soil & land use	Const	AS-1, AS-5, AS-6, AS-7	<p>During construction, the land required for this option would affect 33 farm holdings temporarily. Works associated with erecting the pylons would disturb the agricultural land, however impacts between these working areas may be more limited and less intrusive.</p> <p>There are approximately 206ha of agricultural land within the corridor, excluding the northern arm. There is approximately 54ha of Best and Most Versatile (BMV) land within the land required to construct this option but these soils would be predominantly undisturbed during construction. The permanent requirement for BMV land is 1.5ha.</p> <p>Fourteen farm holdings would be permanently impacted by pylons; however, this would have limited impact on the functioning of the overall holding.</p>	N/A	<p>During construction, this option would affect six fewer farm holdings, 27 farm holdings in total would be impacted. Although impacts at six holdings would be removed compared to the baseline design, the impacts on these holdings during construction from the baseline design would be negligible, and so this does not represent an improvement.</p> <p>At the 27 farm holdings that are impacted by this option, there would be direct temporary disturbance to and restoration of approximately 65ha of agricultural land and soils within a temporary corridor of approximately 206ha of agricultural land, excluding the northern arm. Of this, it is estimated that approximately 13ha of BMV land would be disturbed during construction.</p> <p>The additional areas of land required to mitigate habitat loss during construction are all sited on non-BMV land in Subgrade 3b, so there are no additional impacts on BMV land from the mitigated scheme.</p> <p>The typical cross-section of the buried cable trench is shallower than the typical undisturbed agricultural soil profile, so a greater surplus of agricultural subsoil would be generated. This could also potentially prevent the restoration of this land to BMV quality if the soil profile cannot be restored to its current depth.</p> <p>Eight farm holdings would be permanently impacted by inspection boxes (six fewer than the baseline design). The inspection boxes are smaller than pylon bases, however as the impact on the functioning of the holding from pylons is limited anyway, this represents only a minor improvement. However, there will also be practical farm management restrictions above the cables, particularly in respect of any deep cultivations or the installation of field drainage; and there will be restrictions on future non-agricultural land uses.</p> <p><u>Summary</u> Overall, this option would result in a moderate worsening compared to the baseline design as although there are slightly fewer farm holdings impacted temporarily during construction and the permanent impact is slightly improved; the excavation requires considerably more disturbance to agricultural land and soils during construction at the impacted holdings. There is a risk of downgrading approximately 13ha of BMV land, there is the potential to generate a surplus of agricultural subsoil from construction, and there will be future operational and land use restrictions on the land above the cables.</p>	-
		Op		No operational impacts.	N/A	No operational impacts.	O
	Land quality	Const	LQ-1, LQ-2, LQ-3, LQ-6, LQ-7,	<p>This option is underlain by two designated Mineral Safeguarded Areas (MSA), which would have very limited sterilisation, beneath the pylon bases only. These are:</p> <ul style="list-style-type: none"> <li>• Superficial Sand and Gravel MSA between Ash Hill and Mount Pleasant,</li> </ul>	N/A	The construction of the temporary site haul road along the underground route and the trenches for this option would have a minor worsening impact on the MSAs, as a greater area of the Superficial Sand and Gravel MSA would be permanently sterilised beneath the cable trenches and associated	-

