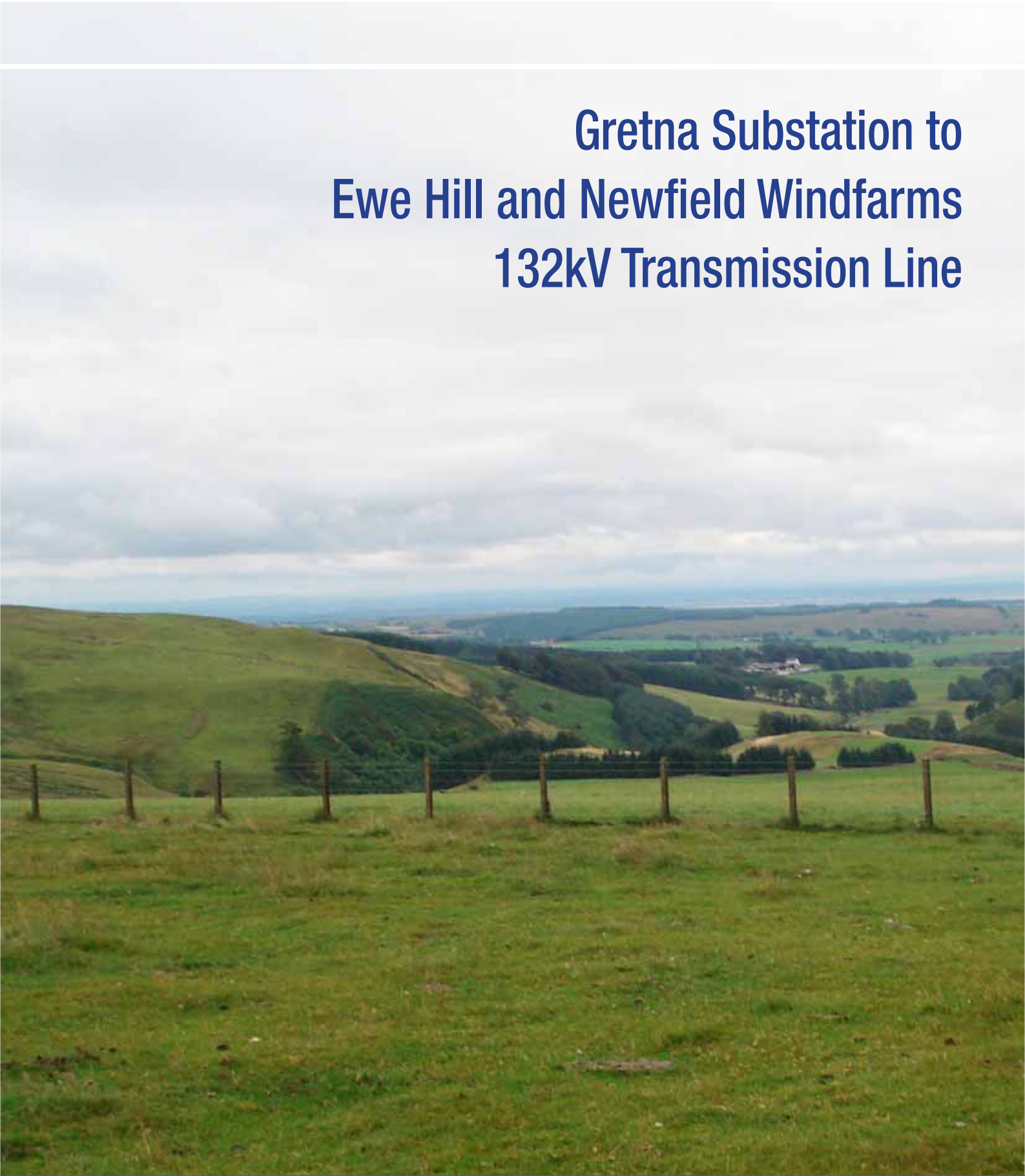
Gretna Substation to Ewe Hill and Newfield Windfarms 132kV Transmission Line



Public Consultation Report

SP TRANSMISSION

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Preface

Proposal

SP Transmission Ltd (SPT) intends to connect the proposed Ewe Hill and Newfield windfarms to its existing grid substation at Gretna, via two new overhead transmission lines; a northern line connecting the proposed Newfield and Ewe Hill substations and a southern line between the proposed Ewe Hill substation and the existing substation at Gretna. Given the load expected to be generated from each windfarm, SPT have concluded that new single circuit 132,000 volt (132kV) transmission line will be required.

Consultation Document

This document has been prepared in order to inform those with an active interest in selection of the preferred routes for the Gretna Substation to Ewe Hill and Newfield Windfarm connections. Once consultation is concluded and opinions collated, SPT will make an informed decision and found upon proposed routes.

Preferred Route Options

SPT has identified preferred routes to Ewe Hill and Newfield. This involved consultation with a range of authorities and other interested parties to identify constraints in the study area. The examination of alternative routes and analysis and evaluation of the preferred route options against a range of established criteria and methodology is set out in this document.

The preferred routes seek to minimise the environmental impact on a range of physical, environmental and socio-economic considerations (including the landscape, woodland, flora and fauna, agriculture, people, settlements, properties and historical features) whilst remaining economically and technically viable.

Consent Procedure

SPT intends to prepare and submit an application for each of the two routes to the Scottish Ministers under Section 37 of the Electricity Act 1989. These applications will be accompanied by an Environmental Statement.

Consultation

Copies of the Consultation Document have been sent to a number of key consultees who include:
Dumfries and Galloway Council (DGC)
Scottish Natural Heritage (SNH)
Historic Scotland (HS)
Scottish Environment Protection Agency (SEPA).

A public exhibition, where copies of this document will be available for public review and details of the project will be on display, at Waterbeck Hall between August 31st and September 3rd 2009.

Section 1: Introduction

1.1 Background

SP Transmission Ltd (SPT), are responsible for the transmission network from the English/Scottish border to just north of Stirling, an area of some 23,000 square kilometres. As the licence holder, SPT is required under the Electricity Act 1989 "to develop and maintain an efficient, co-ordinated and economical system of electricity transmission."

SPT proposes to construct a heavy duty wood pole 132kV overhead transmission line between Gretna Substation and the proposed Ewe Hill Windfarm Substation, with a subsequent wood pole connection to the proposed Newfield Windfarm Substation, refer to **Figure 1** for locations. The transmission line project is required under SPT's duties to connect the two proposed windfarms into the national grid.

The construction of the lines will be dependent upon the success of the two windfarms receiving planning consent. The developer of the Ewe Hill Windfarm site submitted a planning application in June 2006 and the developer of the Newfield Windfarm is in the process of preparing its application. In the event that the Ewe Hill Windfarm application is unsuccessful, but the Newfield Windfarm application is approved, then SPT would be required to construct a transmission line directly from Gretna Substation to the Newfield Windfarm Substation, however, in the event that Newfield's application is unsuccessful, the line will terminate at Ewe Hill. This project has been based on the assumption that both windfarms will be approved.

A routeing study has been prepared which considers the two route sections separately. The corridor options and preferred routes have been described in this report from south to north i.e. the south section (Gretna to Ewe Hill) and the north section (Ewe Hill to Newfield). The report is separated after Section 4 to discuss the corridor options, corridor options appraisal and preferred route corridor for each alignment in Section 5, for Gretna to Ewe Hill, and Section 6 for Ewe Hill to Newfield.

1.2 Purpose of Consultation Document

This Consultation Document has been prepared in order to set out the steps taken in identifying the preferred routes of the wood pole 132kV overhead transmission line between Gretna Substation and the proposed Ewe Hill and Newfield windfarms.

Its purpose is to allow statutory and other interested parties the opportunity to comment on the preferred routes and any other matters in order to inform the selection of the proposed routes. Comments will also inform the preparation of an Environmental Statement for the two lines, which will accompany the applications for consent to construct and operate the lines.

SPT will hold a public exhibition in Dumfries and Galloway, where the background, methodology and evaluation of the preferred options will be on display for stakeholders and the general public to make comment and discuss with members of the professional team. In addition further information on the project can be obtained from a dedicated project email address (ewehillnewfield.projectmanager@sppwersystems.com).

1.3 Scope

The Consultation Document is divided into seven sections which cover:

Section 1 – introduction and background to the requirement for and purpose of this document

Section 2 – a description of the project and a summary of government policy and targets for renewables.

Section 3 – outlines methodologies adopted in the appraisal process for the selection of the preferred routes.

Section 4 – describes baseline landscape and environmental features which are present within the study area and the technical, environmental and landscape constraints that these represent with regard to the identification of route corridor options.

Section 5 – presents the corridor options, appraises the corridor options and presents the selection of a preferred route for the Gretna to Ewe Hill route.

Section 6 – presents the corridor options, appraises the corridor options and presents the selection of a preferred route for the Ewe Hill to Newfield route.

Section 7 - the final section outlines the next steps which will be undertaken following completion of the consultation exercise regarding the preferred route alignments.

1.4 Statutory Consent Procedures

1.4.1 Section 37 Application

Under Section 37 of the Electricity Act 1989, SPT is required to seek consent from the necessary decision making body for the construction of any non-exempted overhead line operating at a voltage greater than 20kV. Two separate applications (one for each connection) will be made by SPT to the Scottish Ministers for Section 37 consent under the Act and at the same time, a request for deemed planning permission will be made under Section 57 of the Town and Country Planning (Scotland) Act 1997.

The development of the proposed overhead lines is defined by the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (amended 2008) as a 'Schedule 2 Development' as it is "an electric line installed above ground with a voltage of 132 kilovolts or more, the installation of which (or the keeping installed of which) will require a Section 37 consent but which is not Schedule 1 development."

Due to the nature and size of the proposal, it is recognised that the development has the potential to have significant effects on the environment, and on this basis SPT proposes to submit an Environmental Statement with the application for consent for each connection. In accordance with regulation 3(2), this intention to submit an Environmental Statement confirms the development as an EIA development.

Section 2: Project Description

2.1 Government Policy and Targets for Renewables

The Energy White Paper sets out the government targets for renewable energy production and states that 10% of electricity supplies within the United Kingdom should be generated from renewable sources by 2010. Depending on the renewable technology employed, this could require installation of up to 10,000 MW of additional renewable energy generation. In Scotland, the Scottish Parliament has set a target that 18% of electricity supplies in Scotland should be generated from renewable resources by 2010. Furthermore, the Scottish Ministers have recently adopted a target to generate 40% of our energy needs from renewable sources by 2020. If these targets are to be met the necessary electrical transmission infrastructure requires to be put in place.

2.2 Renewable Generation Application

Following the announcement of the Government targets for renewable energy, a considerable volume of connection applications from renewable generators has been received by the electricity transmission utilities. The following table outlines the electricity generating capacity of the two proposed windfarms which would be linked to the national grid through the project, assuming both projects obtain development consent and the output levels currently proposed are not altered:

Windfarm	Output
Ewe Hill	44MW
Newfield	78MW

2.3 The Project

Gillespies and WSP Environmental Ltd (WSPE) were commissioned by SPT in June 2008 to undertake an options appraisal exercise for the proposed 132kV overhead transmission lines in Dumfries and Galloway which would connect Gretna Substation with two proposed windfarms at Ewe Hill and Newfield.

The appraisal has been based on identification and assessment of the baseline landscape and environmental features present within a defined study area, which have formed the key drivers in the identification and analysis of route corridor options and preferred routes. These preferred route alignments have been considered, based on a balanced assessment of a range of factors to have the least overall impact on the natural and built environment.

2.4 SPT's Transmission System

2.4.1 SPT's Statutory Duties

SP Transmission Ltd (SPT) is responsible for the transmission network from the English/Scottish border to just north of Stirling, an area of some 23,000 square kilometers. SPT is required under the Electricity Act 1989 "to develop and maintain an efficient, coordinated and economical system of electricity transmission". For SPT to comply with its licence obligations, it must provide all new forms of electricity generation with access to the electricity network.

All transmission licence holders are required by Schedule 9 of the 1989 Act to take account of the following factors in formulating proposals for the installation of overhead transmission lines:

"(a) to have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features or special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and

(b) to do what he 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."

As a result, a licence holder is required to consider then balance technical, economic and environmental issues, through the application of a logical process. The exercise of professional judgment involved in weighing the issues results in routes which, on balance, best meet the stated 'routeing objective'. That routeing commitment requires to reflect the licence holder's statutory duties. This is discussed in further detail in Section 3: Study Approach and Methodology.

2.5 Design, Construction and Maintenance

2.5.1 Design

Following identification of the proposed route for the new line, a detailed topographical survey will be carried out. This is required to identify the proposed positions and heights of each individual pole.

The proposed heavy duty wood pole will support three conductors (wires) in a horizontal flat formation (**Figure 2**). Additionally there is an earth conductor suspended beneath the main conductors in order to provide lightning protection. This also includes fibre optic cores for communication purposes.

The proposed design for both connections is the heavy duty wood pole, refer to Figure 2 for details. The nominal height of the poles is likely to be in the range 15m and the spacing between towers will vary depending on topography and altitude, with towers being closer together at higher altitudes to counteract the effects of greater exposure to high winds and other weather events. The height and distance between towers will therefore be determined after the detailing line survey but will be in the range of 90m.

There are basically two main types of pole, a 'line' pole and an 'angle' pole, refer to **Figure 2** The angle pole as its name suggests is used where the line changes direction.

Site surveys will be carried out at proposed tower positions where required to examine the subsoil conditions in order that the tower foundations, can be designed.

2.5.2 Construction

Line construction typically follows a standard sequence of events which are:

- Prepare access
- Install pole foundations
- Erect poles
- String conductors
- Reinstate pole sites and remove temporary accesses

It is preferred to have vehicular access to every pole site for foundation excavation and installation. Additionally, the conductors are winched to/pulled from angle structures and thus access to these sites is required for conductor drums and winch tensioner.

Access can take various forms and is dependent on ground conditions. In poorer conditions more access works may be required which can vary from laying temporary wooden or aluminium matting to, in some cases, installing crushed stone roads. Helicopters may also be used to facilitate access in sensitive or remote areas.

Wood Pole Foundations

Pole foundations are typically 2-3m deep with excavation carried out by mechanical excavator. Prior to excavation the foundations for each tower site will be securely fenced off to ensure the safety of members of the public and livestock.

Once the poles are placed in the excavation this will be back-filled using the original material in layers. Any surplus material is removed from site.

Conductor (wire) stringing

Once a number of sections of poles are erected, conductor stringing can commence, installing conductors between section poles via the line poles. Conductor drums are set up at one end of the section with a winch tensioner at the other end and the conductors pulled from one end to the other utilising a winch bond. This bond can either be pulled by hand or by the use of a low ground pressure vehicle such as a quad bike.

Prior to stringing the conductors, roads and railways which are to be crossed by the power line have to be protected by building a scaffold tunnel through which vehicles/trains can pass. Other obstacles such as existing power lines have to be either switched off, deviated or protected using “live line” scaffolds.

Materials required for construction are transported around the site by general purpose cross-country vehicles fitted with a lifting device. Excavators are generally of the tracked type to reduce likely damage to, and compaction of, the ground. Materials are delivered to site storage/assembly areas by conventional road transport and then transferred to tower sites by either smaller four-wheel drive lorries or in some cases helicopter.

In all cases every effort is made to cause least disturbance to landowners and local residents during construction. The route of the line is selected to avoid as far as possible communities and individual dwellings. Any ground disturbance during construction of the new line will be reinstated.

