AQUIND Limited

PEIR CHAPTER 2

Consideration of Alternatives

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2 CONSIDERATION OF ALTERNATIVES

2.1 INTRODUCTION

2.1.1.1 This chapter provides an overview of the process that has been implemented for identifying electricity grid connection points in England and France, a location for the Converter Station, the site selection for the UK Landfall and Cable Corridor (Onshore and Marine). This includes the identification, appraisal and selection of options to develop the Proposed Development.

2.1.1.2 AQUIND has opted to provide this information within the PEIR, which is a part of the Consultation Document, to provide as much information as possible on the rationale behind the design and to present the decision-making process that has been followed. Each section describes the methodology and criteria that was employed to evaluate the options at each stage and the conclusions that were reached.

2.1.1.3 The EIA Regulations, in Schedule 4, state that an ES must include: "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*."

2.1.1.4 The 2017 Regulations require a "comparison" of environmental effects of the reasonable alternatives that have been studied when providing an indication of the main reasons for selecting the chosen option. The development of the alternatives includes a comparison of the environmental effects associated with the Converter Station options as well as the option assessments and appraisals associated with the Cable Corridor alignment within the Proposed Development. The Proposed Development is still evolving, and design changes between now and submission of the DCO Application will be documented within the ES.

2.1.1.5 Under the Conservation of Habitats and Species Regulations 2017 a consideration of alternatives to the Proposed Development would be required if it is determined that it is likely to have a significant effect on a European Site, such that it may adversely affect the integrity of the Site. In the event that an Appropriate Assessment ('AA') is required, the applicant must provide the SoS with such information as may reasonably be required to enable it to conduct the AA. Requirements under the Conservation of Habitats and Species Regulations 2017 will be addressed in the Habitat Regulations Report which will provide the basis to inform an AA.

2.2 NATIONAL POLICY STATEMENT CONSIDERATIONS

2.2.1.1 Section 4.4 of the NPS EN-1 (Energy) contains the following requirements with regard to consideration of alternatives:

2.2.1.2 Where there is a policy or legal requirement to consider alternatives, the applicant should describe the alternatives considered. The SoS will be guided by the following principles when deciding what weight should be given to alternatives:

- Compliance with policy requirements;
- Prospect of the alternative delivering the same infrastructure capacity in the same timescale as the Proposed Development;
- Regard to the possibility that all suitable sites for energy infrastructure of the type proposed may be needed for future proposals;
- Alternatives not among the main alternatives studied by the applicant (as will be reflected in the ES) should only be considered to the extent that the SoS thinks they are both important and relevant to its decision;
- If the SoS concludes that a decision to grant consent to a hypothetical alternative proposal would not be in accordance with the policies set out in the relevant NPS, the existence of that alternative is unlikely to be important and relevant to the SoS's decision;
- Alternative proposals which mean the necessary development could not proceed, for example because the alternative proposals are not commercially viable or alternative proposals for sites would not be physically suitable, can be excluded on the grounds that they are not important and relevant to the SoS's decision;
- Alternative proposals which are vague or inchoate can be excluded on the grounds that they are not important and relevant to the SoS's decision; and
- It is intended that potential alternatives to a proposed development should, wherever possible, be identified before an application is made to the SoS in respect of it. Therefore, where an alternative is first put forward by a third party after an application has been made, the SoS may place the onus on the person proposing the alternative to provide the evidence for its suitability as such and the SoS should not necessarily expect the applicant to have assessed it.

2.3 OPTIONEERING PHILOSOPHY AND PROCESS

2.3.1 OPTIONEERING PHILOSOPHY

2.3.1.1 The overall optioneering philosophy that has been applied to sites and routes was one of staged filtering to optimise the selection, based on increasing knowledge of individual options and the environment. The initial stages used high level assessments using baseline principles to enable, where possible, comparison, ranking and selection of options.

2.3.1.2 The selection process has been multidisciplinary, in terms of the technical inputs (e.g. electrical, cable engineering, geotechnical, environmental, planning, civil engineering, access), but also in terms of wider considerations, such as land acquisition and stakeholders.

2.3.1.3 The final selection will adopt a holistic approach, taking into account the inter-relationships between the Converter Station location, the UK Onshore Cable Corridor, landfall location and the UK Marine Cable Corridor, to ensure that the optimal selections are made across all aspects of the Proposed Development.

2.3.2 OPTIONEERING PROCESS

2.3.2.1 The optioneering process was carried out in four stages (it should be noted that Stage 4 of this process is still ongoing):

Stage 1 - Preliminary desktop study
Undertake an appraisal, identify constraints and technical feasibility of potential locations

Stage 2 - Data collation and site visits
Undertake a more detailed analysis of the technical feasibility of potential locations, undertake site visits, as well as review further information on potential constraints

Stage 3 - Constraints workshop
Workshop to identify preferred locations with interested parties including from technical, environmental and planning / consents

Stage 4 - Preferred locations
Identify preferred locations through further assessment of the detailed constraints including cable routing and consultation

Plate 2.1 - Optioneering Process

2.3.3 UK SITE SELECTION STEPS

2.3.3.1 The optioneering approach to selection was undertaken for the:

- Great Britain ('GB') Grid Connection location;
- UK Converter Station location;
- UK Landfall location;
- UK Onshore Cable Corridor; and
- UK Marine Cable Corridor (which was also influenced by the French site selection process).