				<p>Orange Lane.</p> <ul style="list-style-type: none"> <li>• Bedrock- Gypsum/ anhydrite MSA between Orange Lane to Parkgate.</li> </ul> <p>There are four historical landfills within the land required for this option, particularly for access roads. The landfills are all very small and described as inert, commercial and industrial waste with ceramic material.</p>		<p>infrastructure. However, this would be limited in the overall scheme of the MSA extent.</p> <p>This option would avoid interaction with the four historical landfills.</p> <p><u>Summary</u> Overall, this option would result in a minor worsening compared to the baseline design due to the increased permanent sterilisation impact on the MSAs.</p>	
		Op		No operational impacts.	N/A	No operational impacts.	O
	Waste & material resources	Const	WM1 and WM2 apply. WM3, WM4 and WM5 would apply once construction work commences. WM6	Construction of this option would generate construction wastes including excavation waste from erection of pylons, and general construction waste from the cabling of the power supply.	N/A	<p>The undergrounding of the cables and construction of cable end sealing compounds for this option may generate larger quantities of excavation waste compared to baseline design. Additional construction wastes would also be generated from the building of cable end sealing compounds within the substations.</p> <p><u>Summary</u> Overall, this option would result in a minor worsening compared to the baseline design predominantly due to the additional excavation waste that would be created during construction.</p>	-
		Op		No operational impacts.	N/A	No operational impacts.	O
	Committed Development	Const	Avoid/ minimise impacts on approved planning applications and allocated sites.	<p>No planning permissions would be affected by this option in Lichfield.</p> <p>Within East Stafford there are three relevant planning permissions, however none are expected to be directly impacted by the option:</p> <ul style="list-style-type: none"> <li>• P/2017/01272: an application for the conversion and extension to an agricultural building to form a single residential property. This application is within the land required to construct the option however it is not directly impacted.</li> <li>• P/2017/01147: an application for the conversion and alterations of an agricultural barn to form a residential unit and store and extension to residential curtilage. This application is just outside the land required to construct the option, and not directly impacted.</li> <li>• P/2015/00507: an application for the change of use and alteration of two vacant agricultural buildings to create two holiday accommodation units. This application is just within the land required to construct the option, however it is not directly impacted.</li> </ul>	N/A	<p>No planning permissions would be affected by this option in Lichfield.</p> <p>Within East Stafford the same three planning permissions are relevant. One, (P/2017/01272) would be now located outside of the land required to construct this option but would still not be impacted by the scheme. The impacts on the other two applications are unchanged.</p> <p><u>Summary</u> Overall, this option would be neutral compared to the baseline design as although application P/2017/01272 is no longer located within land required to construct the option, it would not be impacted in either option.</p>	O
		Op		No operational impacts.	N/A	No operational impacts.	O
	Planning Policy	Const	Avoid/ minimise impacts on protected areas within planning policy Avoid/ minimise impacts on approved planning applications and allocated sites.	<p>The overhead nature of the route is in line with policies set out in the National Policy Statement (NPS) for Electricity Networks Infrastructure (EN-5).</p> <p>The majority of the option is within the Staffordshire County Council MSA. There is the potential for limited sterilisation of mineral resources.</p> <p>This option is within Cannock Chase Special Area of Conservation Policy Area within Lichfield District.</p> <p>The land required to construct the option falls within 800m of the Hoar Cross Conservation Area (the nearest built development associated with the option is 1.2km from the conservation area boundary) in East Staffordshire.</p> <p>The land required to construct the option is within 2km of five sites designated as sites of biological importance, but there is no direct interface with the works for this option.</p>	N/A	<p>In general, UGC connections are only implemented where there is a densely populated area or where the proposed route alignment is within a protected area, for example an Area of Outstanding Natural Beauty (AONB), in line with NPS EN-5. An UGC connection would run contrary to that policy in this area.</p> <p>There is greater potential for sterilisation of mineral resources given the underground works required for this option.</p> <p>Relationships to Cannock Chase SAC Policy Area within Lichfield District and the Hoar Cross Conservation Area are similar with this option, however the nearest built development within the conservation area is slightly closer, at 1km away.</p> <p>The land required to construct this option looks to cover some/all of three sites designated as sites of biological importance and within 2km of two other designated sites of biological importance. However, there is no direct interface with the proposed works in this option.</p> <p><u>Summary</u> Overall, this option would result in a minor worsening compared to the</p>	-