2.5.3 Maintenance

In general a transmission line requires very little maintenance. It is periodically inspected to identify any unacceptable deterioration of components so that they can be replaced. From time to time inclement weather, storms or lightning, can cause damage to either the insulators or the conductors. If conductors are damaged short sections may have to be replaced and that would involve winching to or from section towers. Insulators and conductors are normally replaced after about 40 years.

Section 3: Study Approach and Methodology

3.1 Overview

The following has been taken into account in the routeing study:

- SPT's Project Design Requirements (Ewe Hill & Newfield);
- SPT (2002) Overhead Transmission Lines - Routeing and Environmental Assessment;
- The Holford Rules: Guidelines for the Routeing of New High Voltage Overhead Transmission Lines with NGC 1992 and SHETL 2003 Notes;
- Section 9 of the Electricity Act 1989;
- Forestry Authority/Forestry Commission (1994) Forest Landscape Design Guidelines, 2nd Edition;
- Forestry Authority (1998) Forest Design Planning – A Guide to Good Practice.

3.2 Detailed Methodology

3.2.1 SPT's Routing Commitment

In developing and maintaining an efficient and coordinated technically and economically viable transmission system in accordance with the licence agreement, SPT is committed to limiting disturbance to people and the environment by its operations.

3.2.2 The Project Routeing Objective

"To identify a technically feasible and economically viable route for an overhead transmission line that meets the technical requirements of the electricity network and causes, on balance, the least disturbance to the environment and the people who live, work and recreate with in it."

3.2.3 Defining the Study Area

The first stage in the routeing assessment process was to establish and define the areas of search for the key environmental and technical constraints. For this project, the following two key areas were defined.

Firstly, a study area was defined. This is the area within which it would be feasible to construct the transmission lines, and to consider alternative alignments, whilst taking into account major topographical and infrastructure constraints such as high ground, ridgelines, slope gradients, settlements or existing transmission lines.

Secondly, a wider buffer area was identified which represents a distance of 5km from the outside of the study area, in which it was recognised that there is potential for the transmission line to indirectly impact upon important designated areas, landscapes and views. This wider buffer area was taken into consideration when defining route corridor options. Refer to **Figure 4** for the study and buffer area extents.

3.2.4 Data Collection

Once the study and buffer areas were defined, the next stage of the process was to identify and collate the baseline for these areas. This process began with initial stakeholder consultation to identify relevant environmental, land use and landscape data and to obtain early views from consultees on constraints and potential effects of the transmission lines.

Baseline information was also obtained from a number of other sources including local authority plans and policies (including local and regional plans), digital datasets, Ordnance Survey maps and site visits.

3.2.5 Constraints Analysis

Analysis of constraints in the study area which have been defined for the project (see Section 4: Baseline Information) is crucial to the understanding of potential environmental effects of route options, and in defining options which avoid areas of highest constraint. Constraints analysis has been used throughout the process, including at the following stages:

- In determining a study area within which potential corridor options can be identified;
- In gathering of high level environmental baseline information relating to the study area;
- In the identification of areas of least constraint which were selected as broad corridors and then narrow route corridors as part of the environmental sieving process; and
- In assessing the potential for corridor options to overlap with, and/or impact upon, areas of environmental constraint.

The constraints identification and analysis process has focused on technical, environmental and landscape constraints in the study area. This has included designated and sensitive areas which have been identified and defined according to a series of guidelines known as the Holford Rules and which has become a commonly accepted means of guiding transmission line routeing studies. The Holford Rules are included in **Appendix 1,** at the end of this report.

The Holford Rules, which form the basis for this routeing study, refer to a hierarchy comprising 'major areas of the highest amenity value' (Rule 1) and smaller areas of 'high amenity value' (Rule 2). No specific guidance is provided on what constitutes major or smaller areas but the rules set out a series of potential designations which may be considered as environmental and landscape constraints. Supplementary notes to the Holford Rules prepared by the National Grid in 1992 (and subsequently reviewed and clarified by Scottish Hydro-Electric Transmission Ltd and Scottish Power Transmission in 2003) also identify residential areas as being important on the grounds of 'general amenity'. It is unclear how 'general amenity' ranks in relation to the terms 'highest' and 'high' amenity which are used to describe features of the natural and cultural environment. Based on the project team's experience with other transmission line projects, particularly for issues of proximity of lines during construction and operation, in this study, residential areas of 5 or more house have been considered in the category of 'highest' amenity for the environment.

The analysis of constraints presented in Section 4: Baseline Information reviews the extent of the areas of highest and high amenity value which have been identified in the project study area. For this project, the analysis of constraints identified that there were relatively few areas of highest (or high) amenity value in the study area, and the approach has therefore required a more detailed analysis of constraints which might not otherwise have been required in more constrained corridors. Hence the study adopted a focus on 'lesser' areas of constraint and, due to the relatively limited numbers of designations and environmental constraints in the area, the approach has drawn very closely on landscape and visual constraints which were identified at an early stage as being significant in the context of the study area and which were likely to provide the basis for a reasonable comparison of the potential impacts of corridor options.

The Holford Rules 3 to 7 refer to the identification of route alignments and where these should be located to minimise environmental impact. These rules, and the accompanying guidance, have been taken into account in the process of identification of a preferred route alignment within the two preferred route corridors.

Section 4: Baseline Information

4.1 Introduction

The purpose of the baseline analysis was to highlight the key landscape, visual and environmental constraints and to identify technical constraints such as steep slopes. Collation of this information included identification of designated and sensitive sites, in order to provide a hierarchy of areas which should be avoided by the transmission line alignments. Collation and assessment of the constraints data at this stage was undertaken with regard to the levels of importance presented within the Holford Rules and referred to as areas of Highest and High Amenity (see Section 3: Study Approach and Methodology).

As the study progressed, an increasing level of detail in baseline information was used to inform the analysis. During the study, it was noted that there are a limited number of Highest Amenity sites within the study area but that it contains a significant number of High Amenity sites, refer to **Figures 5, 6a and 6b.** This has informed the approach adopted in the identification and appraisal of route corridors. Analysis of the constraints data was undertaken using Geographical Information Systems (GIS) to allow the digital data to be mapped and to assist in identification of alternative corridors which provide the necessary environmental, landscape and technical balance.

4.2 Landform

The southern section of the study area, from Gretna Substation to Ewe Hill Windfarm, is generally characterised by flat, agricultural land developing into gently undulating hills as one moves north. Ewe Hill windfarm is located in the higher upland area to the north of this section. The northern section, from Ewe Hill Windfarm to Newfield Windfarm, is more upland in nature and generally comprises gently undulating topography with more varied topography around the incised valleys of the Water of Milk and Corrie Water which dissect the northern part of the study area.

4.3 Landscape Character

The study area broadly falls within three landscape character types within the Dumfries and Galloway Landscape Character Assessment (Scottish Natural Heritage Review No. 94, dated 1998). The extents of each Landscape Character Type (LCT) are shown on **Figure 7**, they are:

- Flow Plateau LCT
- Upland Fringe LCT
- Foothills LCT

The southern section falls mainly within the Flow Plateau Landscape Character Type which is characterised by low lying ground, often in a waterlogged condition, which creates extensive marshy pastures. Areas of higher ground retain rough and improved pastures characterised by hedgerows and tree lined enclosures. This landscape has the following key characteristics:

- Mostly flat and gently rolling topography with an incline towards the Solway;
- Occasional long views over the Solway;
- Waterlogged pastures - ochre, green and brown;
- Large fields with hedgerows in poor condition and fences;
- Cattle grazing;
- Shelterbelts and small informally shaped plantations;
- Riparian woodlands; and
- Scattered farmsteads.

“The flat nature of this landscape can make vertical structures visually very obtrusive with few opportunities for screening”. However due to the uninhabited nature, limited structures may be accommodated where careful design and siting allows a fit with the landscape.

To the north of the Flow Plateau LCT, the study area is dissected by a narrow band of the Upland Fringe LCT, which predominantly lies in altitudes between 120m to 170m above sea

level. This is characterised by high, gently rolling pastures with an uneven topography and numerous minor valleys, ridges and hollows. This landscape type has the following key characteristics:

- Elevated rolling pastures;
- Improved and rough grassland in close proximity;
- Hedgerow banks and tree lines along roads in some lower areas;
- Dry stone dikes;
- Squared forest blocks, increasing forestation evident;
- Contrast between wide open areas and more intimate landform;
- Panoramic views over valley lowlands;
- Small bridges over incised burns; and
- Iron-age fortifications.

"There is limited potential for large scale development due to this areas high visibility from surrounding settled lowlands. Opportunities may exist for small scale developments to use local topography to be screened behind main visual horizons and in local depressions where maximum back clothing and screening effect could be gained".

The majority of the northern section of the study area falls within the Foothills Landscape Character Type. The foothills are generally found at altitudes between 170 and 250m and are characterised by a generally undulating landform with gently rounded summits and craggier peaks in places. This landscape has the following key characteristics:

- Foothills dissected by incised valleys;
- Semi improved pasture enclosed in medium - large fields by stone walls, grazed by sheep and cattle, some rough pasture and heath on higher ground;
- Trees in sheltered pockets with some copses on top of hills;
- Many scattered farmsteads and small settlements;
- Network of minor roads; and
- Numerous archaeological sites particularly Iron Age defensive and Roman monuments.

The scale of this landscape could accommodate the proposed development, however "the elevation and relief is such that sites may be highly visible." In addition, "in this landscape character type 'wild land' values and experience can be very important locally" and development of this nature may compromise this.

In addition to the above, the study area includes small areas of the Coastal Flats, Foothills with Forest and Southern Uplands Landscape Character Types. The report does not contain a description of these latter three Landscape Character Types, as the existing Gretna Substation is already located within the Coastal Flats LCT and less than 9km of the proposed overhead transmission line would pass through it. Although the study area encompasses a small part of the Southern Uplands and Foothills with Forest LCTs, none of the route options pass through it, therefore there are no direct impacts. In addition, route option sF was ruled out on landscape grounds and therefore there are also no indirect impacts on this landscape character type.

For the purposes of this routing study Gillespie's have further sub-divided up the study corridor into the following Local Landscape Character Areas (LCA). These are shown on **Figure 8**.

Lowland Farmland LCA

Located to the south of the study area, crossing in part over the English border, this landscape is characterised by its flat topography, scattered farmsteads, minor road network, woodland copses and field boundaries. Due to its low lying nature the land is of a higher agricultural quality than the rest of the study area and the majority of the land cover is improved grassland with some arable fields. Views around the area are fragmented due to the field boundaries which typically consist of managed hedgerows. A notable feature within this

landscape is the historic feature of Scots' Dike which has a belt of mature native woodland planting.

Transitional Farmland LCA

Located within a central band of the study area this landscape is a transitional landscape taking characteristics from the lowland farmland and upland pasture landscape character areas. The topography is more undulating in nature however there are numerous small tributaries and watercourses which create localised incised valleys. Settlements are generally isolated farmsteads with the notable exceptions of the villages of Corrie Common, Kirtleton and Waterbeck. The predominant land cover is rough pasture with some semi-improved areas. There has also been significant commercial woodland activity over the years and plantation woodland blocks at varying stages of growth characterise this area. Due to its upland nature longer distance views are obtainable, however these are dependant on the topography and woodland cover which can vary greatly as one moves around the area.

Upland Heath LCA

This landscape character area is located to the east of the study area and broadly replicates the coverage of the SNH Foothills Landscape Character Type. The landscape is upland and undeveloped and the majority of the land cover is heath with some scattered locations of unimproved grassland. The topography is varied and due to the elevated, undeveloped nature of the area panoramic long distance views are available from the summits and plateaux.

Plantation Woodland LCA

Located to the centre and the north of the study area these landscape character areas are generally characterised by a monoculture of commercial woodland. There are access tracks for recreation and forestry workers within these extensive swathes of woodland, however due to the nature of these areas, views are enclosed and limited to the surrounding woodland. Areas of clear felling are apparent in both woodland areas.

Upland Pasture LCA

Located towards the centre of the study area this landscape character area is sparsely settled and the majority of the land is characterised by rough pasture. The topography is varied with a range of approximately 100m and the landform is undulating with gently rounded summits and rolling valleys. Woodland cover is limited to small isolated pockets of plantation woodland which provide shelter for sheep, grazing this area. As a result of the topography, limited woodland cover and a lack of development, views from this area are elevated and long distance. However, due to the lack of access most views are not available to the public. Notable features upon the summits within this landscape are the hill forts associated with Iron Age settlers.

Intimate River Corridor LCA

Located to the north west of the study area, this landscape character area is focused around the Water of Milk and Corrie Water river valleys. The landscape is characterised by incised valleys, broadleaf woodlands and meandering watercourses. These areas are reasonably well settled due to the sheltered nature of this landscape and there is a comprehensive minor road network which follows the lower ground within the river floodplains. Views from individual properties are enclosed by the topography and woodland cover creating a sense of isolated intimacy.

4.3.1 Landscape Fit and Constraints

Landscape fit considers the landform of the study area and how it can be used to provide natural screening through sensitive siting. Areas where locating a power line would conflict with the existing landform are consequently avoided. Examples of these include avoiding summits, plateaus and ridgelines where power lines would be highly visible from surrounding areas. In addition, where possible, traversing valleys and steep slopes at right angles has been avoided where locating transmission lines and towers would adversely effect how these features are read at ground level. Points of conflict with the landform occur throughout the study area and the narrow corridors have been located to respond in a positive manner to the landform as far as possible. In addition, the routes will need to consider double climbing,

areas designated as special interest (whether scenically or of natural or cultural value), geological or climatic constraints.

4.3.2 Upland Landscapes

Upland landscape areas have been identified as a key constraint. These areas are generally above 200m altitude and undeveloped in nature. The landscape cover is dominated by heath moorland which contributes to a distinct landscape character within the context of the study area. Due to their upland, exposed and undeveloped nature it is considered that a development of this nature could have a significant negative effect on the character of these areas in addition to the visual effects associated with the prominent location. The main concentration of this landscape character type is located to the east of the large plantation woodland near Kirtleton. Refer to **Figure 9a** for locations.

4.3.3 Intimate Landscapes

The area directly to the south and southeast of Bow Hill (the location of the proposed Newfield Windfarm), between Gillenbie and the B7068, has been identified as an intimate, enclosed landscape. These landscapes are characterised by varied topography, extensive native broadleaf woodland and a higher number of scattered individual properties. These elements combine to create enclosed views from residential receptors where the introduction of a power line is deemed to have a significant visual impact. Refer to **Figures 9a-b** for locations.

4.3.4 Double Climbing

Double climbing is defined as areas where a proposed route would need to cross contours as opposed to following the contours to get from point A to point B when there are obvious opportunities to avoid this. As a general rule, and in accordance with the Holford Rules guidelines, we would seek to route along the lower ground to help minimise views of power lines on the horizon so where climbing upland can be avoided it is anticipated to benefit the receiving environment. Areas which have been identified as unnecessary areas of 'double climbing' include the high ground to the south of the B7068 and around Newland Hill. Further areas are indicated on **Figures 9a-b**.

4.4 Landscape Designations

Regional Scenic Areas (RSA) are areas of scenically valued landscape which form recognisable and comprehensible geographic units and the siting and design of any development should respect the special nature of these areas. The Langholm Hills Regional Scenic Area falls within the study area and is located to the north east, centred on the combination of upland glens and other attractive valley landscapes of Eskdale and the Ewes Water valley, and the adjacent Southern Uplands. The inter-visibility between this area and the proposals is considered as part of the assessment of landscape and visual effects due to the effects a development of this nature would have on the setting of this RSA. Refer to **Figures 9a** for locations.

