Chapter 3

The Routeing Process and Design Strategy

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Chapter 3

The Routeing Process and Design Strategy

3.1 Introduction

1. This Chapter outlines SPEN's approach to routeing, including the routeing objective, the routeing strategy for the proposed development and the outcomes of the routeing and consultation process. Following a review of the relevant policy context, the remainder of this Chapter discusses the design strategy for the proposed development, access tracks and forestry felling, the design of which, in combination with the routeing work previously undertaken, played a critical role in seeking to avoid, prevent and reduce, likely significant adverse environmental effects.

2. Schedule 4 Part 2 of the EIA Regulations states that an EIA Report should include, "*A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*". In the context of the requirements of the EIA Regulations and guidance, SPEN considered reasonable alternatives to the final design of the proposed development, and these are discussed in further detail in this Chapter.

3.2 Guidance

3. It is generally accepted across the electricity industry that the guidelines developed by the late Lord Holford in 1959 for routeing overhead transmission lines, 'The Holford Rules', should continue to be employed as the methodological basis for routeing high voltage overhead transmission lines. The Holford Rules were reviewed circa 1992 by the National Grid Company (NGC) Plc (now National Grid Electricity Transmission (NGET)) as owner and operator of the electricity transmission network in England and Wales, with notes of clarification added to update the Holford Rules. A subsequent review of the Holford Rules (and NGC clarification notes) was undertaken by Scottish Hydro Electric Transmission Limited (SHETL) in 2003 to reflect Scottish circumstances. A summary of the Holford Rules is included in **Figure 3.1**.

4. Key principles of the Holford Rules include avoiding prominent ridges and skylines, following broad wooded valleys, avoiding settlements and residential properties and maximising opportunities for 'backclothing' and the screening[1] of infrastructure.

Rule 1
- Avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the line in the first place, even if the total mileage is somewhat increased in consequence.

Rule 2
- Avoid smaller areas of high amenity value, or scientific interest by deviation; provided that this can be done without using too many angle towers, i.e. the more massive structures which are used when lines change direction.

Rule 3
- Other things being equal, choose the most direct line, with no sharp changes of direction and thus with few angle towers.

Rule 4
- Choose tree and hill backgrounds in preference to sky backgrounds, wherever possible; and when the line has to cross a ridge, secure this opaque background as long as possible and cross obliquely when a dip in the ridge provides an opportunity. Where it does not, cross directly, preferably between belts of trees.

Rule 5
- Prefer moderately open valleys with woods where the apparent height of towers will be reduced, and views of the line will be broken by trees.

Rule 6
- In country which is flat and sparsely planted, keep the high voltage lines as far as possible independent of smaller lines, converging routes, distribution poles and other masts, wires and cables, so as to avoid a concentration or 'wirescape'.

Rule 7
- Approach urban areas through industrial zones, where they exist; and when pleasant residential and recreational land intervenes between the approach line and the substation, go carefully into the comparative costs of undergrounding, for lines other than those of the highest voltage.

Figure 3.1: Holford Rules

[1] It is acknowledged that in relation to the provision of woodland screening (with reference to commercial woodland in particular) screening is often only of a temporary nature.

5. The 'SPEN Approach to Routeing Major Electrical Infrastructure Projects' (2015) guidance requires standard application of the Holford Rules, as well as the Forestry Commission's (now Scottish Forestry) 'Forest Landscape Design Guidelines' (1994) if and when the new overhead line (OHL) may pass through forestry. The Scottish Forestry guidelines state that, where possible, OHLs should follow open space and run alongside woodland, instead of through it.

3.3 SPEN's Approach to Routeing

6. The UK Government, The Office of Gas and Electricity Markets (Ofgem) and the electricity industry, including SPEN, have reviewed their positions on the routeing of major electrical infrastructure projects. They remain of the view that the need to balance economic, technical and environmental factors, as a result of statutory duties and licence obligations, continues to support an OHL approach in most cases.

7. SPEN's approach to routeing an OHL is based on the premise that the major effect of an OHL is visual and that the degree of visual intrusion can be reduced by careful routeing. A reduction in visual intrusion can be achieved by routeing the line to fit the topography, by using topography and trees to provide screening and/or background, and by routeing the line at a distance from settlements and roads. In addition, a well-routed line takes into account other environmental and technical considerations and would avoid, wherever possible, the most sensitive and valued natural and man-made features.

8. While underground cables may have the benefit of reducing effects on landscape and visual receptors, there are associated technical, environmental and economic disadvantages when compared to an equivalent OHL including:

- The physical extent of land required;
- The fault repair time;
- Difficulties associated with general maintenance;
- Increased cost;
- Greater ground disturbance from excavating trenches;
- The restriction of development and planting within the underground transmission cable corridor;
- Requirements for cable sealing end compounds or platforms at each end of each section of underground cable; and
- The fact that underground cabling is a less efficient means of transporting electricity.

9. It is therefore SPEN's view that wherever practical, an OHL approach is taken when planning and designing new or replacement transmission lines. Where an OHL solution is not achievable for technical reasons, SPEN look to an underground cable solution as an alternative. However, sections of underground cable identified for inclusion within a scheme, must balance the economic, technical and environmental considerations.

10. In 2015, SPEN published a summary document outlining the approach taken to routeing transmission infrastructure (Major Infrastructure Projects: Approach to Routeing and Environmental Impact Assessment, SPEN 2015[2]). The routeing of the proposed development has been undertaken in accordance with SPEN's overarching approach to routeing document.

11. **Figure 3.2** illustrates the process flow which SPEN adopts for OHL routeing and which has been applied to this. The following sections describe the key stages in this process.