						baseline design as it would be contrary to NPS EN-5 in terms of the need for an underground route, there is greater potential for a sterilisation impact at the MSAs with this option, and the land required to construct the option looks to cover some/all of three sites designated as being of biological importance.	
		Op		No operational impacts.	N/A	No operational impacts.	O
				<b>Overall rating</b>		<b>Overall rating</b>	
<b>Reason for overall rating:</b>					N/A	<p><u>Temporary</u> The construction of this option would have a greater scale of excavation and vegetation clearance across a larger area and would require greater numbers of HGV movements. This would result in a worsening of impacts on the rural and historical landscape, visual receptors and the setting of built heritage assets, however this would mostly be temporary and reversible. Excavation would result in a greater level of physical disturbance to agricultural land during construction, however this would be temporary and appropriate material handling measures would minimise long term impacts from this.</p> <p>Construction of this option would result in increased risks of localised flooding and disruption to land drainage and the groundwater regime. The increase in HGV movement would also result in localised increased impacts on the limited number of residential receptors close to the works in terms of noise, air quality and traffic disruption.</p> <p><u>Permanent</u> The permanent impacts of this option would be limited to the presence of a number of inspection boxes providing inspection facilities along the underground route. The removal of pylons in the baseline design would have wide ranging impacts, beyond the immediately local area. Although the national level collision risk impact on the bird assemblage associated with Blithfield SSSI, could be mitigated in the baseline design, it would be removed with this option, which would be an improvement. Permanent impacts on the rural and historic landscape character, visual impacts, and impacts on the setting of historic structures would also be removed. Less agricultural land would be required permanently, however this would have limited difference on the functioning of the impacted farm holdings.</p> <p>Vegetation clearance and excavation would permanently impact on buried archaeology and local/regional value ecological receptors, including hedgerow, floodplain grazing marsh and terrestrial habitat associated with ponds, and woodland. Habitat creation would, however, mitigate the ecological impacts.</p> <p>The permanent presence of underground cables is likely to result in a greater extent of permanent sterilisation of MSAs, however this would only be applicable to a small part of the overall MSAs. The presence of underground cables could permanently impact land drainage and the groundwater regime. An underground connection would be contrary to NPS EN-5.</p>	--
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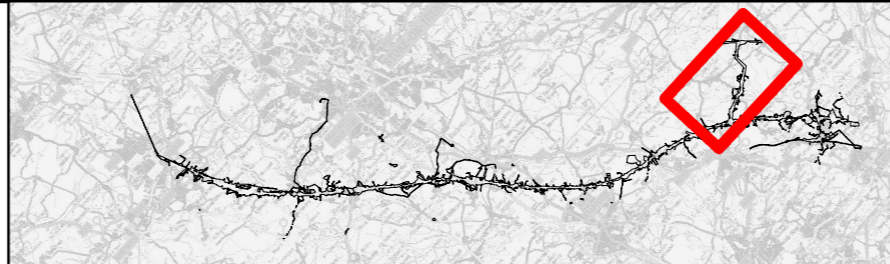
# Appendix G- Illustration of the variation in Mitigation Design





**Legend**

- AP2 Parkgate Overhead Line Grid Supply Point Connection
- Indicative Habitat Creation/ Landscape Planting
- Land Required for Construction