4.5 Nature Conservation Designations

Bells Flow Site of Special Scientific Interest (SSSI) covers an area of approximately 70 hectares and is designated due to its status as an intermediate bog which supports several species of Sphagnum and the nationally scarce bog rosemary (*Andromeda polifolia*). It is located in the southern section of the study area, to the north of Chapelknowe. There are also two local wildlife sites, both of which are registered as lowland raised bog inventory sites, in the south section. One of these is located to the northeast of Chapelknowe and the other to the north of the Gretna Substation.

Consultation with local wildlife groups indicates that red squirrel, which is a protected species, may be present within the study area. Given the range of habitats, including woodland, hedgerows and watercourses, there is also considered to be potential for other protected species, such as otters, badgers and bats, to be present. Winterhope Reservoir may form a habitat resource for wildfowl, although consultation with local and national ornithological groups has not identified it as an important habitat.

4.6 Archaeology and Cultural Heritage

There are several Scheduled Ancient Monuments located throughout the study area. These comprise mainly former hill forts and are therefore mainly found in the upland areas. There are also 19 Category B and 21 Category C(s) listed buildings within the study area. The locations of these are indicated on **Figure 6a-b**

4.7 Geology and Soils

Geological maps indicate that there are several areas of peat within the study area. There are also several rock outcrops at and near the summits of hills in the upland areas. Soils of a reasonable agricultural quality are indicated to be present in the flatter farmland in the southern part of the south section, near and beyond the border with England.

4.8 Climate and Exposure

The degree of wind exposure and climatic conditions are important considerations in the design of a transmission line. High winds and ice can affect line construction, maintenance and reliability of supply. Therefore, exposed ridgelines and summits at high altitudes, which by their very nature tend to have greater wind speeds and lower temperatures, should be avoided wherever possible when routeing transmission lines.

4.9 Development and Planning

There are two local authorities responsible for the development plans within the study area:

- Dumfries and Galloway Council (most of the study area); and
- Cumbria County Council (for a very small part of the southern end of the study area).

Dumfries and Galloway Council

Structure Plan

The current Dumfries and Galloway Structure Plan was approved in 1999. It aims to "encourage the growth and development of sustainable communities in Dumfries and Galloway." The policies contained within the structure plan focus on supporting the development of the local economy, supporting urban and rural communities, protecting the natural and built environment and making the best use of services and facilities.

The quality of the natural and built environment is recognised as "one of Dumfries and Galloway's greatest assets, making an important contribution to the local economy through tourism and by supporting farming, forestry, fishing and the extraction of minerals. Some of these activities are going through a period of significant change leading to the examination of diversification opportunities in farming, while the scale of past forestry planting could provide opportunities for further wood processing activities. The quality of the local environment is also important to the quality of life of local people".

The structure plan recognises the importance of good service infrastructure which includes electricity to meet the needs of individuals, communities and businesses. It outlines that "proposals for major infrastructure provision on land not allocated for such uses, will be required to satisfy the Council on the following matters:

- the reason for selecting the site or route;
- impact on the landscape and the environment;
- discharges to air and water;
- traffic impact;
- safety, security and noise implication; and
- impact on the amenity of the area."

Local Plans

The Dumfries and Galloway Council area is covered by 4 adopted Local Plans. The current adopted plan relevant to the study area is the Annandale & Eskdale Local Plan which was approved in 2006. The Finalised Local Plan for Annandale & Eskdale has been prepared

within the framework of the Dumfries and Galloway Structure Plan and provides detail policy to support the general principles of the Structure Plan.

4.10 Agriculture and Forestry

The land uses in both sections are predominantly livestock farming. In addition, there are several areas used for shooting. There are several stands of commercial woodland within the study area, with the main stands being located to the east of Kirtleton and to the northeast of Corrie Common. However, it has been noted during site visits that there is significant timber cutting activity occurring, including the felling of a stand indicated as ancient woodland to the south of Little Whitriggs, Several stands of commercial forestry have been felled and some areas replanted in the Kirtleton and Corrie Common. There are also several small stands of ancient woodland, principally Cadgill Wood, near Chapelknowe and Corriehills, to the south of Corrie Common.

4.11 Recreation and Tourism

A caravan site is indicated on maps as being located to the north of Kirtleton and a picnic area is indicated to be located adjacent to woodland to the northeast of Corrie Common. The latter was noted, during a site visit, to be located within a former quarry at the end of a forestry access track and appears to be little used.

A few woodland walks and cycle trails are also indicated on maps, although several site visits have confirmed that there is fairly limited use of these.

4.12 Water Quality

There are several watercourses flowing throughout the study area, the main ones including:

- River Sark;
- Kirtle Water;
- Pokeskine Sike;
- Byre Cleuch;
- Water of Milk;
- Stidriggs Burn; and
- Corrie Water.

SEPA has introduced new water monitoring and classification systems that will provide the data to support the aim of the WFD that all water bodies are of good ecological status, or similar objective, by 2015. The WFD introduces a holistic approach to monitoring for a range of different pressures. The new classification system covers all rivers, lochs, transitional, coastal and groundwater bodies, and is based on a new ecological classification system with five quality classes; High, Good, Moderate, Poor and Bad. It has been devised following EU and UK guidance and is underpinned by a range of biological quality elements, supported by measurements of chemistry, hydrology (changes to levels and flows) and morphology (changes to the shape and function of water bodies).

The status of these watercourses ranges from Poor to Good with a number of unclassified watercourses.

4.13 Settlements

The main settlements within the south section of the study area include Chapelknowe, Evertown, Kirtleton and Waterbeck. The main settlement in the northern section is Corrie Common.

4.14 Individual Residential Receptors

Due to the fixed nature and interest in their surrounding environment, individual residential receptors represent a key landscape and visual constraint to be considered in the assessment of a development of this nature. There are numerous residential receptors located throughout the study area. To minimise the significance of impacts on these receptors a 150m buffer was placed around each property order to establish a zone of influence and to aid in the assessment of likely effects of each corridor. The 150m buffer zone was established

through field work, which determined that this distance would be the minimum acceptable in terms of encroachment of the route, within the vicinity of any residential receptor. In addition the viewing orientation and localised screening around each property is assessed through field work and referred to where appropriate.

4.15 Infrastructure

The main roads within the study area are the B6357, B722 and B7068. A high pressure gas main passes from southeast to northwest through the study area. Various minor electricity distribution lines and telephone lines cross the study area.

Section 5: Gretna to Ewe Hill Corridor Options, Corridor Appraisal and Preferred Route Alignment

5.1 Corridor Options

5.1.1 Definition of Route Options

Consideration of corridor route options connecting the Gretna and Ewe Hill Windfarm substations and the Ewe Hill and Newfield Windfarm Substations have been discussed separately and have been referred to as the south section and north section respectively. Section 5 is concerned with the south section (Gretna to Ewe Hill) only.

5.1.2 Broad Corridor Selection

Following the identification of the study area constraints listed in Section 4: Baseline Information, broad route corridors were initially defined between Gretna Substation and Ewe Hill Windfarm, which excluded all areas of Highest Amenity. It was considered that these broad corridors could be used as an intermediate stage prior to the identification of a preferred route alignment, by identifying the parts of the study corridor where the line could potentially be constructed whilst avoiding and/or minimising impact on the highest level constraints.

However, whilst these broad corridors did allow certain parts of the study area to be discounted as unsuitable due to the potential effect of the project on identified constraints, the identification and analysis of broad corridors did not reveal any clear preferences for route alignments.

Although this method of assessment was found to be inconclusive in identifying a preferred route alignment, the process used in identifying the broad corridors was repeated at a more localised level in the identification of the narrow corridors. This sieving process proved to be more successful and these narrow corridor options are described below.

5.1.3 Narrow Corridor Identification

The process for defining the narrow corridors adopted a similar methodology to that for the broad corridors, however High Amenity constraints were also considered to provide a 'second tier' of constraints to be avoided as far as possible in defining the corridor options. This process also specifically took account of guidance in the Holford Rules, particularly Rules 3 to 7 which require the following issues to be considered:

- Avoiding sharp changes of direction;
- Considering topography, particularly visual effects, associated with hills, ridges and skylines;
- Following open valleys where possible;
- Avoiding other transmission lines; and
- Avoiding recreational and residential land.

Each narrow corridor option is approximately 400m wide, where topographical constraints allow, which was considered to be a sufficient width to route a transmission line allowing for deviations around localised constraints. In certain areas of topographical constraint, however, the nominal 400m corridor had to be widened to accommodate more options for detailed routeing to avoid Highest and High Amenity areas. These corridors sought to avoid areas of Highest Amenity, and although some sections of the corridors crossed small parts of various Highest Amenity areas, it was considered that these could be avoided through detailed routeing of the alignment within the corridors. The identification of these corridors also sought to avoid, where practicable, High Amenity constraints including landscape features such as summits, steep slopes, ridgelines and intimate landscapes. However, given the nature of the topography, ground cover and land uses within the study area, it was not possible to completely avoid all of these constraints, but rather to identify a corridor which balanced all the criteria being considered.

As a result of this process, six narrow corridor options were identified between Gretna Substation and Ewe Hill Windfarm.

These corridor options (sA to sF) are described in the following section. For the locations of the narrow corridors, refer to **Figure 10**.

5.1.4 Gretna to Ewe Hill Narrow Corridors

Route sA

This route leaves Gretna Substation from the north, through a landscape dominated by the presence of existing pylons and heads north through agricultural land, passing scattered individual residential premises. It crosses the B6357 between the population concentrations of Milltown and Chapelknowe before turning northwest towards the southern tip of Bells Flow SSSI. The route briefly heads west to avoid new plantations at Solwaybank, before again continuing northwest through undulating pastureland with scattered tree cover and plantation woodland, towards High Stenries, dipping and climbing as it passes the northern side of High Stenries through a landscape characterised by its undulating land form, before climbing up to some immature plantation woodland around High Muir. It then dips down into the Kirtle Water valley and crosses the B722 to the south of West Linnbridgeford. The route then heads north, passing over open and exposed pasture to the west of Kirtleton, and crosses the B7068 west of Fallford. The route continues to head northwest, following the alignment of the Byre Cleuch burn before climbing over upland pasture and the ridge of Kirtlehead Hill and then dropping down to the location of the proposed Ewe Hill Substation, by Crawthat Hill.

Route sB

This route follows the alignment of Route sA before deviating at a point north of High Stenries, where it heads in a more north-northwesterly direction, passing through a landscape of scattered tree cover and rough pasture. It then passes to the east of Kirtleton, skirting the western edges of a large plantation. To the northeast of Kirtleton it begins to head northwest, crossing the B7068 to the northeast of Setthorns. The route then continues, northwest, following the alignment of Route sA, to the Ewe Hill Substation.

Route sC

This route follows the alignment of Route sA before deviating at a point north of High Stenries, where it heads in a more northerly direction, climbing up into the large plantation woodland to the northeast of Chapelhill. The route continues north-northwest, climbing onto higher ground until mid way through the woodland where it begins to drop down, crossing the Pokeskine Sike and exiting the woodland before crossing the B7068 to the north of Megsfield, through a gap between two groups of woodland planting, adjacent to the Gas Governor building. The route then heads to the northwest, over the summit of Ley Hill, before dropping down towards the Winterhope Reservoir access road and then finally following the alignment of Route sA.

Route sD

This route follows the alignment of Route sA before deviating to the east of High Stenries. The route then continues north, passing to the east of Allfornought, and over an upland, exposed and undeveloped landscape, characterised by heath ground cover. The route traverses three hills and passes through a section of plantation woodland. The route then heads northeast, crossing the B7068 to the south of Callisterhall. It climbs over the northern face of Ley Hill before dropping down to the west and towards the Winterhope Reservoir access road where it continues to follow the alignment of Route sA, to the Ewe Hill Substation.

Route sE

This route follows the alignment of Route sA before deviating to the northeast at the B6357 near Milltown. It then passes through open farmland until it reaches the east of Bogray where it heads north-northwest following the alignment of the River Sark. The landscape is characterised by pasture and is more enclosed along this section of the river and the route passes in close proximity to a number of residential properties and scattered groups of established native woodland. To the north of Barnglieshead, the route turns northwest

passing through an exposed upland landscape with very little development. The route then follows the alignment of route sD at the point southeast of Callisterhall to Winterhope Reservoir, before continuing along the route of sA to Ewe Hill substation.

Route sF

This route leaves Gretna Substation from the northeast, through a flat pasture landscape and passing to the east of Staffer before crossing the River Sark. It continues to cross flat pasture and then crosses Scots' Dike, an historic (and scheduled) linear earthwork, consisting of a substantial earth mound covered in a belt of mature woodland and forming a dominant feature in the surrounding flat landscape. The route continues through flat farmland, before crossing the B6357 to the east of Beckhall, where the route turns to the northwest. The route continues through a landscape characterised by plantation woodland, scattered isolated properties and bogs before following the alignment of route sE at the point north of Barnglieshead.

5.2 Corridor Appraisal

5.2.1 Corridor Assessment

Following a review of the constraints data it was considered that the most appropriate approach to appraising each of the narrow corridor options was through a high level assessment against environmental, landscape and visual, technical and economical criteria in order to filter out less favourable options.

The assessment was recorded using a simple matrix/framework approach. This allowed for a straightforward comparative assessment of the options once the assessment had been completed for each, and a concise means of recording the work undertaken.

This appraisal was undertaken qualitatively but employing professional judgement of the relevant specialists in each case and drawing upon knowledge of the study area and its baseline landscape and environmental conditions.

The following section presents a summary of the appraisal of the narrow corridors for the south section. As previously discussed, the process of identification of narrow corridors sought to avoid Highest Amenity and, where possible, High Amenity constraints. Since there are relatively few environmental constraints in the study area, the options analysis was based predominantly on landscape and visual effects. For the location of the narrow corridors in relation to landscape constraints refer to **Figure 10**.

5.2.2 Gretna to Ewe Hill Corridor Appraisal

All of the route options in the southern section converge to the southwest of Winterhope Reservoir before continuing north east to connect to the proposed location of the Ewe Hill Substation, by Crawthat Hill. Consultation was undertaken with ornithological organisations to identify if the area around the reservoir was a significant habitat for wildfowl and therefore whether there may be ecological impacts associated with a transmission line crossing this area. However, no significant issues were raised during this consultation process.

For the purposes of this section, as Routes sF and sE had the greatest number of constraints these will be discussed first.

Route sF crosses through the Upland Heath LCA as it passes to the east and north of the large plantation woodland within this area at Collin Hags. Whilst this LCA is less densely populated than the more southerly part of the study area, which is likely to lead to fewer residential receptors being affected, routeing the transmission line through this upland, exposed and undeveloped landscape is anticipated to lead to significant landscape and visual impacts, including poor landscape fit, loss of the locally important wild character and the potential for 'skylining' by the wood poles. As this landscape character type is unique to the study area and opportunities exist to preserve this character, it was considered that routeing through this area would be inappropriate.

Furthermore, Route sF crosses the alignment of Scots' Dike, on the English border. This is both a Scheduled Ancient Monument and striking earthwork feature with a mature belt of

broadleaf woodland. The proposed alignment is likely to result in removing a section of woodland which would significantly detract from the historical integrity and visual character of this landscape feature. For these reasons, Route sF was not considered any further.

Route sE also crosses through part of the Upland Heath LCA. In addition, it is anticipated that this route will have significant impacts on the properties, including listed buildings, around Barnglieshead and on the numerous scattered individual properties as the route follows the alignment of the River Sark, where the topography and woodland cover create a localised enclosed and intimate landscape. For these reasons Route sE was not considered any further.

The narrow corridors sA to sD all follow the same alignment before diverging at a point east of High Stenries. From here the routes deviate offering alternative routes between Kirtleton and Callisterhall.