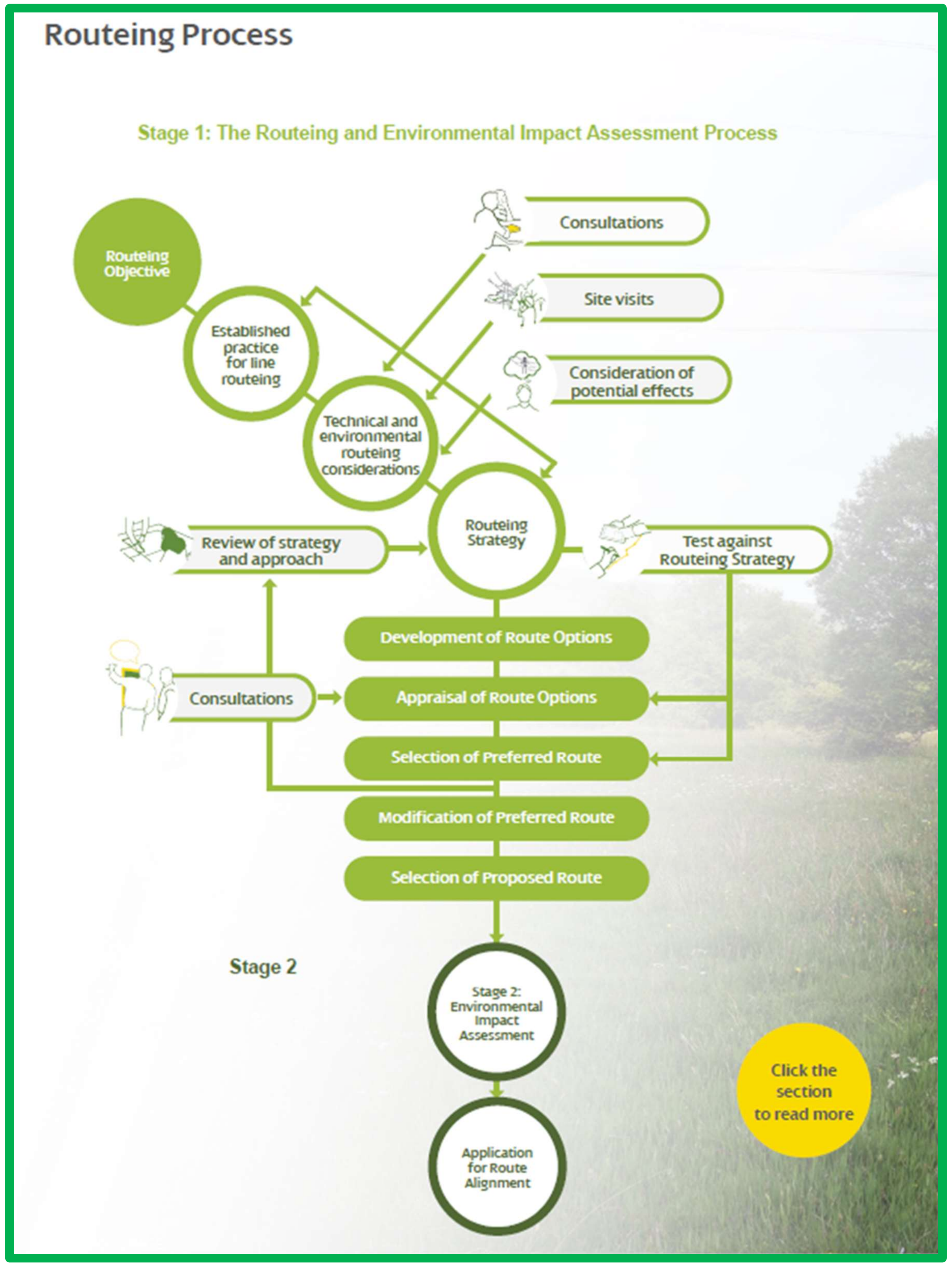

Figure 3.2: SPEN Approach to Routeing

[2] The Guidelines have been recently updated, *Major Electrical Infrastructure Projects: Approach to Routeing and Environmental Impact Assessment* (2nd version, May 2021). However, the options appraisal process was undertaken in accordance with the 2015 Guidelines.

3.4 Overview of the Routeing Consultation Process

12. SPEN is committed to consulting with key stakeholders, including statutory and non-statutory consultees and the local community. The consultation and engagement process begins at the early stages of the development of a project and continues into construction once consent has been granted.

13. SPEN's approach to stakeholder engagement for major electrical infrastructure projects is outlined in Chapter 5 of the document 'Major Infrastructure Projects: Approach to Routeing and Environmental Impact Assessment'. SPEN aims to ensure effective, inclusive and meaningful engagement with local communities, statutory consultees, stakeholders and interested parties through four key engagement stages:

1. Pre-project notification and engagement;
2. Information gathering to inform the routeing stage;
3. Obtaining feedback on emerging route options; and
4. The Environmental Impact Assessment (EIA) stage.

14. In addition, as outlined in **Chapter 1: Introduction**, SPEN as holder of a transmission licence, has a duty under section 38 and Schedule 9 of the Electricity Act 1989, when formulating any relevant proposals[3] to have regard to the desirability of preserving amenity, the natural environment, cultural heritage, landscape and visual quality and do what can 'reasonably be done' to mitigate any effects on such features. This duty is explained in more detail below.

3.5 Routeing Methodology

15. The routeing methodology adopted for the proposed development has been adapted from the process flow outlined in **Figure 3.2**.

16. For simplicity, the methodology is set out in a linear manner as shown in **Figure 3.3** with the findings of each step informing the next step, building up an ever-increasing level of understanding to inform the routeing process. However, it is important that the process for identification of routes remains iterative. This means that the outcome of each step is subject to a technical and, where relevant, consultation 'check' to ensure that RSK, SPEN and key stakeholders are confident with the findings prior to commencing the next step.