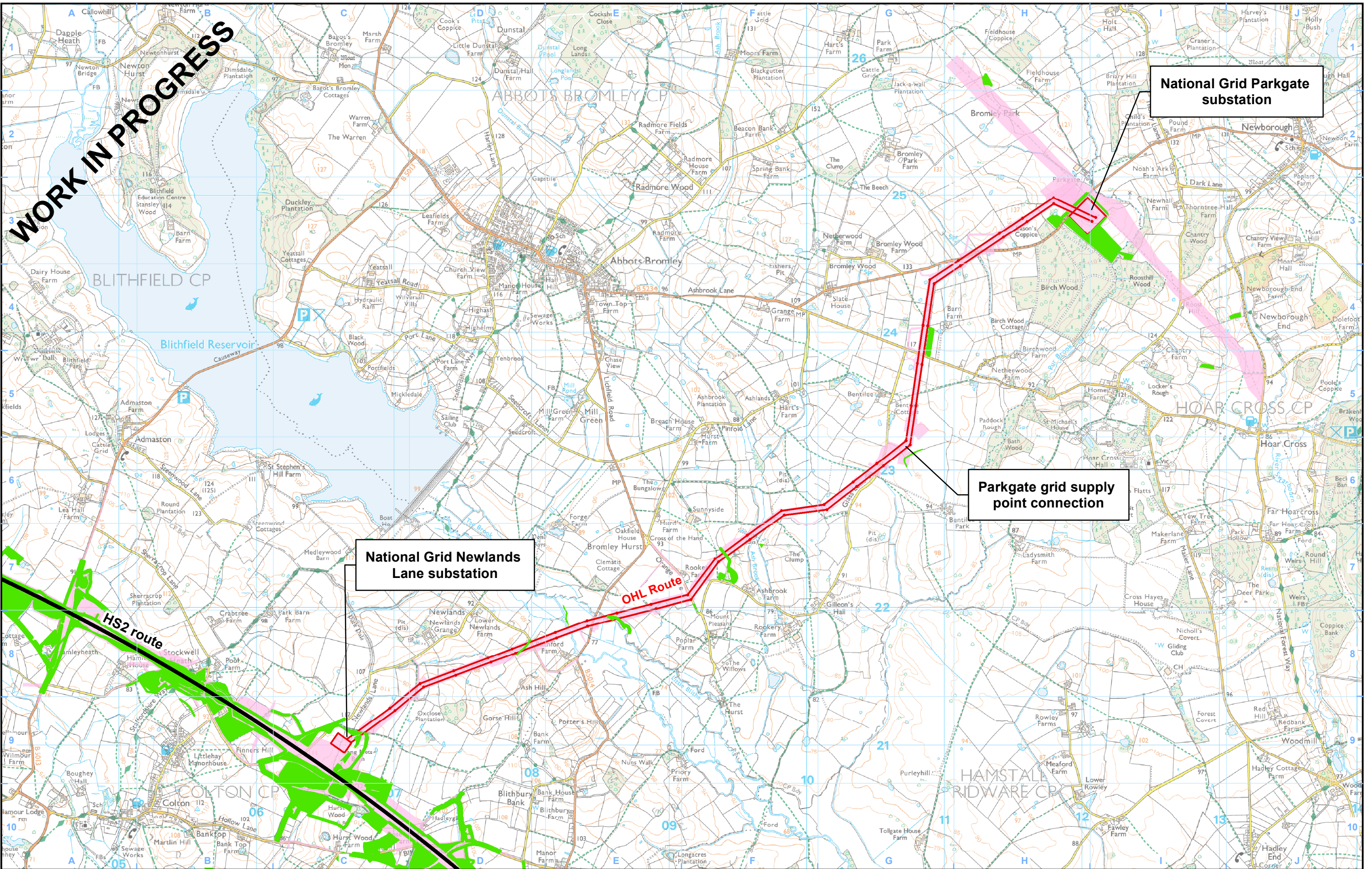
Map Number  
 Map Name  
**Environmental Mitigation for AP2  
 Parkgate Overhead Line Grid Supply  
 Connection Point**  
 Community Area  
 CA1 Fradley to Colton

**HS2**  
Registered in England. Registration number 06791686.  
 Registered office: 2 Snowhill, Queensway,  
 Birmingham B4 6GA.

Scale at A3: 1:25,000

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Doc Number: Date: 12/03/19



**WORK IN PROGRESS**

**National Grid Parkgate substation**

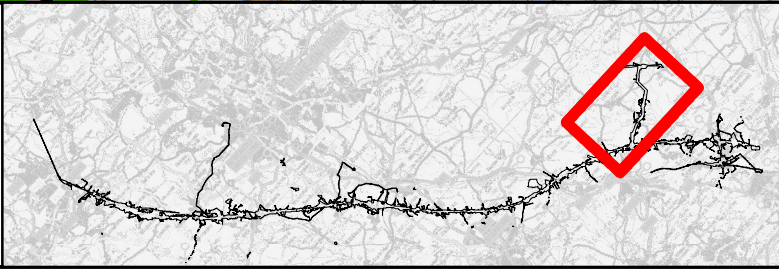
**Parkgate grid supply point connection**

**National Grid Newlands Lane substation**

**OHL Route**

**HS2 route**

- Legend**
- Illustrative Parkgate Overhead Line Grid Supply Point Connection
  - Illustrative land required for construction
  - Illustrative Habitat Creation/ Landscape Planting