2.3.3.2 The process of UK scheme-wide site selection is currently ongoing and consists of a series of steps, as follows. More detail is provided in subsequent sections of this chapter in relation to each step of the process, as indicated:

- Preferred National Grid connection points (substation) were identified (for further details see Section 2.4.4);

- The Connection Agreement at Lovedean Substation was obtained from National Grid (see Section 2.4.4);
- Preliminary Converter Station locations were identified (see Section 2.5.2.4);
- Preferred landfalls were identified (see Section 2.6.2.2);
- The locations of the preferred landfalls were used to develop a Marine Cable Corridor study area (see Section 2.6.1.10);
- The possible Onshore Cable Corridor routes between Lovedean Substation and three shortlisted landfall sites were evaluated in more detail (see Section 2.7.1.3);
- Potential Onshore Cable Corridor routes between Lovedean and the preferred landfall locations were identified, to permit a shortlist of potential landfall sites (see Section 2.7.1.4);
- The preferred landfalls were assessed for marine constructability, and were found to be generally equivalent (see Section 2.6.1.7);
- The optimal Onshore Cable Corridor was selected (subject to ongoing refinement) and used to identify the optimal landfall (see Section 2.7.3 and Section 2.8.1); and
- The Marine Cable Corridor used to inform the marine geotechnical and geophysical surveys was defined between the preferred UK and French Landfalls. This was optimised by preliminary route engineering, and the optimised route surveyed. The outputs of the survey will be used to define the preferred cable route within the survey corridor (see Section 2.8.3).

2.4 SITE SELECTION – GRID CONNECTIONS

2.4.1 OVERVIEW OF INITIAL FEASIBILITY STUDY– AUGUST 2014

2.4.1.1 In August 2014, a preliminary technical-economical study was prepared, which highlighted the objective of developing an interconnector between the UK and another European Union member state. This study investigated commercial feasibility, reviewed technologies available on the marketplace and considered the scope/location of the Project.

2.4.1.2 A connection from the UK to France was favoured because:

- The differences between the French and UK wholesale electricity markets in terms of generation mix and cost profiles creates price differentials and an opportunity to exploit these through an interconnector asset, creating substantial socio-economic welfare benefits;
- France is the UK's nearest neighbour in continental Europe; and
- France is well connected to large electricity transmission systems of other countries.

2.4.2 OVERVIEW OF SITE SELECTION PROCESS FOR GB GRID CONNECTION

2.4.2.1 The technical-economical study referred to in 2.4.1.1 concluded that it would be preferable to connect into the electricity grid in the south coast of England.

2.4.2.2 The South East of England, in particular the counties of Kent and East Sussex, presented an unacceptable risk and were not considered suitable for AQUIND Interconnector. This risk included network congestion and limited capacity to evacuate power in the area as several other interconnectors connect into, or are planned, in the south-eastern region (IFA2000, BritNed, ElecLink, NEMO).

2.4.2.3 The Applicant requested National Grid Electricity Transmission ('NGET') to perform a feasibility study in 2015, based on technical and economic information provided by the Applicant, to identify the available level of entry capacity to the grid, reinforcements that will be required and potential connection locations on the south-east shore of England.

2.4.2.4 Meetings were held between the Applicant and NGET to consider the key issues involved for such a connection which determined the potential location. The following conditions were identified:

- HVDC technology is widely used to transmit large amounts of power (typically over 500MW) efficiently over long distances. HVDC technology is almost always preferred to the more widely known HVAC technology when crossing a body of water
- For the power levels under consideration, the connection needs to be onto the 400kV transmission network. Lower voltage levels, such as 275kV are not available close to the south coast of England and 132kV, a distribution voltage, could not handle this power level;
- An existing 400kV substation must have the thermal capability to handle the power exchange between the interconnector and the GB transmission network;
- The existing substation must have the capability to accept two new electrical connections, one per link, or be easily extended to provide two new connections;
- The import (or export) of power through the connection substation should minimise any adverse consequences on the National Grid network;
- Connection at an existing power generating plant would be difficult as the power export capacity would have been mostly taken up, hence limited capacity for additional power import; and
- The substation should be relatively close to the south coast of England, to minimise the length of HVDC onshore cable required between the substation and the Transition Joint Bay ('TJB'). This minimises the overall disruption caused by cable laying along public highways or through private land.

2.4.3 NATIONAL GRID ELECTRICITY TRANSMISSION (NGET) STUDIES – 2015/2016

2.4.3.1 NGET identified ten substations as shown below in Plate 2.2, on the 400kV transmission network during the feasibility study, all located in central southern England. The thermal capacity, i.e. the ability of the transmission lines to handle the proposed power flows is an important consideration for NGET in planning new connections in the South East and South West of England.