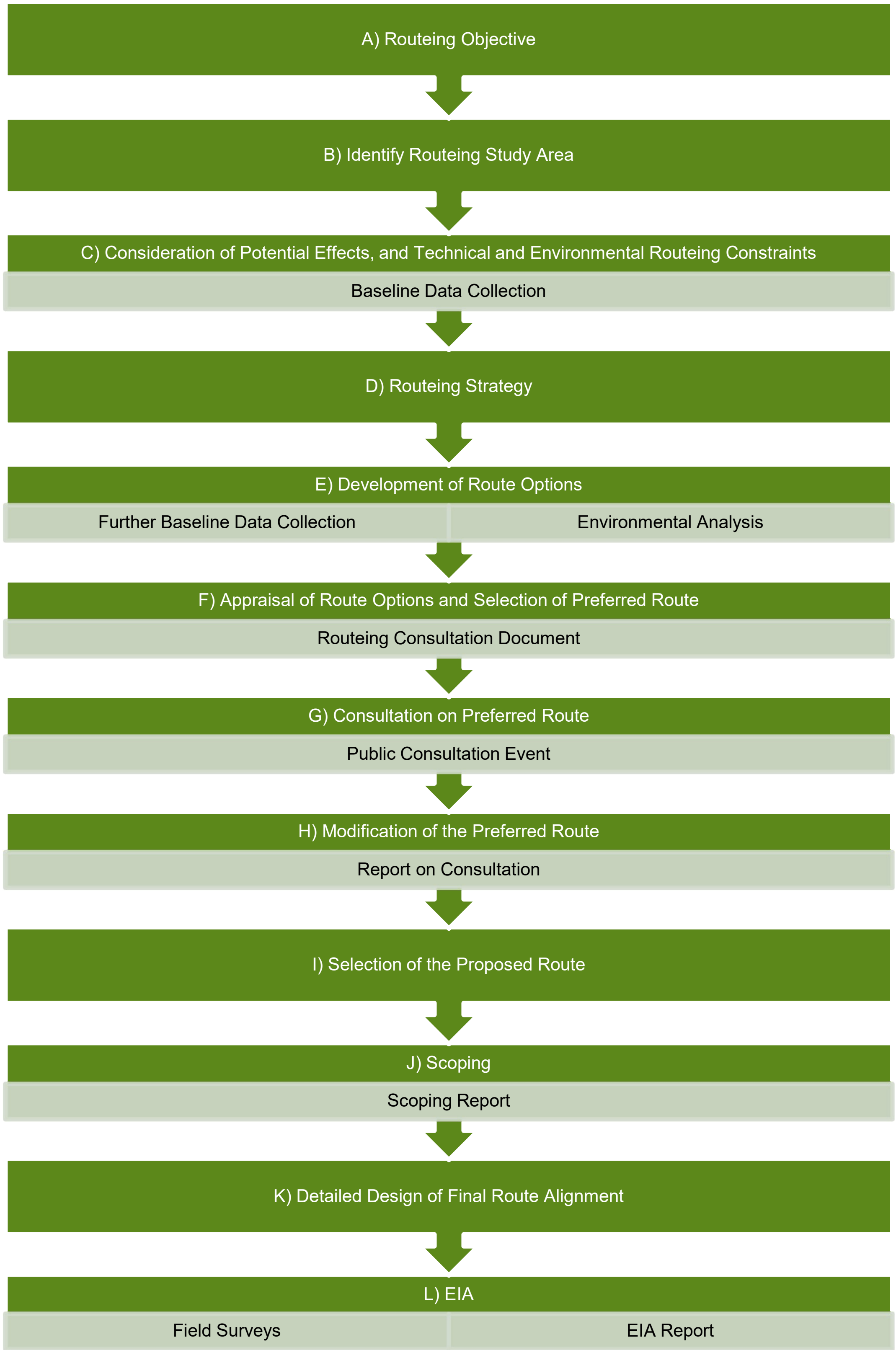

Figure 3.3: Routeing Methodology

[3] Relevant proposals include any proposals for the installation of an electric line, whether above or below ground and other transmission development,

3.5.1 Step A – The Routeing Objective

17. Section 38 and Schedule 9 of the Act impose a statutory duty on SPEN to take account of the following factors in formulating proposals for the installation of transmission lines and other transmission works including cables and sealing ends:

> *"(a) to have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and,*
>
> *(b) to do what it reasonably can to mitigate any effects which the proposals would have on the natural beauty of the countryside or any such flora, fauna, features, sites, buildings or objects."*

18. SPEN has a 'Schedule 9 Statement' which sets out how it will meet the duty placed upon it under section 38 and Schedule 9. In terms of its statutory duties and licence obligations, SPEN must therefore balance technical, cost (economical) and environmental factors.

19. In developing and maintaining an efficient and co-ordinated technically and economically viable transmission system, SPEN is committed to limiting disturbance to people and the environment by its operations. It is widely acknowledged that the best way to achieve this is through careful routeing. The exercise of professional judgement is required in weighing a range of issues to ultimately identify routes, which, on balance, best meet the project routeing objective.

20. As discussed in the Routeing Consultation Document[4], the routeing objective for the proposed development was:

Routeing Objective: To identify a technically feasible and economically viable OHL route between the Kennoxhead Windfarm and Coalburn Substation, which causes least disturbance to people and the environment.

3.5.1.1 Established Practice for Line Routeing and Determination of Effects

21. To define a route that meets the requirements of the routeing objective, a balance must be struck between three sets of considerations:

- Economic;
- Technical; and
- Environmental.

22. These overarching considerations, which informed the routeing methodology for the proposed development, are outlined below.

3.5.1.2 Technical Considerations

23. Technical issues considered in routeing were identified by SPEN. These included physical constraints to routeing such as existing infrastructure (in this case windfarms and OHLs), slope, altitude, access, large waterbodies and the location of committed developments. Additional technical issues, including wood pole design (single or double 'H' poles), construction techniques, operational life and maintenance, and government guidelines were considered during the more detailed design stages as discussed further in **Section 3.5.9** below and **Chapter 4: Project Description**.

24. These technical considerations are not considered as being absolute constraints but are a guide to routeing. The approach taken is to identify preferred environmental options informed by a staged review of technical issues.

3.5.1.3 Economic Considerations

25. The routeing objective requires the proposed development to be economical. It is understood that this is interpreted by SPEN as meaning that as far as possible, and all other things being equal, the connections should be as direct as possible and the route should avoid areas where technical difficulty or compensatory schemes would render the connection uneconomical.