Map Number  
 Map Name  
**Environmental mitigation for illustrative OHL Parkgate connection baseline scheme**  
 Community Area  
 CA1 Fradley to Colton

**HS2**

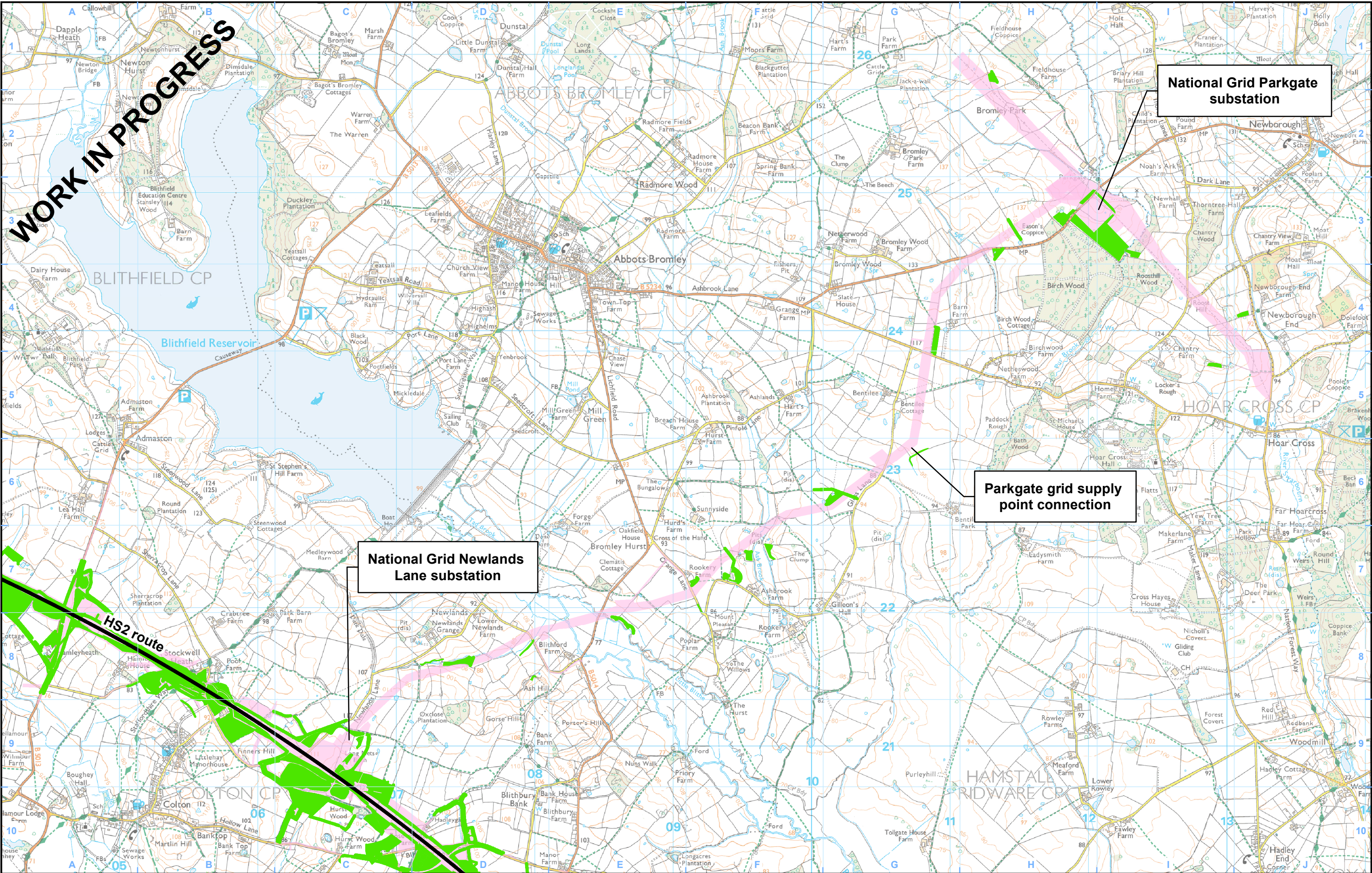
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**WORK IN PROGRESS**