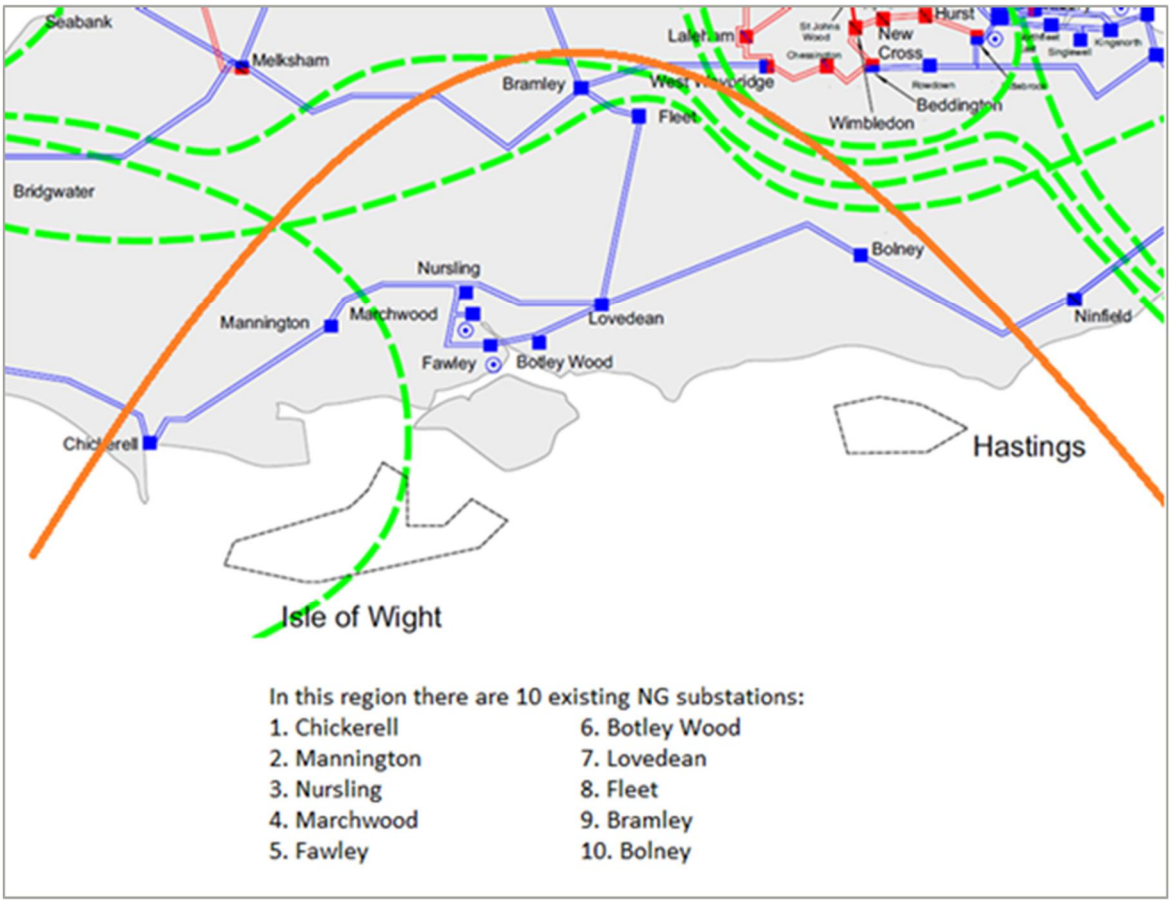


Plate 2.2 - England South Coast map showing the region in which ten connections sites are identified.

2.4.3.2 Seven of the ten substations were then discounted by NGET and three substations were considered for further system analysis, on the basis that the other sites either had limited capacity to evacuate power, represented difficult access for marine and/or onshore cables, or were too close to parts of the network, which were already congested.

2.4.3.3 The three shortlisted substations then went through technical system analysis - Bramley in Basingstoke and Deane Borough, Chickerell in Weymouth and Portland Borough and Lovedean in East Hampshire District.

2.4.3.4 As NGET has access to large datasets of both the planned and as-built GB electricity networks, a robust assessment was undertaken to ensure that NGET develop and maintain an efficient, coordinated and economical electricity transmission network.

2.4.3.5 Chickerell was further discounted on the basis that a connection at Chickerell would require a complete rebuild of the substation and additional wider reinforcements across the network. Therefore, only Bramley and Lovedean options were considered further.

2.4.3.6 Bramley and Lovedean were further evaluated on entry capacities for 1500 MW, 1800 MW and 2x1000 MW for import and export from the GB electricity network.

2.4.3.7 It was established that the costs and reinforcements associated with connecting a 1500 MW capacity would be similar to 1800 MW for both Bramley and Lovedean substations. Therefore, to maximise the efficient use of the available capacity, both a 1800 MW and 2x1000 MW options were considered.

2.4.3.8 Based on market intelligence and the available capacity required, Voltage Source Converter ('VSC') was chosen to be the preferred Converter Station technology over alternative technologies such as Line Commutated Converter ('LCC') due to its significant technical benefits.

2.4.3.9 These benefits include:

- XLPE cable can be used instead of MI cable;
- Independence from the AC network strength;
- Ability of independent reactive power control;
- Smaller footprint than LCC; and
- Minimal harmonic distortion on AC system.

2.4.3.10 To comply with NETS SQSS requirements, the normal Infeed Loss is set at a maximum of 1320 MW, limiting the rating of a single link. However, no single link of this rating has ever been built, making it a technically risky solution. The SQSS Infrequent Infeed Loss is set to a maximum of 1800 MW. For any interconnector capacity of over 1800 MW, two links will be required to avoid complete loss of power during a fault or outage condition.

2.4.3.11 The SQSS restrictions also introduces constraints on the topology of the HVDC configuration, i.e. influencing the choice of twin symmetrical monopole or a bi-pole arrangement to match the Normal Loss criterion.

2.4.3.12 The 2x1000 MW was selected as a symmetrical monopole scheme, such that any (converter or cable) fault can only result in a 50% reduction of power flow, whereas a bi-pole arrangement of 1800 MW would entail the complete loss of power flow in the case of a cable fault or 50% reduction in the case of a converter fault.

2.4.3.13 The analysis also concluded that based on market intelligence the largest bi-pole configuration of 1800 MW would present a higher technical risk and was therefore discounted.

2.4.3.14 NGET conducted a Cost-Benefit Analysis of the two sites, technology configuration and entry capacities. National Grid reinforcement costs and generator connection costs were considered alongside other generation connections in the area, to produce the most economic and efficient point of connection for the end consumer.

2.4.3.15 This analysis used NGET's technical knowledge of the network (including agreed future connections), studies, agreed cost information, environmental considerations and other constraints associated with the project, alongside input from the Applicant on the details of the assets to be connected. A connection at Bramley substation

required a substantially longer Onshore Cable Corridor through sensitive areas such as the South Downs National Park ('SDNP'). Lovedean substation was closer to the potential landfall locations, which is preferable for both technical and environmental reasons. Refer to Section 2.6 for more information on the landfall optioneering.

2.4.3.16 The conclusion of the NGET studies identified that the connection of 2x1000 MW at Lovedean substation was the most efficient, coordinated and economical grid connection point for the GB consumer.

2.4.4 FINAL UK GRID CONNECTION LOCATION – 2016

2.4.4.1 In October 2015, based on the results of the feasibility study, the Applicant made a formal application to NGET for a connection of 2x1000 MW at Lovedean substation.