Route sA passes to the west of Kirtleton and whilst the majority of Kirtleton sits within the valley of the Kirtleton Water, potentially screening views of any transmission lines along this alignment, the route crosses the B722 and the landscape in this area is on an open and exposed plateau, and the effects of any power lines on the nearby visual receptors are anticipated to be significant.

Route sB, which uses the plantation woodland as a backdrop, and Route sC, which uses the woodland as a screen, both avoid the Upland Heath LCA and are therefore considered to be the routes of least landscape and visual impact within this section. It has been noted during site visits that felling has taken place within the plantation woodland and further felling may take place in the future. To ascertain the preferred route a number of viewpoints and cross sections were taken through this area, refer to **Figure 11a-d**. (While in the short term any overhead transmission lines within corridor sC would be largely screened by the woodland, should this area be felled (which is considered likely following consultation with the woodland manager), then the transmission line would be clearly visible, over a wider area, and many of the wood poles would skyline' on the horizon. Furthermore, consultation with wildlife groups has indicated that red squirrel, which is a protected species, may use any remaining woodland as habitat. The sections also demonstrate that the optimum location for siting a transmission line with regard to the key view from the settlement of Kirtleton is broadly in line with route sB, as the trees are approximately the same height as the transmission line and would therefore provide a good backdrop.

Route sD also uses the plantation woodland as a screen for viewers from Kirtleton, however, as it passes through the Upland Heath LCA it is likely to result in an poor landscape fit, loss of wild character and 'skylining' due to its elevated nature. This option was, therefore, not considered further.

For the reasons set out above, Route sB is considered to be the route with least environmental and landscape impacts for the southern section.

There are also environmental and economic benefits associated with this corridor with regards to retaining the plantation woodland and limiting impacts on forestry operations. Furthermore, the Holford Rules recommends that all "other things being equal" it is preferable to "choose the most direct line" to reduce the need for sharp changes in direction and therefore requiring fewer angle poles. Route sB is the most direct of all the options considered.

5.3 Preferred Route Alignment

5.3.1 Gretna to Ewe Hill Preferred Route Alignment Criteria

The criteria used to identify these alignments was based on Rules 3 to 7 of the Holford Rules and with due regard to the localised landform and topography within the preferred corridors.

This was an iterative process which involved design, high level assessment and re-design to arrive at an appropriate route within the preferred narrow corridor and the following design principles were considered:

- avoiding where possible shorter than required distances between poles (i.e. minimising the total number of poles on the route alignment);
- minimising the number of changes in direction to reduce the number of angle poles required (which are more complex in design and more visually intrusive as there will be more stays and more pole top steelwork);
- considering the location of each individual pole in an attempt to distance them as far as possible from nearby residential receptors on the route alignment;
- using detailed routing to avoid woodland copses and other landscape features where possible; and
- using detailed routing to avoid encroaching on the 150m trigger zone of individual residential properties within the narrow corridors.

This is not an exhaustive list and the proposed route alignment considered a number of environmental, landscape and visual constraints to arrive at a balanced selection. An overview of the design of each alignment is discussed below.

5.3.2 Gretna to Ewe Hill Preferred Route Alignment

The approximate length of this route alignment is 15 kilometres, refer to **Figure 12**. As one travels from south to north the detailed routing attempts to minimise adverse impacts by:

- following a consistent offset of 80m where the proposed route runs parallel to the existing Scotland – England inter-connector transmission line to help minimise localised cumulative visual impacts in this area;
- avoiding the new plantation at Solwaybank
- avoiding the small summits and high ground as far as possible in the mid section of the route near High Stenries to minimise visual impacts on nearby residential receptors;
- aligning the powerline close to the plantation woodland, to the east of Kirtleton, to minimise visual impacts on this settlement and West Linnbridge; and
- following the Byre Cleuch burn (i.e. the low ground) as the alignment travels upland to meet the Ewe Hill Substation tie in by Crawthat Hill to achieve the best landscape fit.

Section 6: Gretna to Ewe Hill Corridor Options, Corridor Appraisal and Preferred Route Alignment

6.1 Corridor Options

6.1.1 Definition of Route Options

Consideration of corridor route options connecting the Gretna and Ewe Hill Windfarm substations and the Ewe Hill and Newfield Windfarm Substations have been discussed separately and have been referred to as the south section and north section respectively. Section 5 is concerned with the north section (Ewe Hill to Newfield) only.

6.1.2 Broad Corridors

Following the identification of the study area constraints listed in Section 4: Baseline Information, broad route corridors were initially defined between Ewe Hill Windfarm and Newfield Windfarm, which excluded all areas of Highest Amenity. As discussed in Section 5.1.2, the identification and analysis of broad corridors did not reveal any clear preferences for route alignments.

Although this method of assessment was found to be inconclusive in identifying a preferred route alignment, the process used in identifying the broad corridors was repeated at a more find grained level in the identification of the narrow corridors. This sieving process proved more successful and these narrow corridors are described below.

6.1.3 Narrow Corridor Identification

As discussed in Section 5.1.3 the process for defining the narrow corridors adopted a similar methodology to that for the broad corridors. As a result of this process five options were identified between Ewe Hill Windfarm and Newfield Windfarm.

These corridor options (nA to nE) are described in the following section. For the locations of the narrow corridors refer to **Figure 13.**

6.1.4 Ewe Hill to Newfield Narrow Corridors

Route nA

This route leaves Ewe Hill Substation from the northwest before turning southwest on the northern side of the summit of Crawthat Hill. It then descends steeply, passing to the south of a hill fort, on Newhall Hill, where it begins to head west into open farmland and crosses the B7068 to the south of Paddockhole. The route continues west, following the alignment of the Water of Milk through a steep sided valley covered in established native woodland. The route then turns northwest and crosses the Water of Milk, to the north of Linnhall, and climbs through undulating, bleak, pastoral farmland characterised by stone dikes and small tributaries. It passes to the southwest of a hill fort on the summit of Pyatshaws Rig, before descending into the valley between Corrie Common and Corriehalls. It passes through some immature plantation woodland before beginning to descend, skirting to the south of established plantation woodland. The route continues to descend through open pastoral farmland into the floodplain of the Corrie Water. From this point the route would pass through open pastoral farmland to the location of the proposed Newfield Substation, at Hogg Hill.

Route nB

This route leaves Ewe Hill Substation from the west-northwest through a natural dip in the landscape and descends to the north of Crawthat Hill through open pastoral farmland. The route passes Milton House, a listed building, and crosses belts of established native woodland associated with other properties in the vicinity. The route then turns to the northwest and crosses the Water of Milk, before climbing steeply up the side of the river valley. At the top of the slope, the route crosses a narrow road and then passes through a woodland shelter belt before crossing the lower ridgeline north of Birsca and then descending down to Stidriggs Burn. On the western side of the burn, the route begins to climb up through

bleak pastoral farmland and over the plateau of Pyatshaws Rig, with a hill fort located to the south. The route then follows the alignment of Route nA from the base of Pyatshaws Rig.

Route nC

This route leaves Ewe Hill Substation from the northwest, following the alignment of a small burn down the side of Crawthat Hill, passing to the north of Pearsby Hall and through some established belts of native woodland. It then follows the alignment of the contours of Craighousesteads Hill before descending down into the river valley of the Water of Milk. The route crosses the Water of Milk to the south of the meeting point with Booths Burn, before climbing steeply out of the valley. The route then continues to climb through a bleak pastoral landscape, passing to the north of the properties at Stidrigg, before it crosses established plantation woodland and skirts the high ground to the north of Corrie Common. The route follows the hillside down towards the floodplain of the Corrie Water to the west, past some established plantation woodland to the north and some recently felled woodland to the south. On the western side of the Corrie Water, it would follow up the side of the hill and over a small road to the Newfield Substation.

Route nD

This route heads north from the substation, for a short distance, passing to the west of Mid Hill and then follows the line of an existing farm track around to the north-northwest and over the northern side of Craighousesteads Hill, before descending down into the river valley of the Water of Milk. The valley sides of the Water of Milk are less pronounced in this area than in those described previously, with gentler slopes on the western side. The route crosses the Water of Milk, north of Craighousesteads, and continues in a westerly direction for approximately 1.5km, before following route nC to the north and east of Corrie Common.

Route nE

This route leaves Ewe Hill Substation from the north before descending to low ground through pastoral upland farmland. On the eastern side of Pike Knowe, the route turns to the northwest and follows the Capel Burn downwards through a transitional landscape of upland heath and scattered trees to pastoral farmland. The route then follows the base of Newland Hill to the northwest and crosses the Capel Burn and Water of Milk to the north of Capelfoot. The route turns west to the north of Upper Whitcastles and then crosses the ridgeline to the south of Whitcastles. The route then crosses the pronounced valley of Booths Burn, before crossing established plantation woodland and emerging to the south of a picnic area. The route continues to descend to the southwest and follows the alignment of route nC and nD at a point west of the established plantation woodland, by Corrie Common.

6.2 Corridor Appraisal

6.2.1 Corridor Assessment

As discussed in Section 5.2.1, following a review of the constraints data it was considered that the most appropriate approach to appraisal each of the narrow corridors options was through a high level assessment against environmental, landscape and visual and technical criteria in order to filter out less favourable options.

The following section presents a summary of the appraisal of the narrow corridors for the north section. The process of identification of narrow corridors sought to avoid Highest Amenity and, where possible, High Amenity constraints. Since there are relatively few environmental constraints in the study area, the options analysis was based predominantly on landscape and visual effects. For the location of the narrow corridors in relation to landscape constraints refer to **Figure 13**.

6.2.2 Ewe Hill to Newfield Corridor Appraisal

Route nA would impact on views from Corrie Common, which are primarily focused to the south, as it passes to the south of this settlement through an open valley. In addition, Route nA could potentially impact on the setting of two Scheduled Hill Forts at Pyatshaws Rig and to the south of Newhall. There are also a concentration of potential landscape and visual constraints as the route passes through the Intimate River Corridor LCA, near Paddockhole,

including loss of native broadleaved woodland and impacts on close range, enclosed views from properties within this area.

Similarly, Route nB impacts on views from Corrie Common, traverses the edge of two plateaus upon which hill forts are located and contributes to potential landscape and visual effects as it crosses the Water of Milk flood plain. As Corrie Common is the significant settlement within this section and avoiding impacts on views from it is considered a priority, and due to the deeply incised valley sides around the Water of Milk which make achieving a landscape fit with the proposed route difficult, routes nA and nB are not considered viable.

Route nC crosses the Water of Milk at a section where the topography presents difficulties in finding an acceptable landscape fit, due to the steeply incised valley sides, as well as passing in close proximity to three individual properties. Furthermore, the focus of views for properties around the Water of Milk is to the south, resulting in the alignment of this route potentially impacting on views from a number of farmsteads and dwellings further upstream. Although Route nC also passes close to the north of Corrie Common, and a number of the properties do have views to the north, these views are of commercial forestry plantations, including a large area that has recently been felled and replanted. However, due to the section which gives rise to topographical difficulties, this corridor has not been considered further.

Route nD presents fewer topographical conflicts than Route nC, but as the route deviates to the north of Route nC, it crosses the plateau of Craighousesteads Hill which has a hill fort at its summit. However, this area has a number of other man-made interventions in the landscape, including a phone mast, overhead power lines and views of the Minsca Windfarm. Despite the proximity of the proposed route to the setting of the hill fort, this feature is neither visible nor accessible by the public. Between Ewe Hill Substation and the hill fort, Route nD passes through a valley with stands of mixed woodland, before passing between properties at Capelfoot and Craighousesteads, but at distances of approximately 0.5km and these properties benefit from localised screening by existing stands of mature, mixed tree planting. As the route passes to the north of Corrie Common, the issues are the same as set out for Route C, however, the proposed line would be approximately 1km away from the properties and eventually back-dropped, again, by coniferous plantations, following re-planting . The property at Little Whitriggs would experience direct and close views of the proposed route, although this could be alleviated by routeing the line as far back as is possible and the recently re-planted mixed woodland will eventually, provide a backdrop to the line. Despite the issues regarding the proximity to Corrie Common and Little Whitriggs, this route does present a reasonable landscape fit and is more direct than Route nE.

Route nE takes a longer route through an open and attractive upland landscape, which currently has no other significant overhead lines or infrastructure. Shortly after leaving the Ewe Hill Substation the route passes between Newland Hill (with remains of an ancient hill fort) and Pike Knowe which could give rise to some technical constraints due to the steepness of the slopes and the proximity of the gas main. The route also passes to the north of properties at Capelfoot, Upper Whitcastles and Whitcastles, all of which would have close views of the proposed overhead line. The route passes through plantation woodland but consultation with the woodland manager indicates that this section of the woodland is likely to be felled in the near future, so any screening from Corrie Common would be lost (until the new trees had matured sufficiently). This alignment also passes through areas accessible to the public for walking and picnicking and would start to impact on views from properties at Cowburn, Burnfoot Cottage and Wynholm. The same issues as set out for Route nD, regarding Little Whitriggs would also apply to Route nE. The issues regarding the properties at Capelfoot, Upper Whitcastles and Whitcastles would be mitigated by local screening of groups of trees views from Upper Whitcastles and Capelfoot are orientated south.

Both Route nD and Route nE have similar and reasonably equal issues regarding environmental and landscape impacts and both are considered further although other technical constraints are likely to also influence the final selection of the northern route.

6.3 Preferred Route Alignment

6.3.1 Preferred Route Alignment Criteria

Two route alignments were identified for further consideration, within the north section, utilising the same criteria as set out in Section 5.3.1.

6.3.2 Ewe Hill to Newfield Preferred Route Alignment

The approximate length of Route nD is 8km and Route nE is approximately 9.5km. As one travels from east to west the detailed routing for Route nD attempts to minimise adverse impacts through:

- following the valley between Craighousesteads Hill and Pike Knowe and taking advantage of the groups of trees for screening to achieve a good landscape fit;
- routeing the overhead line away from as many properties as possible;
- routeing the overhead line through recently felled coniferous plantation rather than mature woodland groups;
- taking the shortest route practicable.

For Route nE, attempts to minimise adverse impacts were considered by:

- following the low ground as far as possible as the alignment heads towards Capel Burn to achieve a good landscape fit;
- following the direction of the contours as far as possible as the alignment passes through Capel Burn valley to achieve the best landscape fit;
- avoiding the small blocks of plantation woodland to the south of Whitcastles to minimise the effects on landscape features;
- passing through the plantation woodland north of Corrie Common at its narrowest section to minimise the clear felled area required to accommodate the power line thus reducing landscape impacts; and
- using the breadth of the narrow corridor to distance the alignment as far as possible from Corrie Common to minimise visual impacts on this settlement.

After very careful deliberation of all the technical constraints, Route nD **(refer to Figure 14)** was considered, on balance, to be the preferred route, for the following reasons:

- fewer and reduced visual impacts from residential properties;
- route avoids having to cross the gas pipeline, which represents a significant technical and economic constraint;
- route avoids public walking areas within forestry plantation;
- route avoids introducing this form of manmade intervention into an area of upland landscape character which currently has minimal interventions within it;
- shortest route

The preferred route alignments, for both the north and south sections, as shown on **Figure 15** have attempted to select a route of least environmental, landscape, visual and technical constraints based on the information assessed to date. The following section goes on to outline how the preferred routes will become proposed routes following the public consultation process.

Section 7: Next Steps

7.1 The Next Steps

7.1.1 Selection of the Proposed Routes

At the conclusion of the consultation process, proposed routes will be selected by SPT after consideration of:

- all the comments and responses made by statutory and other interested parties during the consultation process;
- the appraisal of options on both route corridors;
- having regard to all other matters that SPT consider to be relevant.