3.5.1.4 Environmental Considerations

26. Statutory duties imposed by Schedule 9 of the Act require licence holders to seek to preserve features of natural and cultural heritage interest and mitigate where possible, any adverse effects which a development may have. Experience across the electricity industry shows that OHLs, underground cabling and associated development are likely to affect, to varying degrees, the following:

- Landscape and visual amenity;
- Ecology, ornithology and nature conservation;
- Geology, hydrogeology and hydrology;
- Cultural heritage; and
- Forestry and woodland.

27. Other considerations which may affect routeing to a greater or lesser degree include:

- Planning allocations and major applications;
- Noise;
- Traffic (access for construction);
- Land use (agriculture); and
- Socio-economics (tourism and recreation).

28. Some environmental effects can be avoided or reduced through careful routeing whilst other effects are best mitigated through local deviations of the route, the refining of wood pole locations and specific construction practices. The 'Detailed Design Considerations' section of **Chapters 6 to 11** indicate, for each assessment topic area, those factors that were taken into consideration in the routeing and design process.

3.5.2 Step B - Identify Routeing Study Area

29. After establishing the routeing objective (Step A) the next step in the routeing process involved identification of the Study Area (Step B), predominantly for the purposes of gathering data specific to the project area. In identifying the Study Area, it was important to ensure that this was large enough to accommodate all likely route options reflecting the routeing objective and routeing strategy. On this basis, a Study Area with a 2 km buffer zone was defined on the basis of perceptibility of a wooden pole OHL within the landscape (Horn, McAuley and Turnbull, 2010).

30. A preliminary check of high-level constraints was undertaken to ensure the Study Area enabled scope for routeing alignments that would avoid impacts on highly sensitive receptors, including Special Protection Areas (SPA), Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI) and areas historically used for opencast mining. The purpose of defining the Study Area and buffer zone is as follows:

- The Study Area comprises the area within which various options for locating the proposed development are identified and assessed; and
- The buffer zone comprises a larger area within which potential impacts of the proposed development on the environment may occur. Potential impacts are identified and evaluated, in order to define the overall preferred route.

3.5.3 Step C – Consideration of Potential Effects, and Technical and Environmental Routeing Constraints

31. The next step (Step C) was to collect baseline information and map environmental and technical constraints (i.e. the 'areas of highest amenity value') within the Study Area to form the basis of analysis and to inform the identification and appraisal of route options (Step D-F), reflecting guidelines included in the Holford Rules.

[4] Routeing Consultation Document, Kennoxhead Windfarm to Coalburn Substation 132kV Overhead Line (December 2019)

32. These key environmental and technical constraints specific to the proposed development were as follows:

- Coalburn Moss SAC/SSSI, which has been designated for its raised bog habitat. The site is present within the north of the Study Area, occupying approximately 235 ha;
- Presence of Coalburn, Douglas and Glespin settlements as well as individual dwellings;
- Muirkirk and North Lowther Uplands SPA/SSSI, occupying the south-western portion of the Study Area (3% of Study Area) and covering Kennoxhead Windfarm;
- Several areas of ancient woodland from the Ancient Woodland Inventory within the Study Area. These are located in the north-western portion of the Study Area, south-west of Rougham Wood at Stockbriggs and at Windrow Wood and an unnamed wood south-west of Douglas;
- Millers Wood (SSSI) and ancient woodland located to the south-west of Douglas;
- Recreational resources such as Hollandbush Golf Course and a number of core paths and rights of way;
- Listed Buildings (Category A to C) within Douglas;
- Presence of watercourses and waterbodies, including Poniel Water, Coal Burn, Longhill Burn, Kennox Water, Douglas Water, Alder Burn and Broadlea Burn;
- Scheduled Monuments (Douglas St Brides Chapel and Auchensaugh Hill);
- Presence of Douglas Valley Special Landscape Valley (SLA);
- Presence of Planning designations (Residential Masterplan Site, Development Framework, Strategic Economic Investment Location);
- Existing 400 kV OHL to the north and consented windfarms and wind turbines;
- Consented planning applications for redevelopment e.g. Auchlochan Bing and Bellfield Bing to the east of Coalburn;
- Presence of past, present and future areas of mineral extraction;
- Presence of adits and shafts associated with mineral extraction;
- Areas of peat; and
- Potential areas for future minerals extraction e.g. small area of coal north of Coalburn Moss SAC and area of sand and gravel near Poniel.

3.5.4 Step D - Routeing Strategy

33. Following the identification of environmental and technical constraints (Step C), a routeing strategy was agreed, which provided project-specific principles aimed at delivering the routeing objective:

Routeing Strategy:

- To identify a technically feasible and economically viable route between Kennoxhead Windfarm and Coalburn Substation whilst taking into consideration environmental, technical and economic constraints. The route should, on balance, cause the least disturbance to the environment and the people who live, work and enjoy outdoor recreation within it.
- To help minimise landscape and visual effects, in accordance with the Holford Rules and SPEN's routeing methodology, the proposed OHL should seek to avoid high ground and ridgelines, responding to the grain of the landscape, subject to avoiding areas of highest amenity and environmental values as far as practicable (as above).
- To help assess temporary and permanent cumulative effects, careful consideration should be given to the relationship of the proposed OHL with other electricity infrastructure within the Study Area.

34. Whilst not the only influence on route alignment, the key considerations that have informed the routeing strategy have been the need to minimise impacts to:

- The settlements of Coalburn, Douglas, Auchlochan Garden Village;
- Coalburn Moss SAC; and
- Consented developments (including windfarms, commercial development, and mineral extraction).

3.5.5 Step E - Development of Route Options

35. Based on the environmental and technical constraints identified in Step C and in accordance with the routeing strategy agreed in Step D, route options were developed to be taken forward for detailed assessment.

36. The nature of the topography and the technical and environmental constraints in the Study Area between Kennoxhead Windfarm Substation and the existing Coalburn Substation informed the identification of route options. This process involved designing routes in accordance with the Holford Rules, that best fit the landscape and minimise effects on visual amenity, whilst avoiding wherever possible areas of high environmental value. These areas generally include areas of natural and cultural heritage value designated at a national, European or international level as these are afforded the highest levels of policy protection.