2.4.4.2 NGET produced a Connection and Infrastructure Options Note ('CION') (NGET ESO, 2018) in accordance with its statuary obligations and confirmed Lovedean substation as the preferred connection point with a capacity of 2x1000 MW.

2.4.4.3 The CION also identified VSC to be a preferred converter technology with a symmetrical monopole configuration based on the benefits described in Section 2.4.3.8, and the fact that it can offer additional ancillary services to the grid.

2.4.4.4 A Connection Offer was issued by NGET in February 2016 and subsequently signed by the Applicant in June 2016.

2.5 SITE SELECTION – HVDC CONVERTER STATION

2.5.1 PRELIMINARY CONVERTER STATION LOCATIONS – APRIL 2016

2.5.1.1 In April 2016, the Applicant conducted a preliminary Converter Station site identification exercise. Potential Converter Station site locations were identified by placing the existing Lovedean substation at the centre of an optioneering exercise.

2.5.1.2 The following criteria were used in the initial siting exercise:

- The site should be within 2 km (radius) of the existing Lovedean substation, for further information see Section 2.5.1.7;
- Beyond the 2 km radius there were no viable solutions which fit the Converter Station requirements due to localised constraints;
- Overall site dimensions of 160 m x 200 m with a permanent access way of at least 6 m wide (note that this area has since increased following engagement with Converter Station suppliers);
- Beside or close to existing roads to minimise new road construction;
- An additional area nearby of approximately 100 m x 100 m to use as a temporary laydown area during the construction period;
- Close to good quality roads (A class or B class) that allow transport of multiple 300 t loads using a multi-wheel low-loader trailer;
- Allowance for a turning radius of 30 m for the site entrance;

- Aim to minimise areas of high environmental value or public amenity, such as ridge tops and rare species habitat;
- Aim to minimise close proximity to dwellings, public buildings, and public spaces due to possible audible noise and electromagnetic interference from the Converter Station;
- Areas of high coastal salt or industrial contamination should be avoided;
- Flood plains, rivers or streams should be avoided;
- Marshland which would require piling for foundations should be avoided; and
- Footpaths and historic public rights of way should be avoided, where practicable.

2.5.1.3 Constraints identified within the 2 km study region, which posed limitations to the Proposed Development, included the SDNP approximately 500 m to the north, directly east and approximately 700 m west of Lovedean substation, densely populated areas to the east and south (Waterlooville and Denmead), as well as numerous rural dwellings in close proximity to the substation. There are many listed buildings in the south west segment of the search area.

2.5.1.4 Another major constraint was the presence of transmission lines/towers and underground cables entering/exiting the substation. These, combined with a lack of existing, suitable access across the fields in the area, required for the construction, were considered likely to provide a significant constraint to development in this area.

2.5.1.5 The distance between the Converter Station and the substation was limited to 2 km as the AC cable easement between the Converter Station and substation (approximately 11 m wide), essentially creates a corridor where no tree or hedge growth is permitted, although the land can be returned to agriculture. Therefore, the longer the AC cable route, the greater the disruption and impact on the local environment.

2.5.1.6 During construction, this corridor width extends up to 23 m (depending on haul road requirements) in order to construct the AC cable trenches. Increasing the AC cable distance from the substation connection point to the Converter Station beyond the 2 km would increase the environmental impact in the surrounding area. A longer route would also be less economical and result in increased power loss for the interconnector, reducing its benefits.

2.5.1.7 The Applicant initially identified five sites within the 2 km radius of Lovedean substation as possible locations to develop the Converter Station, these are denoted by the orange areas identified in Plate 2.3.