7.1.2 Scoping

Following consultation, it is SPT's intention to submit a Scoping Report to the Scottish Ministers with a written request under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 for their opinion as to the information to be provided in the Environmental Statement that SPT intends to prepare. The Scoping Report will set out the proposed structure and content of the Environmental Statement and identify the possible effects on the environment of the proposed route alignments. The scoping report will reference this Consultation Document.

7.1.3 Detailed Studies

Further detailed studies including technical studies will be undertaken for the preparation of the Section 37 application and the Environmental Impact Assessment (EIA). The Environmental Statement, which reports the findings of the EIA, will provide a detailed visual and environmental assessment of the proposed routes and will include all appropriate mitigation measures. Computer aided techniques will be used to assist the evaluation of the visual effects of the proposed routes.

7.1.4 Statutory processes

The Environmental Statement will assess the environmental impact of the proposed route alignments, which will be developed from the preferred route alignments identified in this Consultation Document following public consultation. It is envisaged that this process will identify the main environmental considerations. The Environmental Statement will incorporate relevant information from this document and the consultation process. Following further detailed environmental and technical assessment, it may identify localised deviations from the proposed route alignments in order to mitigate local impacts. The Environmental Statement will identify and describe in detail the environmental effects of line construction and operation and will identify all appropriate mitigation measures.

FIGURES

Legend

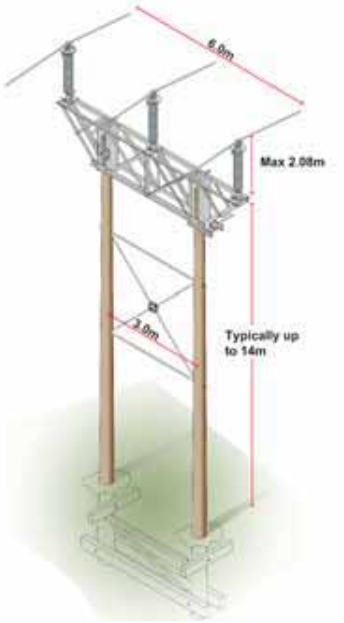
- Substations

Notes

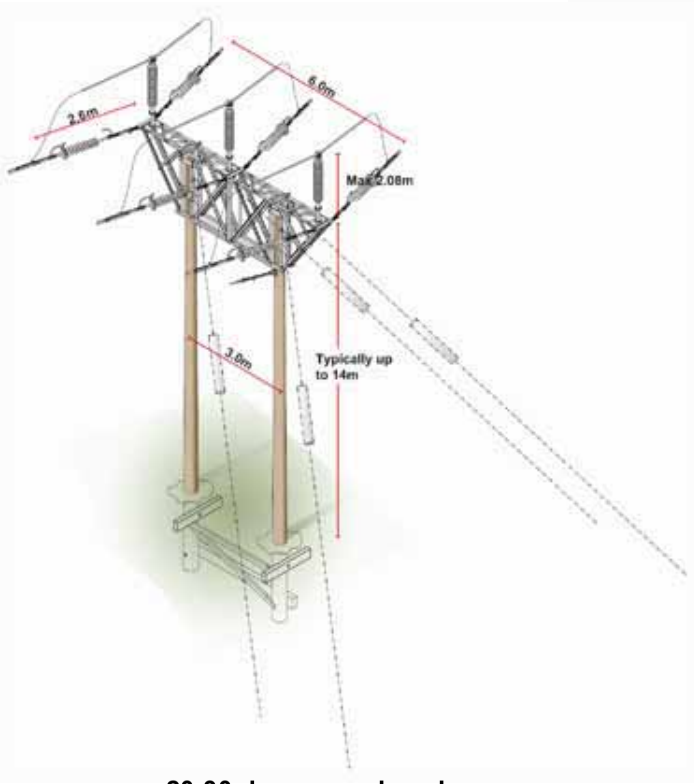
Figure 1
Project Context Plan

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

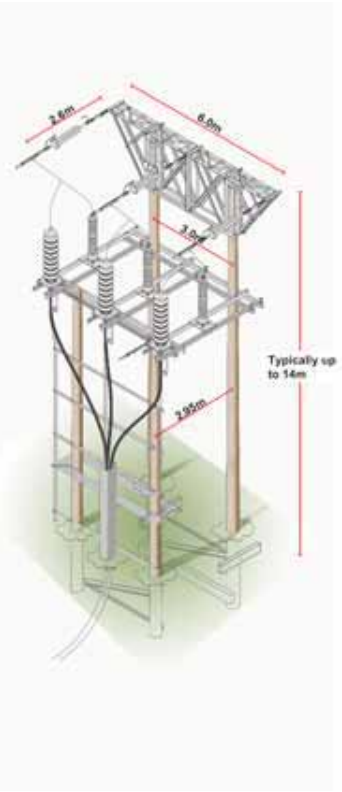
Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Straight line poles



20-30 degree angle poles



Terminal structure

Legend

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Notes

Images provided by
CAPITA LOVEJOY

Figure 2
Typical Heavy Duty Wood Pole Construction Images

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 17.08.09
Revision: -
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Legend

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Notes

Figure 3
Typical Heavy Duty Wood Pole Construction Images

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
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Legend

- Study Area
- Buffer Area

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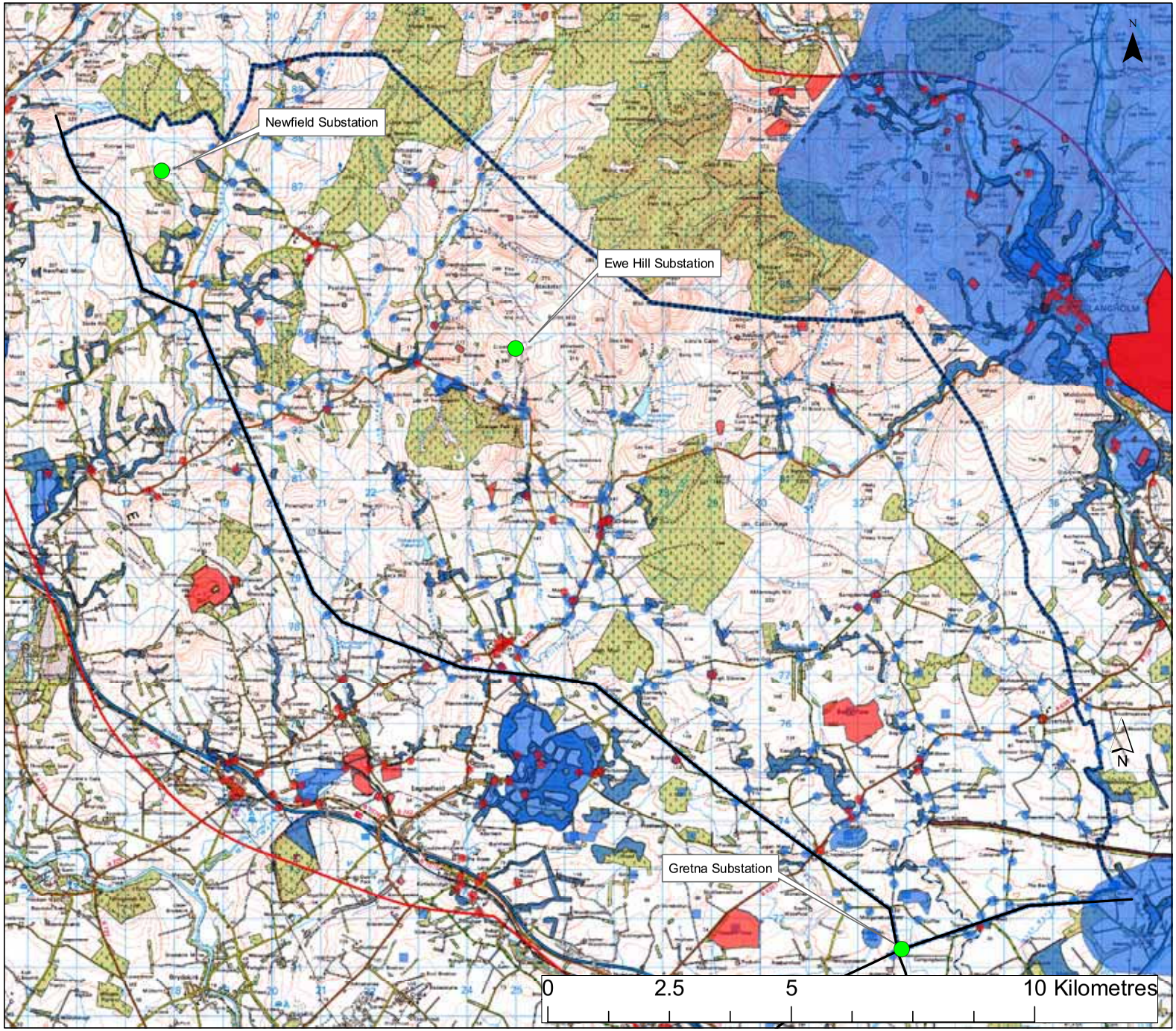
Notes

Figure 4
Study Area and Buffer Area

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Buffer Area
- Substation Locations
- Highest Amenity Constraints
- High Amenity Constraints

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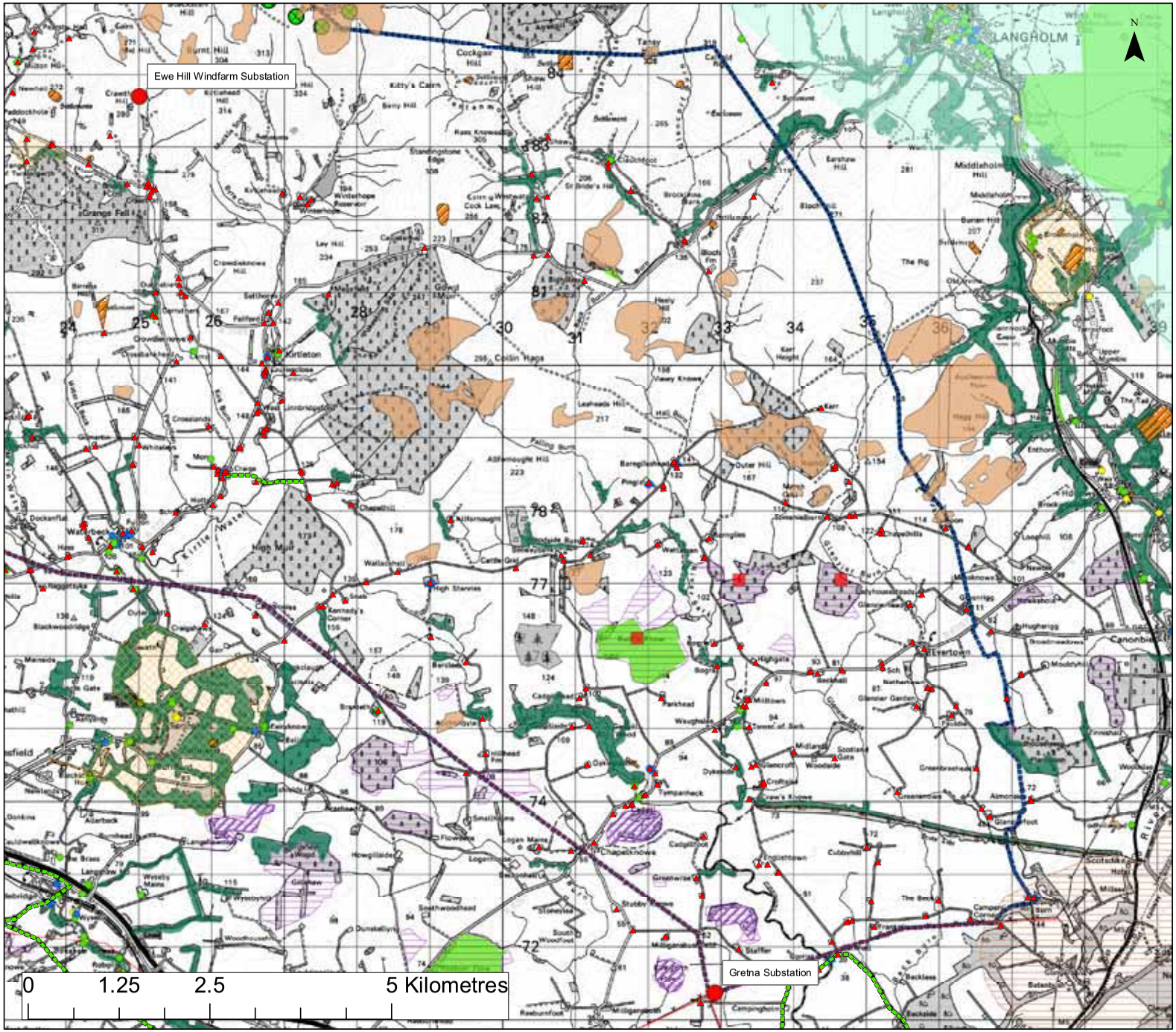
Notes

Figure 5
Highest and High Amenity Constraints

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Existing Transmission Lines
- Substation
- Proposed Wind Turbine
- Site of Special Scientific Interest
- Ancient Woodland Inventory Site
- Local Wildlife Site
- Intermediate Bog Inventory Site
- Blanket Bog
- Bog / Mire
- Scheduled Ancient Monument
- Category A Listed Building
- Category B Listed Building
- Category C Listed Building
- Non-Inventory Designated Landscape
- Regional Scenic Area
- Landscape of County Importance (Cumbria County Council)
- Residential Property
- Right of Way

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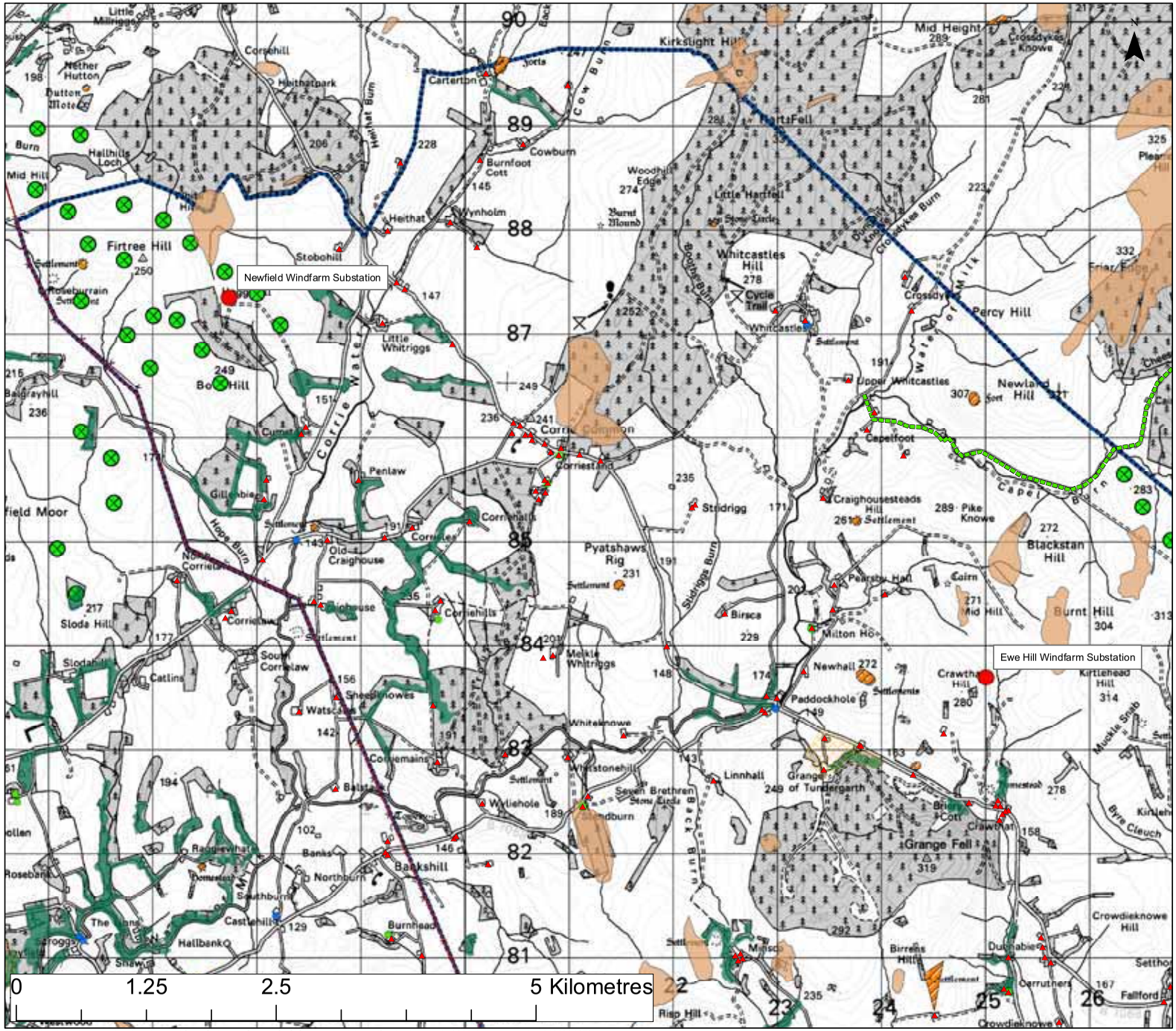
Notes