**National Grid Parkgate substation**

**Parkgate grid supply point connection**

**National Grid Newlands Lane substation**

**HS2 route**

- Legend**
- Illustrative land required for construction
  - Illustrative Habitat Creation/ Landscape Planting



Map Number  
 Map Name  
**Environmental mitigation for illustrative UGC connection option**

Community Area  
 CA1 Fradley to Colton

**HS2**  
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## Appendix H - Cost Assessment Breakdown

The table below shows the cost differences of the illustrative alternative Parkgate grid supply point connection with underground cables compared to the illustrative Parkgate grid supply point connection with overhead lines.

Item	Illustrative Parkgate GSP connection with overhead lines (£ million)	Illustrative alternative Parkgate GSP connection with underground cables (£ million)
Preliminaries and temporary works (see note 2)	1.76	9.81
Towers, foundations, and installation of towers	9.49	-
Trenching and containment	-	12.82
Procurement and installation of conductors	5.58	33.70
<b>Parkgate to Newlands Lane connection</b>	<b>16.83</b>	<b>56.33</b>
Substations and Newlands Lane ATFS works	46.48	46.48
Environmental mitigation (see note 3)	0.69	0.76
Other associated utility diversions	0.35	0.35
Additional utility diversions allowance at highways	-	0.50
Indirect costs (see note 4)	10.62	17.23
<b>Sub-total costs excluding Contingency:</b>	<b>74.97</b>	<b>121.65</b>
Contingency (40%, see note 5)	29.99	48.66
<b>Total costs including Contingency:</b>	<b>104.96</b>	<b>170.31</b>
<b>Total cost difference from Proposed Scheme</b>		<b>65.35</b>

**Notes:**

1. All costs are stated at base date Q1 2015.
  2. Preliminaries and temporary works costs include items such as pre-construction surveys, construction compounds, security, access roads and haul roads, traffic management and temporary watercourse crossings.
  3. The approach to environmental mitigation costs used in the report entitled Grid Supply Point Connection at Parkgate, published in February 2019, was based on the mitigation design for a wider section of the railway route, which included the Parkgate connection. That approach therefore included the costs of mitigating the grid supply point connection alongside other mitigation costs which were not directly attributable. Environmental mitigation represented £12.5m of the £92.5m reported in Section 4.4 of the Grid Supply Point Connection at Parkgate report for the Parkgate connection, £10.9m of the c.£100m reported for the deficient Rugeley connection, and £23.5m of the £160m reported for the Option 2 scheme. The approach has been altered for this addendum, which includes only directly attributable mitigation costs in order to allow a more direct comparison between the illustrative overhead line and underground cable schemes. The previous approach was consistently applied across all options in the Grid Supply Point Connection at Parkgate report. Using the same approach as set out in this addendum, the Option 2 connection at Rugeley would cost an estimated £173m, when compared to £105m and £170m for the overhead line and underground cable connections at Parkgate respectively.
  4. Indirect costs include HS2 corporate costs, project management, design development & insurances. They are calculated on a % basis.
  5. Contingency (40%) is consistent with the Proposed Scheme and with HMT 'Green Book' guidance. This was not included in the costs presented in the report entitled Grid Supply Point Connection at Parkgate.
  6. Land and property costs have been omitted from this comparison. It is not possible to confirm if there would be any likely land and property cost difference between overhead and underground until detailed design information is available. However it is anticipated that these would be higher for an underground cable connection than for an overhead line connection. The £92.5m cost reported in Section 4.4 of the Grid Supply Point Connection at Parkgate report included £4m for land and property costs for the Parkgate connection, £1.8m of the £100m reported for the deficient Rugeley connection, and £5.4m of the £160m reported for the Option 2 scheme.
  7. As outlined in 5.5.2, operational costs are anticipated to be broadly similar for both options. However as also outlined in 5.3.9, in the event of cable failure, more difficult repair work may be required for an underground cable than for an overhead line. Therefore it could be expected that underground cables would have a higher whole life cost.
-