2.5.1.8 Therefore, given the constraints in the surrounding area, a 2 km radius was considered acceptable.

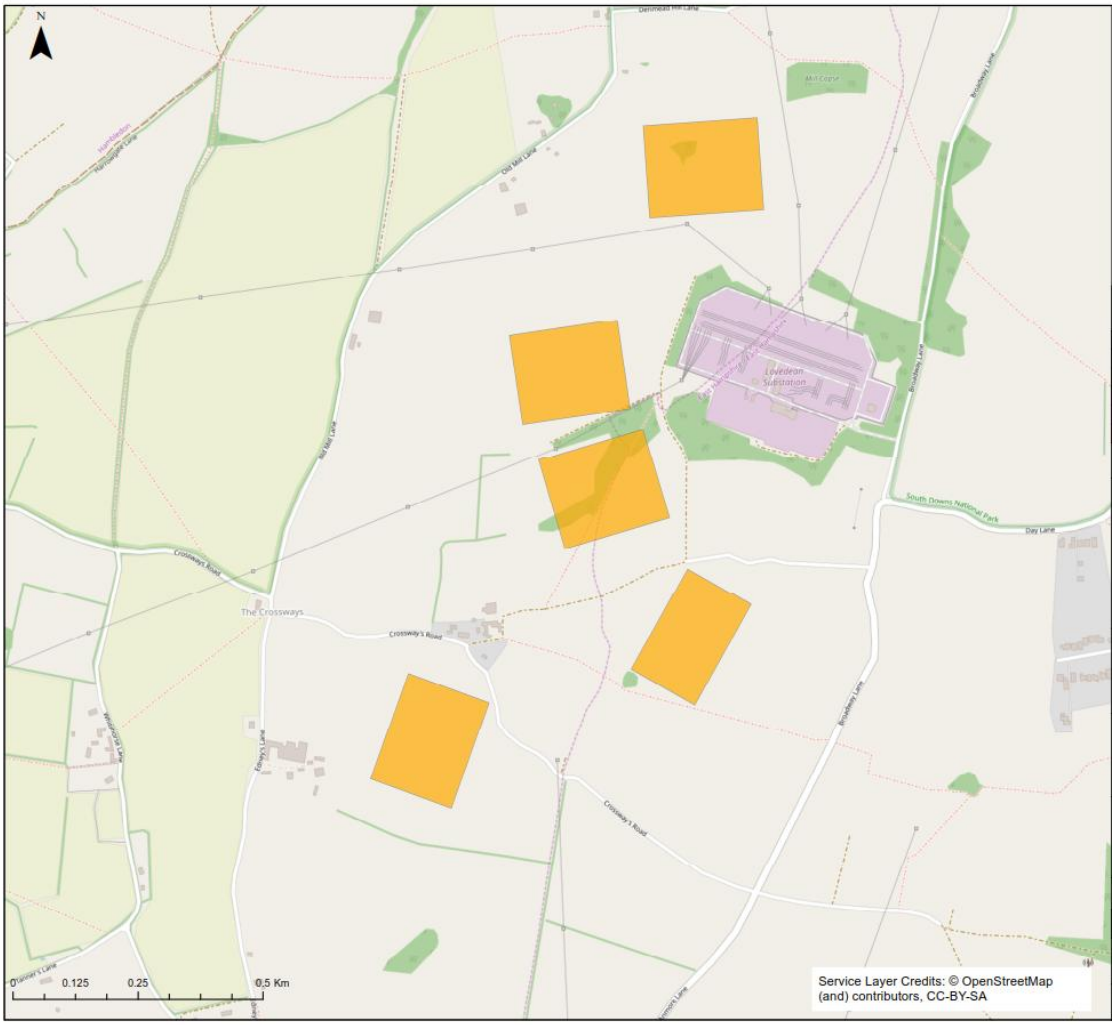


Plate 2.3 - Preliminary Converter Station Investigation Options

2.5.2 OPTIONEERING STAGE 1 - 2017

2.5.2.1 After the initial identification of potential Converter Station site areas, the Applicant conducted further detailed assessments to ensure the technical viability of siting the Converter Station in or around the proposed Converter Station Area. The key considerations applied during this assessment included:

- Space requirements: finished platform area of up to 4-6 ha for the Converter Station site, plus sufficient area for the required temporary laydown area during construction;
- Environmental constraints in proximity to Lovedean substation e.g. proximity to SDNP; areas of residential development; heritage assets, presence of Ancient Woodland, Sites of Importance for Nature Conservation ('SINCs');
- Planning constraints in proximity to Lovedean substation e.g. proposed battery storage development and the 'Denmead Gap', both of which are south of Lovedean substation;

- Existing infrastructure constraints (e.g. power cables, overhead lines ('OHLs'));
- Surface water and groundwater source protection zone ('SPZ') and flood risk, including the level of the water table;
- Favouring use of previously developed land in the vicinity or, where not feasible, the most sustainable greenfield location (i.e. distance to the substation, environmental impacts, opportunities for incorporation of mitigation); and
- Potential for limitation of operational noise impacts.

2.5.2.2 As it was identified above in Plate 2.3, one of the proposed sites was situated on Ancient Woodland (Stoneacre Copse). This option was relocated further south and the site footprint was elongated to accommodate other site constraints, see Plate 2.4.

2.5.2.3 Localised constraints such as the widespread coverage of the SDNP covering the north-east and west of the substation identified that Converter Station locations to the north of the substation would not be viable so the northernmost location was discounted. In addition, residential constraints due to proximity of settlements at Denmead meant that the most southwestern-most option was also discounted. The result of this exercise identified three potential Converter Station locations.

2.5.2.4 Ongoing consultations resulted a fourth option been introduced at the request of Planning Officers from the WCC and EHDC, this was perceived to potentially provide benefits in terms of landscape and visual amenity and located further south from residential receptors than the previous southwestern option. Therefore, the four options considered were as follows:

- Option A: South-west of Lovedean substation;
- Option B: West of Lovedean substation and between the existing 400 kV overhead line circuits;
- Option C: Located between Stoneacre Copse and the existing 132 kV cable circuits exiting substation; and
- Option D: Further south-west of Lovedean (On request by the LPA).