Figure 6a
Gretna to Ewe Hill - Constraints Map

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Existing Transmission Lines
- Substation
- Proposed Wind Turbine
- Site of Special Scientific Interest
- Ancient Woodland Inventory Site
- Local Wildlife Site
- Intermediate Bog Inventory Site
- Blanket Bog
- Bog / Mire
- Scheduled Ancient Monument
- Category A Listed Building
- Category B Listed Building
- Category C Listed Building
- Non-Inventory Designated Landscape
- Regional Scenic Area
- Residential Property
- Right of Way

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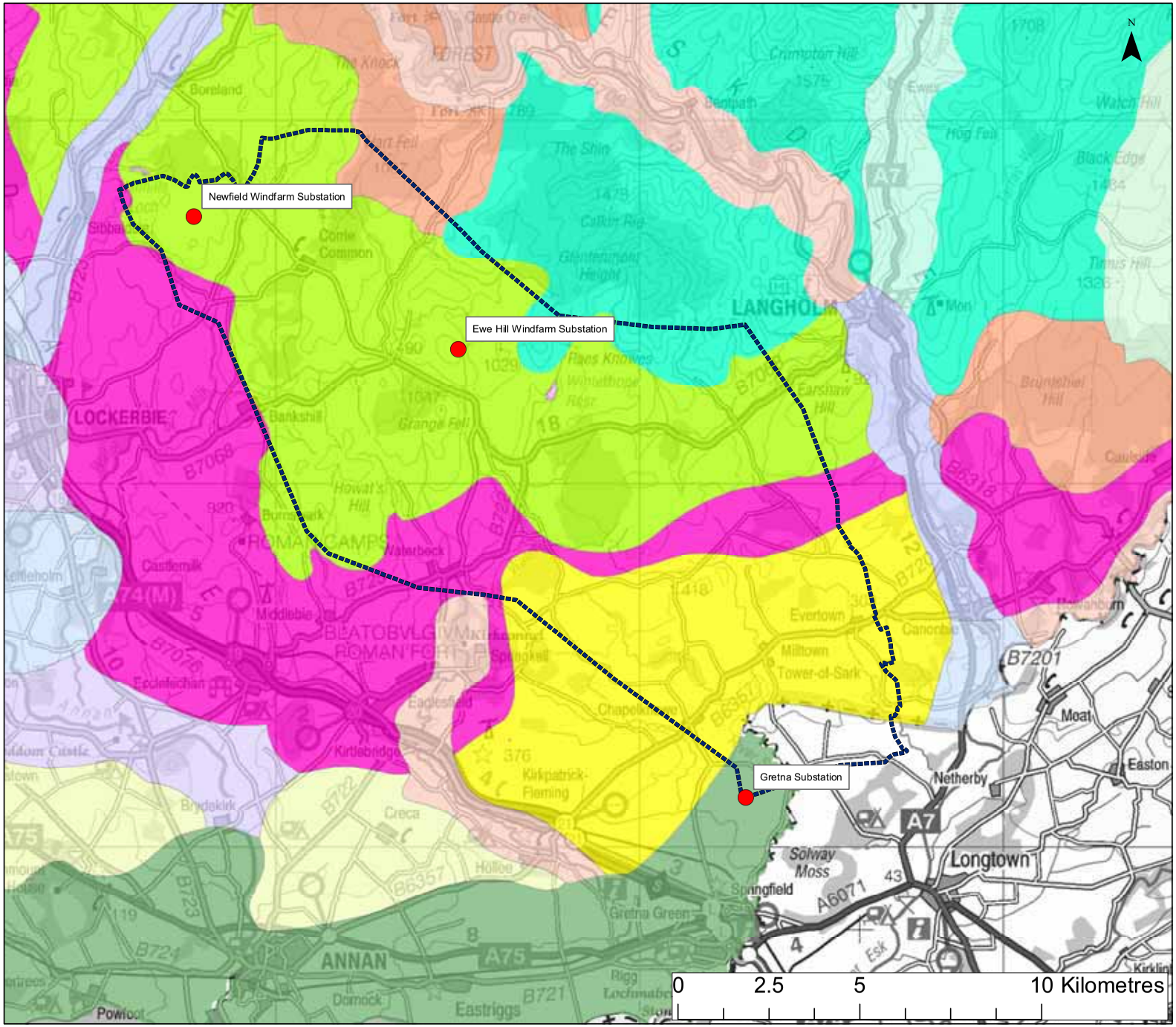
Notes

Figure 6b
Ewe Hill to Newfield - Constraints Map

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Substations
- Flow Plateau LCA
- Upland Fringe LCA
- Southern Uplands LCA
- Foothills LCA
- Foothills with Forest LCA
- Coastal Flats LCA

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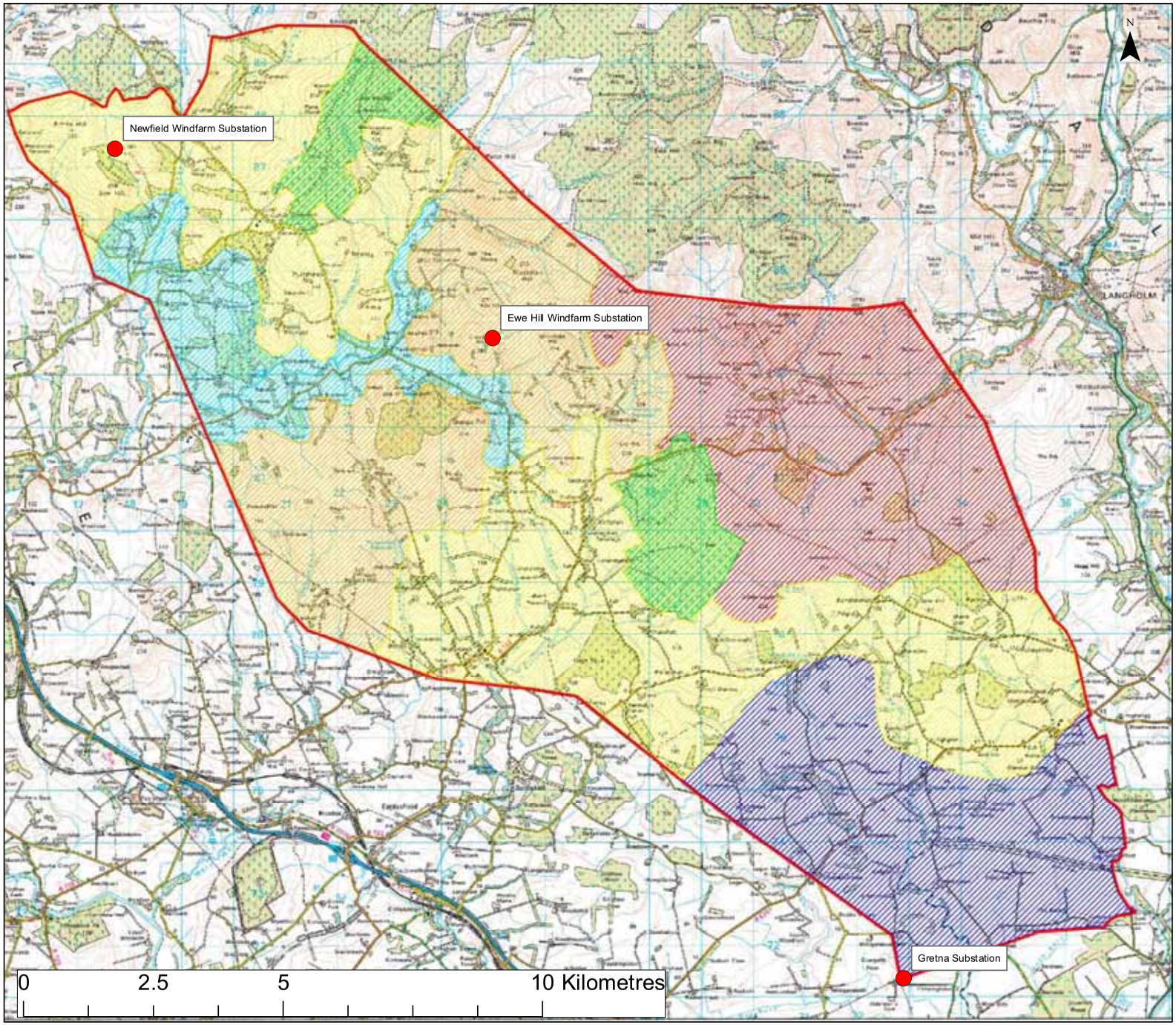
Notes

Figure 7
SNH Landscape Character Types

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 14.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Substations
- Lowland Farmland
- Intimate River Corridor
- Transitional Farmland
- Upland Pasture
- Upland Heath
- Plantation Woodland

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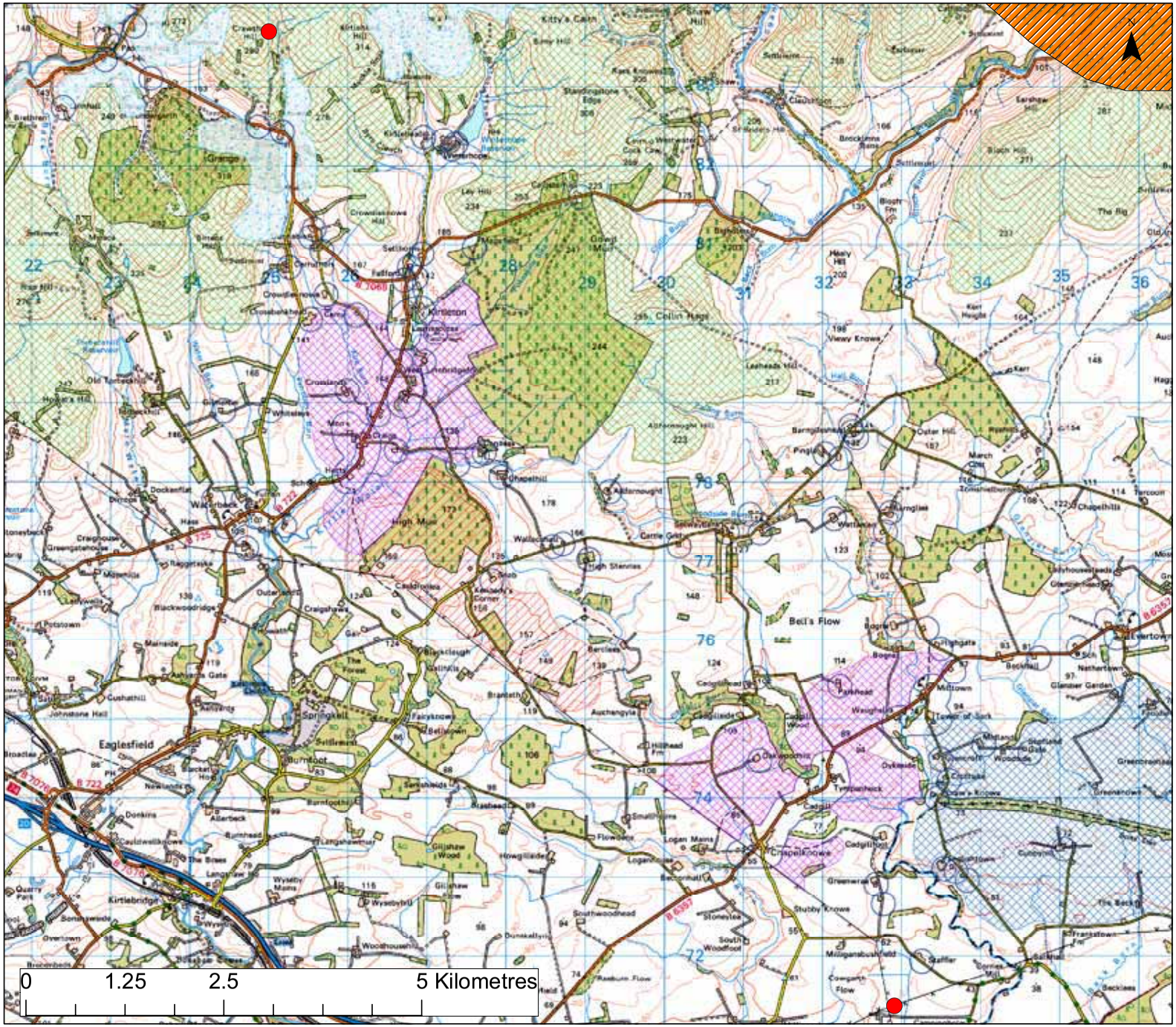
Notes

Figure 8
Gillespies Landscape Character Types

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 14.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Substations
- Residential receptor (150m buffer)
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- Upland landscape
- Intimate landscape
- 'Double climbing'
- Regional Scenic Area