37. In response to the identification of the key environmental and technical constraints and strategy, a sensitivity weighting (hard constraint, moderate constraint or soft constraint) was defined on an aspect-by-aspect basis, for each environmental feature identified. This was undertaken with reference to Holford Rules 1 and 2 and by using relevant guidance and professional judgement relating to designations and their sensitivities.

38. In terms of the Holford Rules, there are constraints within the Study Area which would be classified as 'areas of highest amenity value' under the definition in Holford Rule 1; Site of Special Scientific Interest, Special Area of Conservation, Special protection Area, Listed Building, Scheduled Monument.

Holford Rule 1: Avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the line in the first place, even if the total mileage is somewhat increased in consequence.

39. In addition, there are constraints which would be considered under Holford Rule 2, which are also included as strategic constraints.

Holford Rule 2: Avoid smaller areas of high amenity value, or scientific interests by deviation; provided that this can be done without using too many angle towers, i.e. the more massive structures which are used when lines change direction

40. To identify route options within the Study Area, the strategic constraints were categorised in terms of their potential to impact on the process of route option identification as follows:

- Hard Constraint: feature to be avoided wherever possible;
- Moderate Constraint: feature normally avoided where other alternative routes/alignments are available. If no other alternatives available, feature can be passed through with mitigation; and
- Soft Constraint: feature present that could be relatively easy to mitigate, either by design, micro-siting or construction practices.

41. **Table 3.1** details how this categorisation applies to the strategic constraints identified within the Study Area.

Sensitivity	Justification	Examples	Route Identification Response
Hard	Holford Rule 1 features (international and national designations) or environmental features considered particularly sensitive to transmission infrastructure; Technical constraints of key significance	European designated sites (e.g. SPAs and SACs); National Park; National Scenic Area	Avoid wherever possible and prioritise for mitigation
Moderate	Holford Rule 1 features considered less sensitive to transmission infrastructure; Holford Rule 2 features (regional and local designations)	Geological SSSIs; Category B and C Listed Buildings; Local Nature Reserve	Proceed with caution
Soft	Holford Rule 2 features considered not to be sensitive to transmission infrastructure	Geological Conservation Review Sites	Some constraints of lesser sensitivity – no issue for route identification

Table 3.1: Strategic constraint categorisation

42. A sensitivity weighting (hard constraint, moderate constraint or soft constraint) was defined on an aspect-by-aspect basis, for each environmental feature identified. This is undertaken with reference to Holford Rules 1 and 2 and by using relevant guidance and professional judgement relating to designations and their sensitivities. Using this system it was possible to map overall receptor sensitivity across the Study Area, which helped identify and refine potential route options (Step F).

43. A 'heat map' was generated which assigns colours (red, amber, green) to hard, moderate and soft constraints, respectively. The purpose of heat mapping is to provide a graphic indication of overall receptor sensitivity across the Study Area.

44. Holford Rules 1 and 2 were applied to these site-specific strategic constraints using the following hierarchy to identify and refine potential route options:

- Avoid SACs, Class 1 peat areas, residences, scheduled monuments, listed buildings and non-designated heritage assets of potentially national significance;
- Preferably avoid or limit the distance travelled within SSSIs, RSPB Bird Sensitive Areas, Native/Nearly-native woodland, and within 100 m of existing and committed residential properties (100 m was adopted as a trigger for further detailed consideration and would not necessarily represent a constraint in every instance);
- Cultural heritage assets should be considered from a setting perspective where they are of national importance, or where the setting is pertinent to its citation. When assessing the impact on setting, a buffer of 2 km from the cultural heritage asset has been used. Setting effects were also considered within the route option appraisal;
- Where it is possible to do so, avoid or limit the distance travelled within Planted Ancient Woodland Sites, potential disturbance to Black Grouse Lek sites and disturbance to wader nest sites near to ponds, forested areas and peat; and
- A 200 m buffer was mapped around each residential property to allow this proximity to be balanced with other considerations, while also helping identify possible 'pinch points'.

45. In total, three route option alignments were identified and appraised. These are shown on **Figure 3.5**.

3.5.6 Step F - Appraisal of Route Options and Selection of 'Preferred Route'

46. To allow identification of a preferred route, an appraisal of the route options was undertaken. The purpose of this is to identify the relative potential of each route option to accommodate an OHL, including a focus on potential landscape and visual impacts of the options as directed by Holford Rules 3 to 7.

47. The conclusion of this appraisal was the identification of an emerging preferred route, which was considered on balance to cause the least disturbance to the environment and the people, who live, work and enjoy outdoor recreation within it, and best reflects the routeing strategy. Whilst this route was defined based upon the information available to date, it was accepted that further consultation may lead to technical matters emerging which require a review of the preferred route.

48. The preferred route was reviewed by SPEN in relation to the system/network design requirements and also the existing OHL network (in relation to required clearance distances and the crossing of the existing network). This review was undertaken to ensure that, based on the level of detail available, the preferred route was within the technical parameters required to construct an OHL and associated development.

49. The preferred route has been re-produced in **Figure 3.5**. This route was taken forward to consultation (Step G) in December 2019 and February 2020 (see **Chapter 2: Approach to the EIA**).

3.5.7 Step G - Consultation on Preferred Route

50. As highlighted in **Chapter 2: Approach to the EIA**, SPEN issued a Routeing Strategy Document in 2019 setting out the routeing methodology, including the routeing objective and the routeing strategy, and the outcome of the appraisal of route options culminating in the preferred route. The Routeing Consultation Document was consulted upon and comments sought from statutory and non-statutory consultees and the public. Following this, public consultation events were held in February 2020.

3.5.8 Step H-J - Modifications to 'Preferred Route', Identification of the 'Proposed Route' and Scoping

51. Feedback received from statutory and non-statutory consultees, the public and landowners during the routeing consultation exercise was taken account of by SPEN, and modifications to the preferred route were made. SPEN were of the opinion that the preferred route taken forward to the detailed alignment stage best met the routeing objective for the proposed development and SPEN's wider statutory duties. This decision was communicated to key stakeholders, communities and individuals who engaged with SPEN during the consultation period in a Report on Consultation[5]. The preferred route was progressed to the EIA Scoping stage and detailed design alignment, now termed the 'proposed route'.