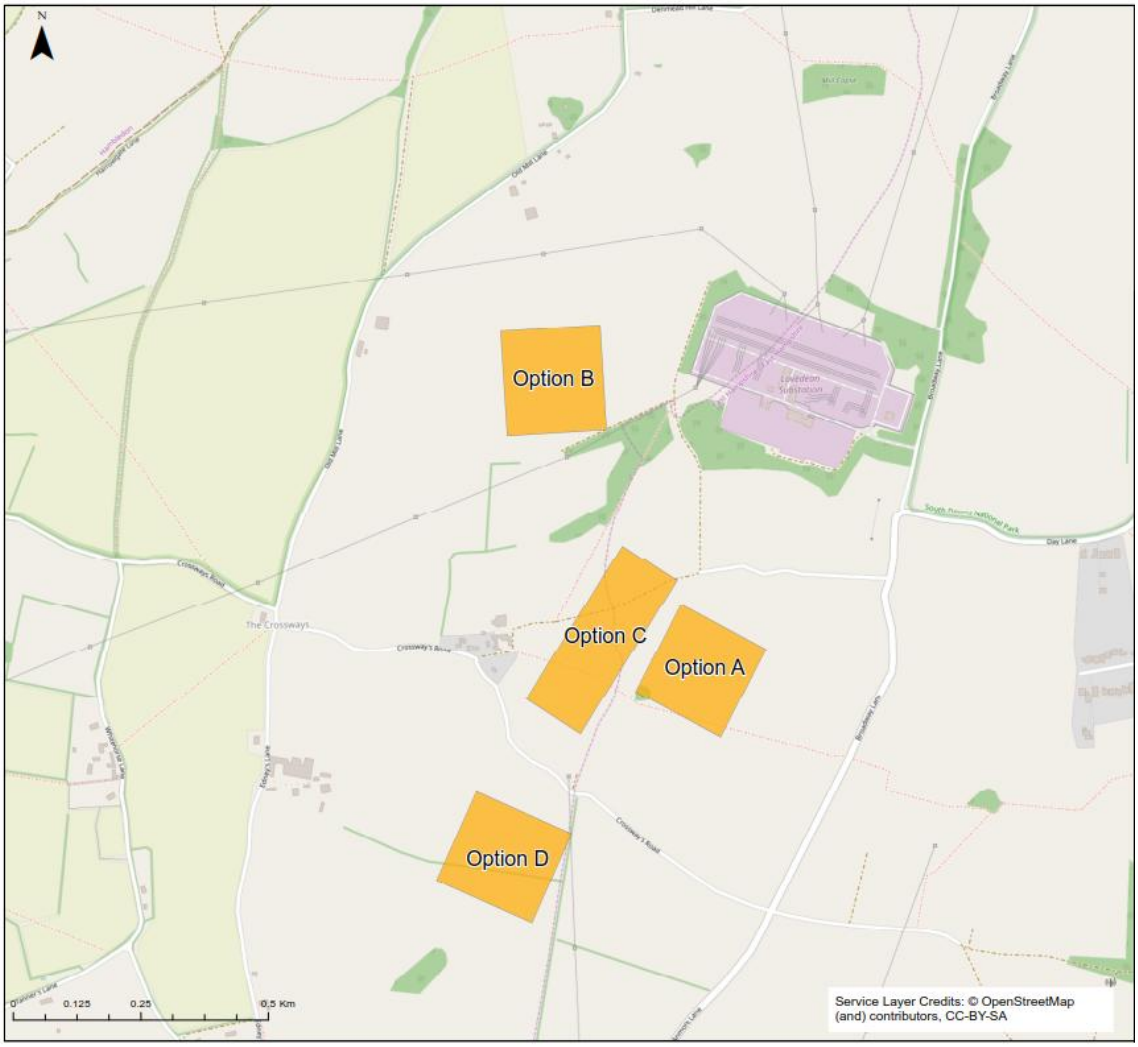


Plate 2.4 - Potential Converter Station Locations

2.5.2.5 Option C was subsequently discounted on the basis that it was more challenging with regards to constructability and its impact given that the layout is constrained by both the nearby Ancient Woodland and underground cables approaching the substation. There are at least seven residential visual receptors within 200 m of Option C and a possible closure/diversion of the PRoW from Denmead Farm would be required if selected. The landscape and visual amenity study concluded that the option of siting the Proposed Development in this area could feature prominently in local views from SDNP.

2.5.2.6 Originally, Option D was proposed on the basis that it might improve the visual impact of the Proposed Development. After careful consideration, the assessment concluded that this option had a more significant impact on the Denmead residents to the south due to this more southerly location. Option D is positioned within 100-300 m of at least five properties, some of which are listed buildings, with limited local vegetation to act as screening. Also, as Option D was proposed at an increased distance from

the substation than the other options, this increased both the AC cable route length and the environment affected during construction. The increased distance also increased the likelihood of a 12 AC cable solution, compared to the 6 AC cable solution deemed achievable for all other options, due to the cable capacity constraints. Doubling the number of AC cable increases the impact on the environment and increases system losses. In addition, the construction of a Converter Station at this location would sever an existing hedgerow field boundary.

2.5.2.7 Therefore, it was concluded that Option A and Option B were the short-listed Converter Station sites and further assessments were progressed on these sites.

2.5.3 OPTIONEERING STAGE 2 - 2017/2018

2.5.3.1 In Quarter 3 and 4 2017, the Applicant conducted a desktop study to inform the environmental constraints for Options A and B, and consultation with the LPAs. The desk study considered:

- Construction stage laydown and site establishment access;
- Access route options;
- Preliminary site stability assessment (desk based and subject to ground investigations);
- Flood risk areas;
- Local footpaths/Public Rights of Way ('PRoWs');
- Existing utilities;
- Land availability;
- Local residents;
- Local air quality & noise;
- Landscape and visual amenity; and
- Biodiversity.

2.5.3.2 Public consultation events were held in January 2018. The information presented at these events identified the two Converter Station locations, and invited public feedback.

2.5.3.3 Subsequent to the desktop study and consultation further assessments were undertaken to consider the two preferred sites. The following environmental, social and economic topics were considered:

- Landscape and visual amenity;
- Ecology and biodiversity;
- Arboriculture and Ancient Woodland considerations;
- Ground conditions;
- Noise and vibration;
- Transport and access (existing roads);
- Soils and agricultural land use;
- Archaeology and cultural heritage;
- Water resource and flood risk;
- Waste and materials;
- Air quality;
- Socio-economics; and
- Human health.

2.5.3.4 Engineering and design considerations included:

- Earthworks requirements;
- Access road route;
- Temporary construction laydown areas;
- AC cable route location;
- Auxiliary supplies and power management; and
- Drainage management and water supply.

- DC cable route location;

2.5.3.5 As the AC cable route is related to the location of the Converter Station site, the AC cable route was investigated in conjunction with the Converter Station optioneering process.

2.5.4 PREFERRED CONVERTER STATION LOCATION

2.5.4.1 Based on the analysis and assessment undertaken for both Converter Station options, Option B was identified as the preferred option.

2.5.4.2 The preference for Option B was particularly related to its environmental outcomes from a noise, ecology and visual perspective. In addition, this option performed best from a technical perspective.

2.5.4.3 In the course of the assessment, it was concluded that landscape and visual impacts were an important distinguishing factor between the sites. Due to the relative sensitivity of the location in which the sites being considered are located, and proximity to sensitive features such as SDNP landscape was therefore attributed the greatest weight in the assessment of the options. Of the options, Option B benefited from existing topography which provided natural screening of the Site.

2.5.4.4 When assessing the potential visual impacts, it was identified that the associated access route for Option B would be of greater visibility in the landscape due to the route longer length. In addition, it was better screened from key receptors including the urban area, public highway and public rights of way by virtue of existing topography and vegetation. This location also had the benefit that existing screening could also be further supplemented by landscaping. Overall, it was anticipated that of the options, Option B had the potential to result in a less significant visual impact.