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Notes

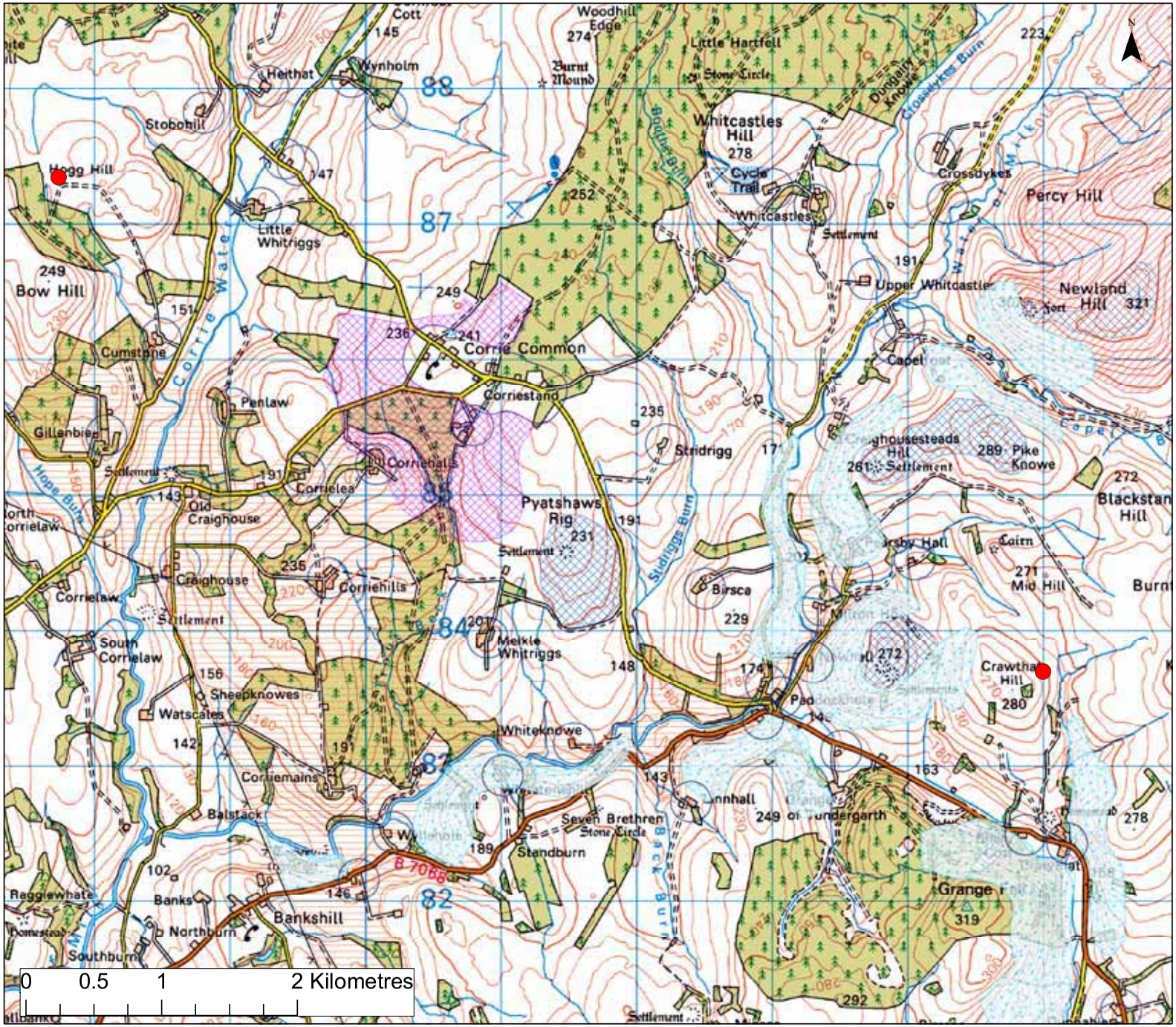
Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 9a
Gretna to Ewe Hill -
Landscape Constraints

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 14.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Substations
- Residential receptor (150m buffer)
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- 'Double climbing'
- Intimate landscape
- Regional Scenic Area

GILLESPIES WSP

Notes

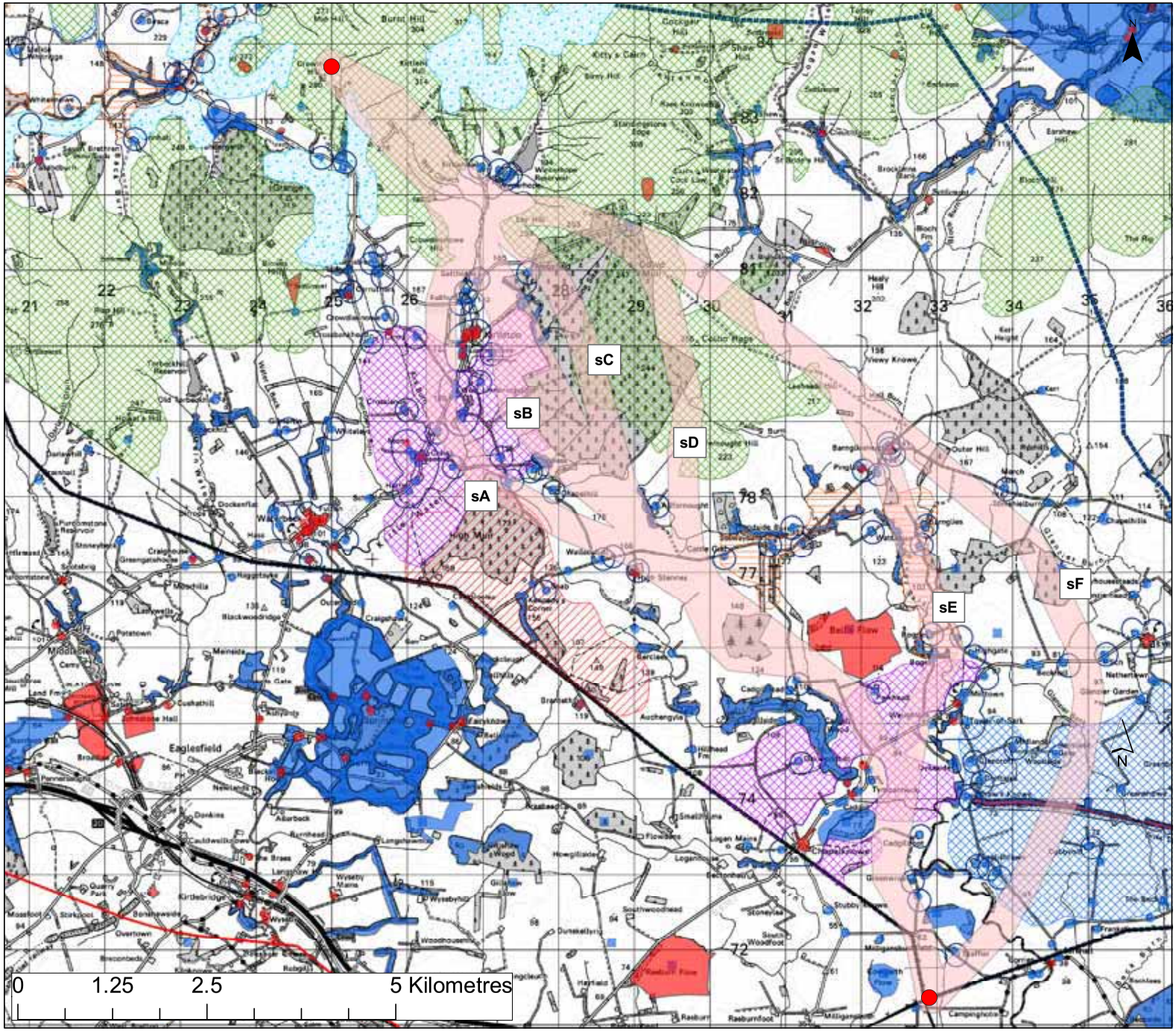
Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 9b
Ewe Hill to Newfield - Landscape Constraints

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 14.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Substation Locations
- Narrow Corridor
- Highest amenity constraints
- High amenity constraints
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- Upland landscape
- Intimate landscape
- 'Double climbing'

GILLESPIES WSP

Notes

Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 10
Gretna to Ewe Hill -
Narrow Corridors

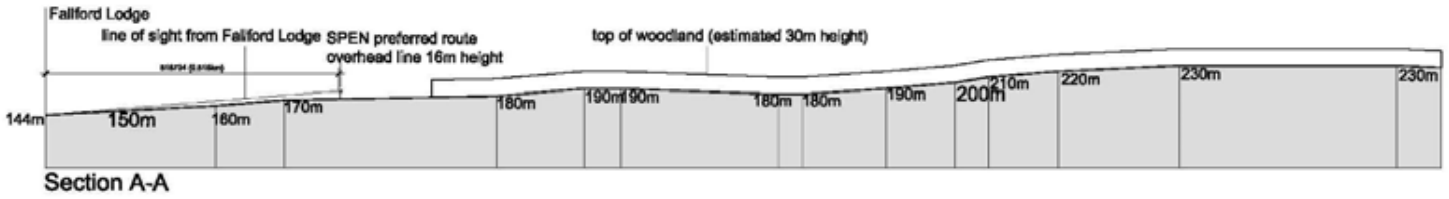
Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 17.08.09
Revision: -
Drawn by: AR
Checked by: SI

Section Location (scale 1:50,000 @ A3)

Existing View



Section A-A

Legend

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Notes

Figure 11a
Section AA - Narrow Route Corridor Selection sB/sC

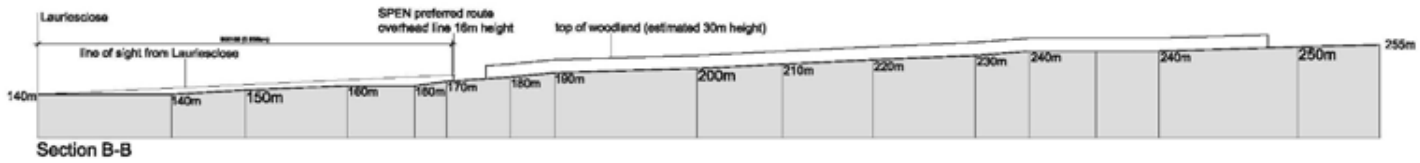
Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI

Section Location (scale 1:50,000 @ A3)

Existing View



Section B-B

Legend

GILLESPIES WSP

Notes

Figure 11b
Section BB - Narrow Route Corridor Selection sB/sC

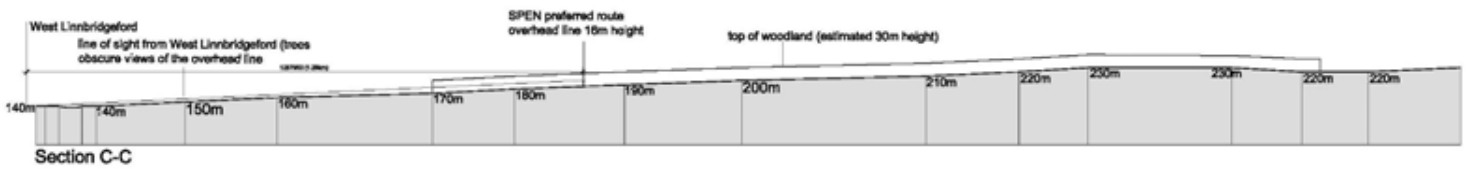
Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI

Section Location (scale 1/50,000 @ A3)

Existing View



Section C-C

Legend

GILLESPIES WSP

Notes

Figure 11c
Section CC - Narrow Route Corridor Selection sB/sC

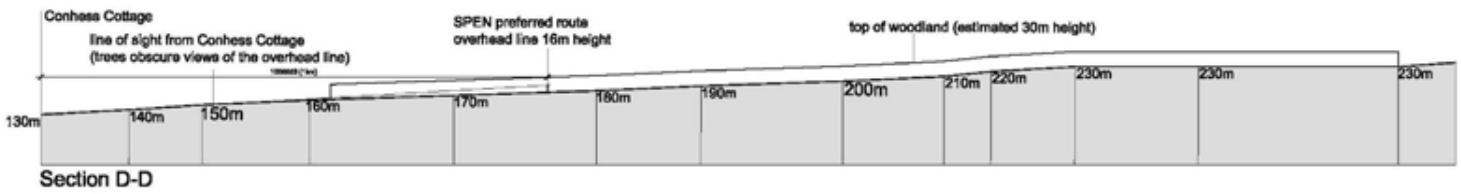
Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI

Section Location (scale 1/50,000 @ A3)

Existing View



Section D-D

Legend

GILLESPIES WSP

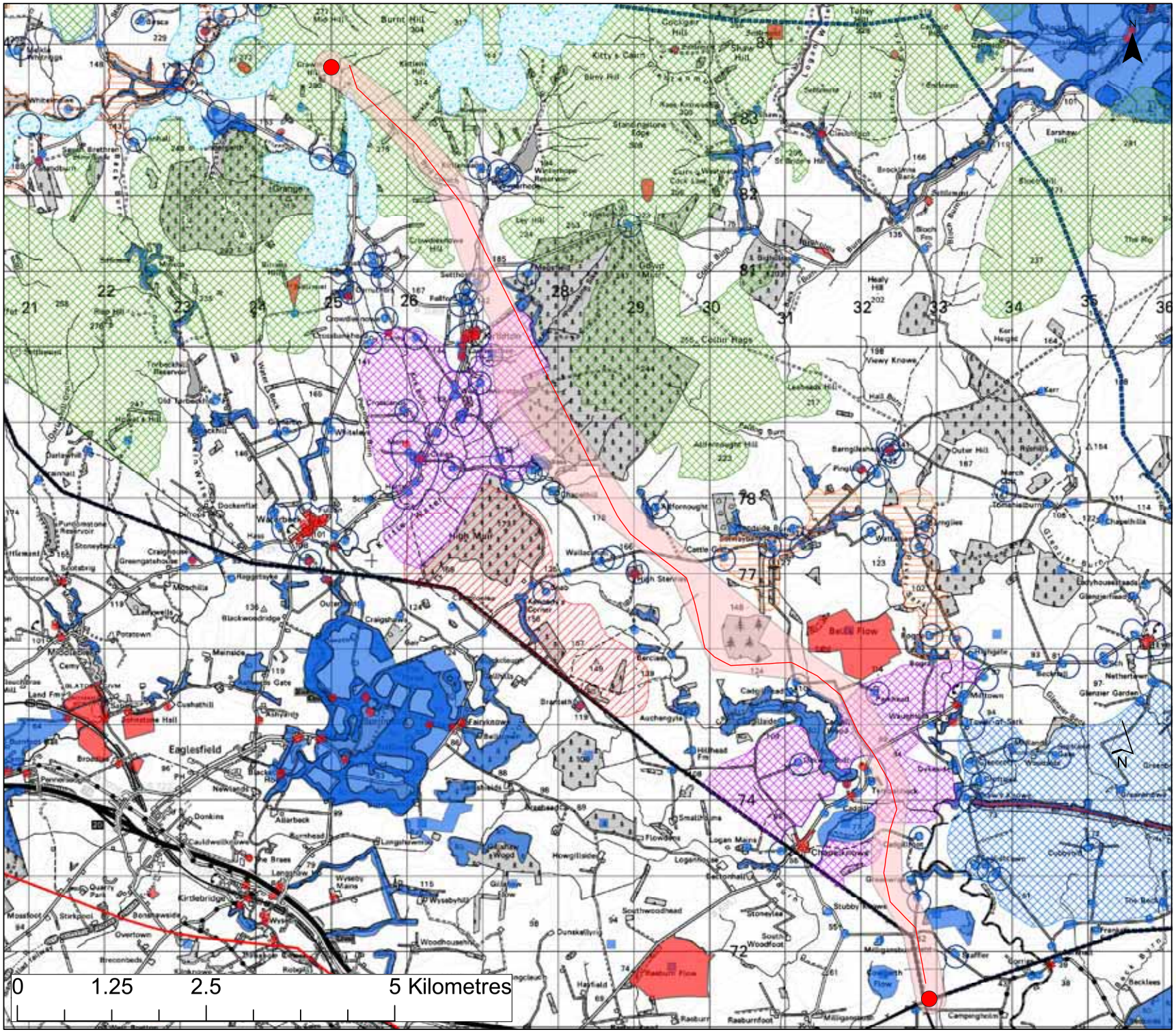
Notes

Figure 11d
Section DD - Narrow Route Corridor Selection sB/sC

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 12.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Substation Locations
- Narrow Corridor
- Highest amenity constraints
- High amenity constraints
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- Upland landscape
- Intimate landscape
- 'Double climbing'
- Preferred Route Alignment