3.5.9 Steps K and L - Detailed Design of Final Route Alignment and EIA

52. Scoping provided stakeholders with a final opportunity to comment on the preferred route and to agree an appropriate EIA scope. All comments were fed back into the design and field surveys were undertaken in accordance with the agreed scope.

53. At this stage (i.e. detailed alignment stage) a design workshop was held between SPEN and the technical specialists to consider consultee comments and the early results from the field surveys and agree upon amendments to the proposed route. The result of this workshop was a detailed alignment that would be taken to landowners for their final review. Following landowner approval, the detailed alignment was then subject to an EIA, the findings of which are presented in this EIAR. The detailed alignment was refined as necessary following feedback from the EIA in order to minimise the potential for significant adverse effects on the environment and the people who live, work and enjoy outdoor recreation within it.

3.6 Design Process

3.6.1 The Design Strategy – Policy Context

54. The proposed development does not constitute a major development under The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013 Part 3, Regulation 13. Therefore, a design statement explaining the principles and concepts which have been applied to the design is not required. However, SPEN recognise the value in explaining the design principles and concepts which have been applied to the proposals. Scottish Planning Policy (SPP) (2014) also highlights the importance of design as a material consideration in the determination of planning applications.

[5] Available at: https://www.spenergynetworks.co.uk/pages/kennoxhead_wind_farm_grid_connection.aspx

Development design and well-designed places is highlighted as a key consideration in the vision for the planning system in Scotland as set out in the SPP.

55. Planning Advice Note (PAN) 68 Design Statements (2003) aims to see the planning process used more effectively to create places of lasting quality. Importantly, whilst PAN 68 is concerned mainly with urban design and the architectural quality of buildings as opposed to utility infrastructure, it does state that even where a formal design statement is not necessary, applicants should still have a clear and logical design philosophy which could be explained if required.

56. PAN 68 highlights the need for the programme for delivery of the project to be considered in designing the project. The programme for construction of the proposed development is 12 months. Further details of the construction and decommissioning phases are provided in **Chapter 4: Project Description**.

3.6.2 Detailed Design Alignment

57. Following the identification of a preferred route, work was progressed to identify the most appropriate alignment for the proposed route. This design process was led by the SPEN OHL design team informed by the emerging findings of the environmental surveys and input from technical specialists at a design workshop in November 2020, comments from consultees via the EIA Scoping process and, importantly, landowner feedback.

58. The process adopted for designing and assessing the final route alignment is outlined in **Figure 3.4**.

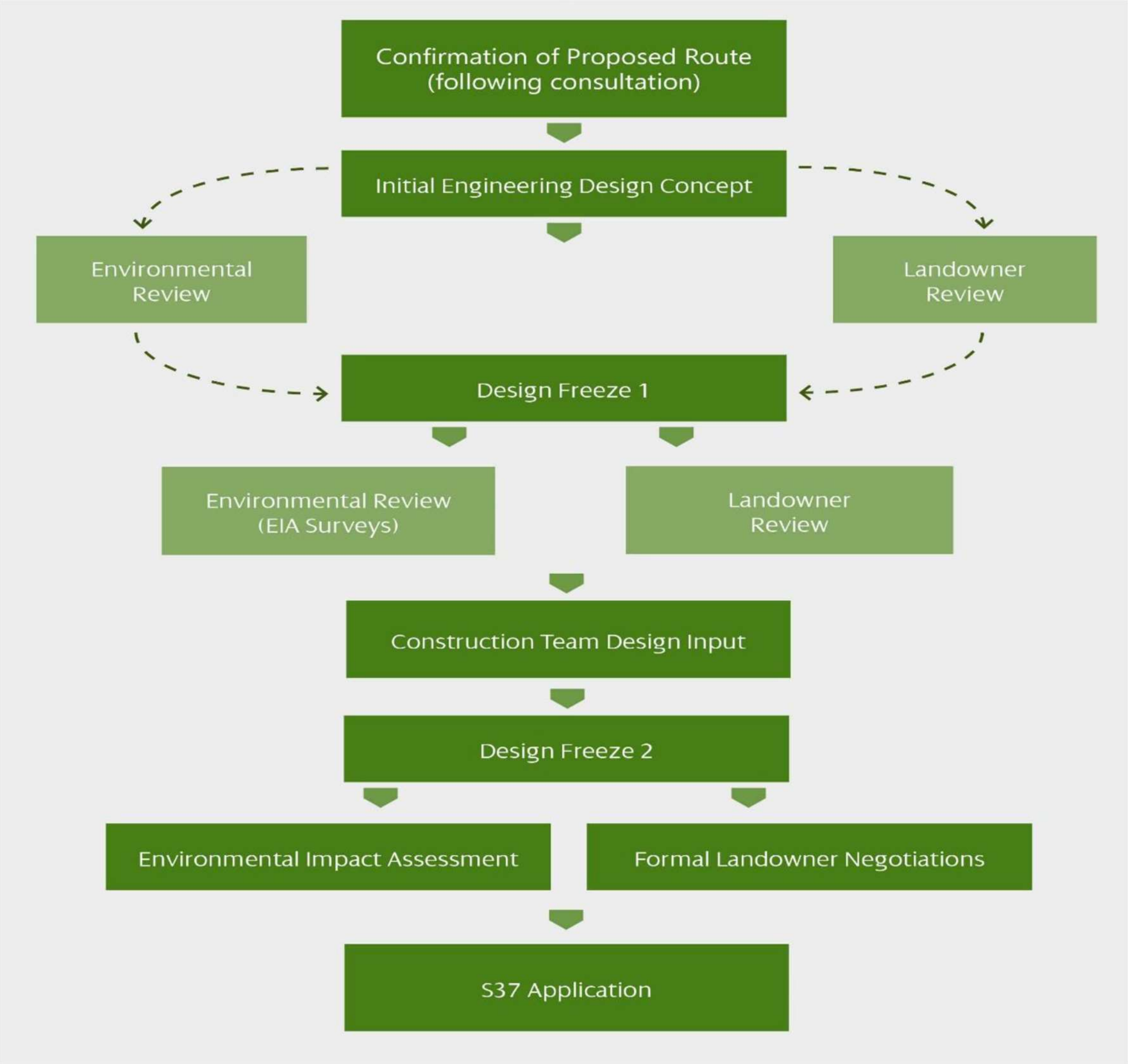

Figure 3.4: Detailed design and assessment process

3.6.2.1 Project Design Parameters

59. It is important to highlight the following project parameters which influenced the design of the proposed development from the outset:

- The purpose of the proposed development is to create a grid connection between Kennoxhead Windfarm and Coalburn Substation;
- The height of the landform (Above Ordnance Datum (AOD)) that the OHL is traversing was an important design parameter in influencing the selection of the support type;
- Under section 9 and Schedule 9 of the Act , SPEN is required to develop and maintain an efficient, co-ordinated and economical system of electricity transmission, for which design plays an important role. As a consequence of the above, design and routeing objectives for the proposed development required technical, economic and environmental issues to be balanced; and
- The design strategy reflects well established procedures and guidance (the Holford Rules) and incorporates poles and associated infrastructure used widely across the UK electricity transmission network.

60. In line with established practice, the design of the following was considered in sequence; informed by technical considerations, including the required transmission capacity:

1. The pole locations, type, and span length;
2. The location and design of access tracks and working areas; and
3. The design of forestry felling and re-planting.

61. These elements are discussed below.

3.6.2.2 The Design Team

62. The design work was led by SPEN's in-house engineering design team, informed by the findings of an environmental constraints mapping exercise undertaken by RSK's project environmental specialist teams. Consultation has also been undertaken with landowners to inform the siting of poles and other infrastructure.

3.6.2.3 Wood Pole Design

63. The key design objective for the selection of the wood poles has been to meet technical requirements, including capacity, safety, network security requirements, and OHL design parameters, whilst taking account of economic and environmental considerations.

64. As the proposed OHL is above 200 m AOD, it requires construction using H poles (rather than single poles), with a span length of around 100 m and pole heights ranging from 11 m – 18 m with a typical height of 13 m. Using smaller, timber structures instead of steel towers is advantageous because wooden poles have less visual impact, pole locations can be relatively flexible and the construction requirements of timber structures would also be potentially less disruptive to the landscape and habitats found along the proposed route.

65. There are three types of pole proposed:

- Intermediate poles where the pole is part of a straight section of line and no change in direction is required. Straight sections of wood pole lines include section poles where segmentation is required to contain any failure of the OHL;
- Angle or tension poles where there is a horizontal or vertical deviation in the line direction and straight sections of line require to be segmented. Angle poles can accommodate changes in direction of up to 75 degrees; and
- Terminal pole where the OHL ends before entry into a substation.

66. Proposed span lengths between poles across the route range between approximately 77 m and 119 m. The standard height of poles above ground is 15 m.

67. Further details of the poles, including construction details, diagrammatic illustrations and photographs are provided in **Chapter 4: Project Description**.

68. Wood poles are dark brown when first erected and weather to a silver/grey after about five years, a colour in between these is the colour on which routeing and impact has been assessed. The wood pole top cross-arms are galvanised steel and support

the aluminium conductors on stacks of grey insulator discs. Both the steelwork and aluminium will weather and darken after a few years.

3.6.2.4 Access Track Design

69. Access to wood pole and cable locations and working areas is proposed during the construction of the proposed development. The overall design objective for the access tracks has been to avoid and/or reduce effects upon natural and cultural heritage interests and to cause least disturbance to current land use and land management practices. The principle method employed to achieve this has been to maximise the use of existing tracks (and bridges). Where this is not possible, or where the use of existing tracks would result in unnecessarily long connecting tracks, two options for temporary access tracks have been considered as follows:

- The use of temporary spurs from existing roads/tracks; and
- The use of temporary tracks between poles which connect to an existing road or track.

70. Further details of the proposed tracks are provided in **Chapter 4: Project Description**, including the temporary track options available for different ground conditions, and the proposals for reinstatement once the tracks are removed.

3.6.2.5 Forest Felling and Re-Planting Design

71. The overall design objective has been to minimise the extent of felling required and woodland areas and individual trees were avoided where possible during the routeing phase when balancing with other technical and environmental objectives, and 'crowning' of individual mature trees is proposed where this can be accommodated to avoid felling the tree. Where routeing through woodland has been unavoidable, a 'wayleave' corridor is required for safety reasons to ensure that trees do not fall onto the line and for health and safety of forestry operatives. SPEN has statutory powers to control tree growth within the wayleave corridor. The wayleave corridor for the proposed development is described in detail in **Chapter 4: Project Description**.

3.6.3 Undergrounding

72. SPEN is obliged to comply with the requirements of the Act to develop and maintain an efficient, co-ordinated and economical system of electricity transmission. SPEN's approach seeks to find an OHL solution for all connections and only where there are exceptional constraints would underground cables be considered as a design alternative. Such constraints can be found in urban areas and in rural areas of the highest scenic and amenity value. Where an OHL solution is not achievable for technical reasons, SPEN look to an underground cable solution as an alternative. However, sections of underground cable identified for inclusion within a scheme, must balance the economic, technical and environmental considerations.

73. The main environmental advantage of underground cable when compared to OHL is often the reduction in effects on visual amenity and landscape character. The main environmental disadvantages of underground cable when compared to OHL often relate to greater effects on habitats and natural heritage interests; unknown archaeology; drainage and land use for construction/development. The disadvantages often arise from the invasive nature of excavation of trenches to lay the cable, the extent of the area disturbed, the equipment required and the volume of materials involved.

74. At the northern and southern extents of the proposed development, underground cabling has been proposed. This is a common approach taken to allow an OHL to enter a substation. During the design development of the proposed development, the southern section of proposed underground cable was extended. This was because an OHL in this location was considered not to be achievable within the proposed route for technical reasons, namely the proximity to the Kennoxhead Windfarm Extension turbines. In addition, the proposed route could not be amended to form an alternative OHL route due to the surrounding environmental constraints. Therefore, an underground cable was proposed.