2.5.4.5 With regard to ground investigations, both options were similar, however clay depth, foundation conditions and the lower potential for existing karstic features (potential causes of ground instability) were more favourable for Option B.

2.5.4.6 From a technical and engineering perspective, the AC and DC cable entry and exit points were preferable for Option B. In addition, the site would necessitate a shorter AC cable length and swathe and avoiding the need for the AC cable to cross existing transmission cables.

2.5.4.7 Option B had the potential to affect a lower number of sensitive noise receptors, and at a lower exceedance of accepted limits.

2.5.4.8 Option B had the potential to result in a greater loss of existing established habitats than Option A, including the loss of established trees and hedgerows which would require appropriate mitigation.

2.5.4.9 Both options were could be achieved from an environmental and technical perspective. However, with the weighted approach taken to assess the options,

Option B was considered to present the least level of impact within the existing environmental constraints.

2.5.4.10 The environmental topics listed in Section 2.5.3.3 which were appraised to provide this conclusion are summarised in Section 2.5.4.11 to Section 2.5.4.42.

Landscape and Visual Amenity

2.5.4.11 The appraisal concluded that Option B would be the preferred option.

2.5.4.12 The Combined Zones of Theoretical Visibility ('ZTV') illustrates that Option A would have a wider visual extent than Option B, therefore impacting a broader range of visual receptors including residents and users of PRoWs.

2.5.4.13 Option B would be located further away from concentrations of sensitive receptors (nearby residents and users of the PRoW and well-traversed highway network). In addition, the views of the site from the south would be partially screened by Stoneacre Copse, and views from the east are screened by mature vegetation surrounding the existing substation, which it was anticipated would be retained; there are limited views from Horndean and Catherington due to the immediate context, with more localised screening than Option A.

2.5.4.14 Measures such as reducing the finished platform level, bunding and planting trees are proposed to mitigate against the visual effects experienced by sensitive receptors for both Options A and B.

2.5.4.15 Without mitigation, it is considered that the visual effects of Option B would be less than Option A, due to existing screening measures. Introducing further proposed mitigation measures for both options shall provide a much-reduced visual impact for Option B, as opposed to Option A.

2.5.4.16 The assessment concluded that with mitigation and existing landscape, Option B had the most potential to be assimilated in to the existing landscape, and with existing energy infrastructure (overhead lines).

Ecology and Biodiversity

2.5.4.17 The appraisal concluded that Option A would be the preferred option.

2.5.4.18 For Option A, the land itself is of lower ecological value and there are fewer protected species and priority habitats likely to be affected relative to Option B.

2.5.4.19 Option B has the potential to result in more extensive habitat loss (hedgerow) than Option A, and would potentially require more extensive mitigation measures. Notwithstanding the impacts, it is anticipated that the design of the Proposed Development would seek to reduce impacts, avoiding the loss or deterioration of ancient woodland and ancient or veteran trees.

Ground Conditions

2.5.4.20 Both options are located within the Source Protection Zone 1 (SPZ1), which is related to the underlying Principal Aquifer (Chalk) and proximity to the drinking water extraction wells/springs operated by Portsmouth Water. Therefore, both site options carry similar risks and SPZ protection would need to be considered during construction. As a consequence, there was no preferred option.

Noise and Vibration

2.5.4.21 The appraisal concluded that Option B was the preferred option due to the number and proximity of sensitive receptors (including dwellings) in the vicinity of the Site.

2.5.4.22 A number of mitigation measures have been proposed and included within the noise model in order to attenuate noise and minimise the potential impacts at the nearest receptors. With the inclusion of mitigation measures for both options such as orientation of noise sources, it was predicted that noise levels on the closest façade of the most exposed receptors were likely to be lowest for Option B.

Transport and Access (existing roads)

2.5.4.23 The appraisal concluded that there was no preferred option.

2.5.4.24 Option A is located closer to the local highway network and requires the development of a shorter access track to serve the Converter Station site during the construction and operational stages.

2.5.4.25 While the volume of earthworks is anticipated to be lower for Option A than Option B, it is anticipated that the majority of earthworks can be utilised on site and the total number of traffic movements during the construction stage are considered to be comparable between the two options. As a result, the potential for harm to the countryside and the rural character of local roads is similar for both options.

2.5.4.26 In terms of potential impact to the existing highway network during the construction, there was no preferred option.

Soil and Agricultural Land Use

2.5.4.27 The concluded Option B would be the preferred option. Option A is further away from the existing substation and may be disruptive in terms of residual field size and shape. Whereas, Option B is closer to the main substation and less disruptive in terms of residual field size and shape, and also considered to be less suitable for arable farming due to the topographical constraints.

Heritage and Archaeology

2.5.4.28 An appraisal of the potential impacts on archaeology and cultural heritage showed that Option B is the preferred option based on the proximity to Listed Buildings.

2.5.4.29 Both Option A and Option B could potentially affect the setting of designated assets within a 2 km radius. In terms of built heritage setting, there is the added protection of screening in the current topography and planting to potentially reduce the impact on the setting of Listed Buildings and building clusters for Option B; and is therefore considered to cause the least harm to their significance.

2.5.4.30 No Scheduled Ancient Monuments or Conservation areas were identified as being sensitive, and were therefore considered in the assessment of setting.

2.5.4.31 There was no preferred option from an archaeological perspective, on the basis on the baseline data collected to date.

Water Resources and Flood Risk

2.5.4.32 The appraisal concluded that there was no preferred option.

2.5.4.33 From a flood risk perspective, there is no preference for the proposed Converter Station location as both sites have similar constraints with regards to the management of surface water, foul water management, water supply and groundwater.