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Notes

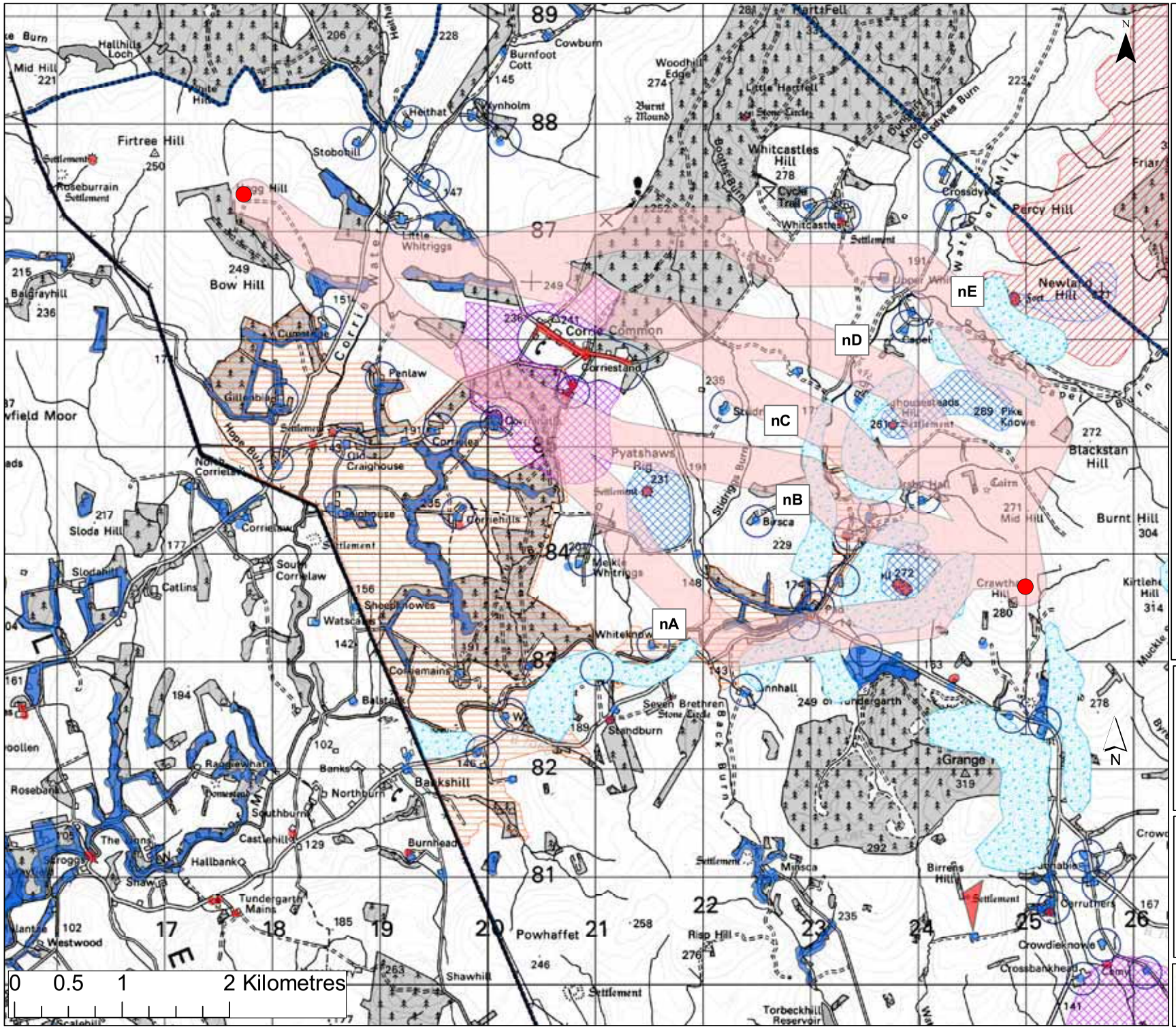
Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 12
Gretna to Ewe Hill -
Preferred Alignment

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 17.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Substation Locations
- Narrow Corridor
- Highest amenity constraints
- High amenity constraints
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- Intimate landscape
- 'Double climbing'

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Notes

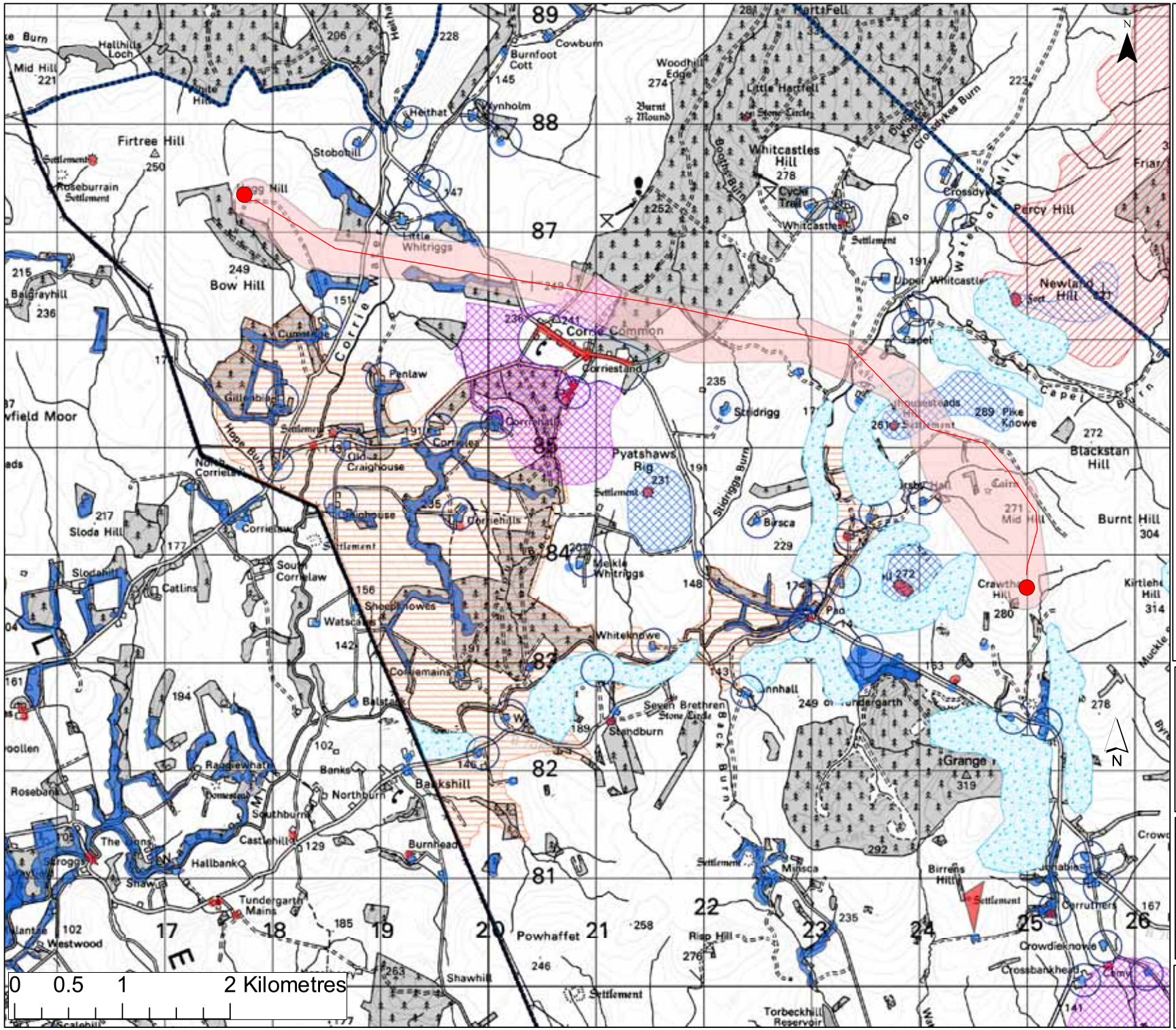
Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 13
Ewe Hill to Newfield - Narrow Corridors

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 17.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Substation Locations
- Narrow Corridor
- Highest amenity constraints
- High amenity constraints
- Impact on views from settlements
- Impact on setting of historic features
- Varied topography and slopes
- Intimate landscape
- 'Double climbing'
- Preferred Route Alignment

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Notes

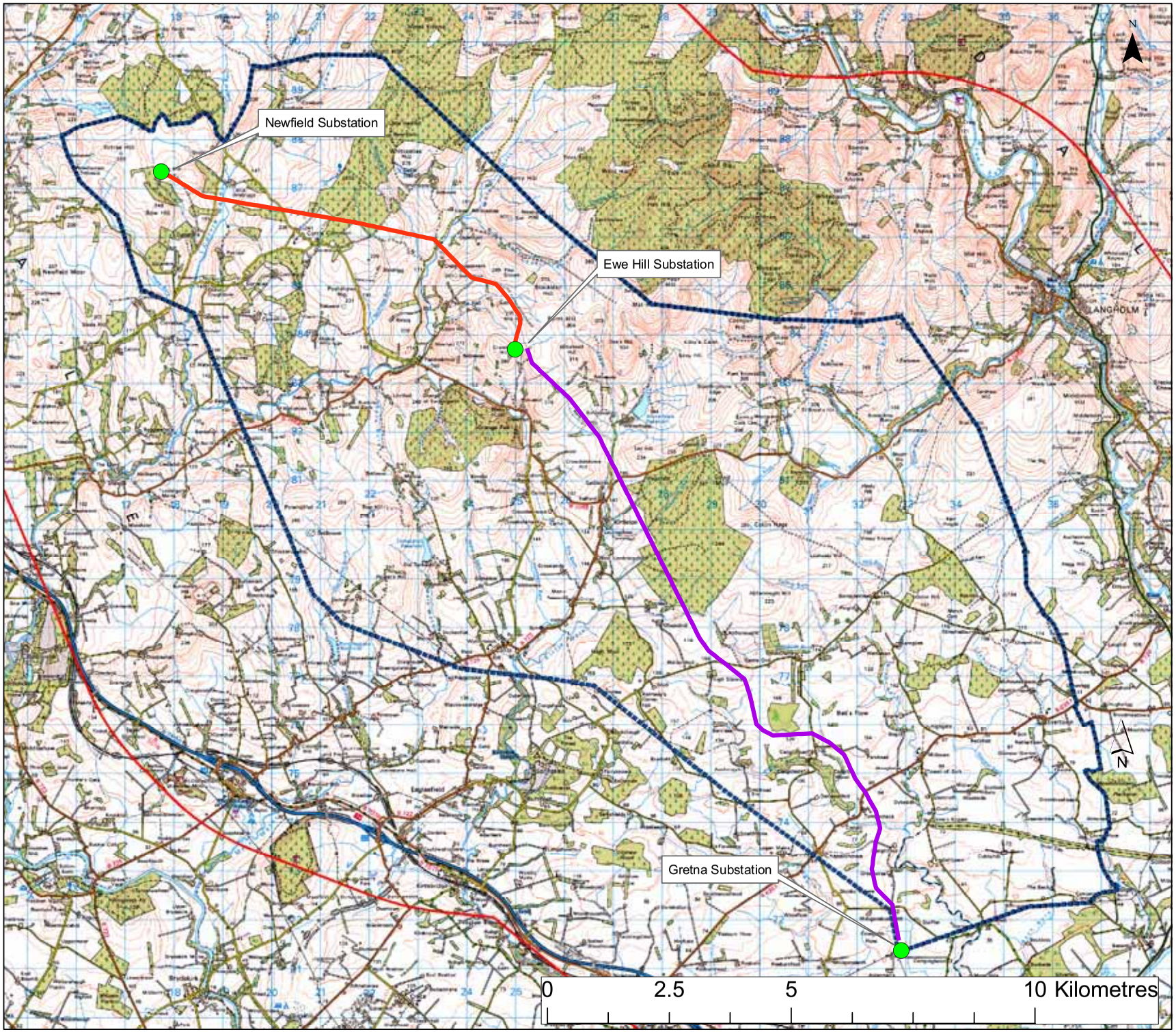
Ridge lines, summits and plateaus have not been annotated but have been considered, as read off the OS base mapping.

Figure 14
Ewe Hill to Newfield - Preferred Alignment

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

SP TRANSMISSION

Date: 17.08.09
Revision: -
Drawn by: AR
Checked by: SI



Legend

- Study Area
- Gretna to Ewe Hill Preferred Alignment
- Ewe Hill to Newfield Preferred Alignment
- Substation Locations

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Notes

Figure 15
Preferred Alignments

Size: A3
Scale: Not to Scale
Project: Gretna Substation to Ewe Hill and Newfield Windfarms

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APPENDICES

APPENDIX 1 - THE HOLFORD RULES

The Holford Rules were formulated by the late Lord Holford, Professor of Town Planning, University College, London in 1959 and published by the Royal Society of Arts. The Holford Rules remain the starting point for routeing electricity transmission lines in the UK. Since the Rules apply English designations, they require some interpretation to match them to circumstances in Scotland. The Holford Rules are a product of a specific time and set of circumstances. At the time the Holford Rules were written, the area of land designated for amenity value was far smaller than now and the design of routes to avoid such areas was easier as a result. In Scotland, land designated for amenity value is largely confined to areas of land with sparse population. The Holford Rules give no guidance on how to reconcile routeing to avoid areas of amenity value where this would have a greater visual intrusion due to the proximity of the line to people. This limitation of the Rules is clarified in the National Grid Company's (NGC's) Supplementary Notes to their Guidelines for the Routeing of New High Voltage Overhead Transmission Lines.

A central premise of the Holford Rules is that the extent of the visual effect of an overhead transmission line can be reduced by careful routeing. The Holford Rules provide a valuable basis for an approach to transmission line routeing, but require adaptation to meet present day circumstances. The routeing practice followed by SP Transmission plc is derived from the Holford Rules and takes account of the National Grid Company's Guidelines for the Routeing of New High Voltage Overhead Transmission Lines.

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.

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.

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

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.

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 the trees.

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 concatenation or 'wirescape'.

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

The National Grid Company (NGC) reviewed the Holford Rules in 1992 (refer Appendix 3) and confirmed them as an invaluable tool in selecting and assessing line routeing options as part of the environmental assessment process. As a result of this review, the Rules have had some supplementary notes added to them by NGC.

In 2004 a further review was carried out by Scottish Hydro-Electric Transmission Limited in conjunction with Scottish Power Transmission Limited (refer Appendix 3) and their review confirmed the relevance of "Rules" in overhead Line routeing.

APPENDIX 2 - Glossary

Angle Poles: Poles erected to allow for a change in direction of the line.

Conductor: The name given to the metallic wires strung from pole to pole to carry electric current. These are generally made of aluminium.

Earth Conductor: A wire under slung on a wood pole. These are used for protection against lightning strikes but can also contain fibre optic cores for communication purposes.

Insulators: Materials that are very poor conductors of electricity. Air exists as natural insulation around conductors, but at supports, an insulator string (or strings) is required to prevent live contact with the wood pole body. Glass, polymeric or porcelain insulators can be used.

Insulator Strings: Insulator units assembled in articulated strings between the pole steelwork and conductors.

Kilovolt (kV): 1,000 volts.

Megawatt (MW): 1,000,000 watts.

The National Grid: The electricity transmission network of the UK.

Overhead Transmission Line: An electric line installed above ground usually supported by heavy duty wooden poles.

Substation: Controls the flow and voltage of power by means of transformers and switchgear, with facilities for control, fault protection and communications.

Volts: The international system unit of electric potential and electromotive force.

Watt: The unit of electric power.

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SP TRANSMISSION

Ewe Hill and Newfield Project Manager
Scottish Power Energy Networks
New Alderston House
Dove Wynd
Strathclyde Business Park
Bellshill
ML4 3FF