75. Undergrounding of existing OHLs forming part of the distribution network will also be required as a consequence of the proposed development to allow for the proposed 132kV OHL to cross. . Further details these crossings are provided in **Chapter 4: Development Description**. Although not part of the proposed development, these works have been considered as part of the assessments within this EIAR.

3.6.4 The Design Stages

3.6.4.1 Initial Design Concept

76. An initial engineering concept design comprising angle poles only was designed by SPEN's OHL design team to reflect technical parameters which aimed to:

- Minimise the number of poles required;
- Maximise the span lengths between poles;
- Avoidance of wake effects from wind turbines;
- Minimise the number of angle poles; and
- Minimise the number of crossings of the A70 and local road network, watercourses, core paths and existing OHLs.

3.6.4.2 Layout 1

77. The initial engineering design of the proposed development was subjected to a review by the environmental specialist teams at a design workshop in November 2020, informed by environmental information gathered during the desk and field surveys as well as feedback from consultees. This further environmental information and its application to the alignment stage included:

- **Landscape and visual**: informed by consultation responses and landowner feedback, further field work was undertaken to establish the existing baseline conditions. Baseline data was collected from publicly accessible and private land (where access was granted) to identify potential landscape receptors, and key views and visual receptors (people). The alignment of the OHL was reviewed in relation to landscape and visual sensitivities, and potential landscape and visual effects, to determine the most appropriate alignment, as well as the location and height of individual poles (subject to technical limitations of the OHL design e.g. topography). The landscape and visual review considered key views from residential properties and how the alignment of the OHL is integrated alongside existing landscape features (e.g. forestry and other existing OHLs) and in relation to underlying landform and topography.
- **Forestry**: desk based and field surveys were undertaken to assess existing woodland conditions and review proposals for long term management of woodland blocks. Consultation with Scottish Forestry (then Forestry Commission Scotland) regarding the development of route options and then the preferred route was undertaken in June 2019 and January 2020 respectively. The information gathered from surveys and consultation was used to inform the alignment of the OHL, to seek to minimise felling of woodland and utilise existing forest edges where possible.
- **Geology, Hydrology, Hydrogeology, Water Resources and Peat**: a walkover hydrological survey was carried out to obtain an overview of the study area conditions at the time of the visit, including identifying the key constraints to design: peatland areas; watercourses and waterbodies; designated sites with a hydrological or peatland designation; private water supplies and public water supply infrastructure; and mining and mineral extraction. The findings resulted in a number of design modifications to the alignment of the OHL including, moving the OHL west to avoid damage to the Coalburn Moss SAC/SSSI, watercourse buffers being agreed with SEPA, and all poles being located outwith this buffer wherever possible, minimising watercourse crossings, avoiding mine shafts and adits, and avoidance of sensitive wetland habitats.
- **Ecology**: the initial biodiversity field surveys comprised an extended Phase 1 Habitat Survey including an assessment of suitable habitat for any protected species e.g. otter, water vole, pine martin, red squirrel, bats (roosting potential within adjacent woodland and/or buildings) and badger, as well as a search for field signs of such species, a national vegetation classification survey, and a groundwater dependent terrestrial ecosystem survey. The findings of the extended Phase 1 habitat survey and protected species surveys informed the alignment of the OHL where appropriate, such as relocation of poles to avoid sensitive habitats and impacts on protected species.
- **Ornithology**: Desk studies, consultations to date, and a programme of targeted ornithological field surveys between February 2020 and July 2021, including vantage point surveys, walkover surveys, breeding bird surveys and a raptor nest search. These included surveys for populations where individuals breed, roost or forage at distances of up to 5 km from the New 132kV OHL.
- **Cultural Heritage**: a desk-based assessment and walkover field survey was conducted to identify all known cultural heritage assets within 200 m of the preferred route. Amendments were made to the route of the proposed development to avid impacts on non-designated assets.

78. In addition to the environmental design inputs outlined above, SPEN engineers undertook a site walkover survey and made changes to avoid unsuitable ground conditions, such as run off catchment areas and marshland.

79. At this stage, SPEN's design team issued layout 1 which included all wood pole locations and indicative working areas and access tracks. This design was subject to review by the environmental specialist teams based on data collected from their EIA surveys, and consultation with landowners.

3.6.4.3 Layout 2

80. Following landowner consultation Layout 1 was realigned so the OHL crosses rather than circumnavigates Douglas West Wind Farm to avoid a proposed mixed use development. This resulted in Layout 2 which also comprised all working areas, construction compounds and access tracks along the proposed route following the detailed SPEN construction team input and review.

3.6.4.4 Final Layout

81. Layout 2 was subject to review by the environmental specialist teams based on data collected from their EIA surveys, and consultation with landowners. Modifications to Layout 2 were recommended by environmental specialists and landowners primarily to:

- Relocation of the main site compound to avoid requirement for felling and to reduce construction traffic using proposed junction onto Coalburn Road;
- Micrositing of a laydown area to avoid requirement for felling;
- Relocation and redesign of proposed accesses and work areas following discussions with South Lanarkshire Council roads department;
- Realign the proposed OHL to avoid the requirement for felling for wayleaves. This would mean siting two poles a minimum of 10 m from manmade ponds on the area of degraded land (from opencast workings) south east of Carmacoup forest. It was proposed that extra mitigation measures would be undertaken in relation to sediment management and surface water management to protect the ponds from sediment release. In addition, the connectivity between these manmade features and the wider water environment will be assessed in the EIA Report. SEPA agreed that this approach was acceptable;
- Realign the route to circumnavigate the route around Douglas West Wind Farm, which is under construction, following confirmation of as built coordinates to avoid turbine topple distance and minimise wake effects and other cumulative development in vicinity;
- Realign the proposed OHL to avoid crossing land allocated for housing development;
- Finetuning of cable location in discussion with landowner at Kennoxhead; and
- Finetuning of cable location at Coalburn substation to reflect electrical requirements.

3.6.4.5 Detailed Alignment Outcome and EIA

82. SPEN is of the opinion that the final design of the proposed development, shown in **Figures 4.1a-f**, best meets the strategic routeing objective and is consistent with SPEN's statutory duties and licence oblihgations.

3.7 References

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