Waste and Material Resources

2.5.4.34 The appraisal concluded that Option A would be the preferred option.

2.5.4.35 The excavation volumes associated with the earthworks for each option depend on the topography of the existing landscape, and the requirement to provide a level platform. An assessment of the anticipated cut and fill works concluded that Option B would result in almost double the surplus volume. For both options, it is considered that the excavated material could be utilised in the development of the proposed landscaping bunds, with any surplus spread across fields in the locality so as to reduce the need to transport the waste along the highway network.

Air Quality

2.5.4.36 The appraisal concluded that there was no preferred option.

2.5.4.37 Neither Option A nor Option B would have been located within an Air Quality Management Area ('AQMA').

2.5.4.38 For both options, there may be some air quality impact during construction due to HGV movements and dust generation, however a Construction Environmental Management Plan ('CEMP') would be put in place to mitigate these effects. The number of vehicle movements are considered to be similar for both options. Option A is approximately 100 m away from the nearest residential receptor, however Option B is approximately 200 m from the nearest residential receptor and would, without this mitigation, have a marginally greater impact.

2.5.4.39 There was no preferred option, as the air quality impacts would only come about as a result of construction, which is temporary, or from the use of back-up diesel generators, which will be in place for operation during loss of supply. In addition, both options are located a sufficient distance away from the closest sensitive receptors as to have no impact.

Socio-economics

2.5.4.40 The appraisal concluded that there was no preference between either option as there are no private or community assets within the site options, aside from agricultural land.

2.5.4.41 The development of a Converter Station at Option A had the potential to result in the largest impact on PRoWs both during the construction and operational stages, however, further work would be required to determine a clear preference between the two options.

Human Health

2.5.4.42 The appraisal concluded that there was no preference between the two options.

2.5.4.43 Option A is closer to the densely populated residential area via Broadway Lane. Option B is approximately an additional 400 m from the densely populated area, although both options have identical cable routing along the highway, with similar access via the junction of Broadway Lane.

2.6 SITE SELECTION – UK LANDFALL

2.6.1 PRELIMINARY DESKTOP STUDY – 2015/2016

2.6.1.1 In April 2015, a preliminary desk top study was undertaken, at which time, three preferred substation locations had been identified by NGET as discussed in Section 2.4.3.

2.6.1.2 Utilising the identified substations as a basis for the landfall search, the search area extended across the south coast of England, bounded by West Bay in the south-west and Bognor Regis in the south-east.

2.6.1.3 Lovedean substation was chosen for the Proposed Development and a connection agreement signed with NGET in February 2016 which further narrowed down suitable landfall locations through consideration of:

- Areas of sandy beach with minimal rock outcrops, to allow cable burial and with sufficient space for hauling operations;
- No significant steep slopes to the rear of the beach to prevent access or to inhibit cable laying;
- Limited marine features (e.g. skerries (small rocky islands), wrecks) and sufficient water depths to allow for suitable approach of cable lay vessel; and
- Availability of access to the Site.

2.6.1.4 Following a review of the data sources, such as aerial photos and land mapping, potential landing sites were identified.

2.6.1.5 The search area and 29 preliminary potential landing locations are identified in Plate 2.5.

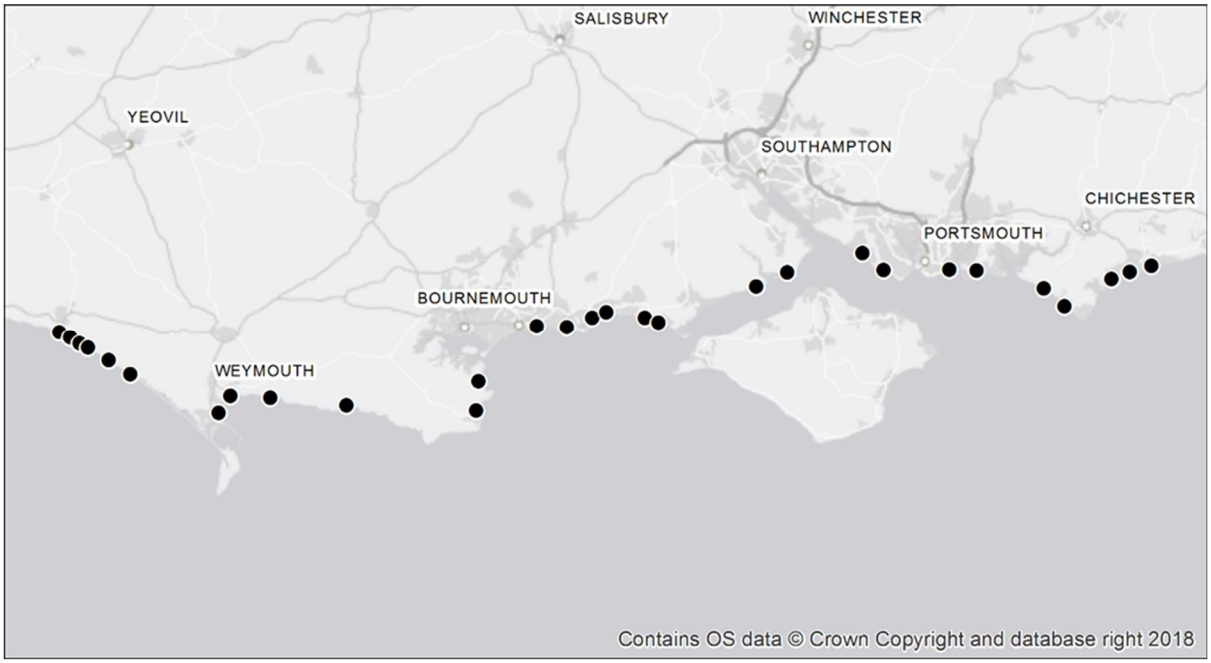


Plate 2.5 - Substation Location Search Area and Potential Landfall Sites

2.6.1.6 Landing sites were initially categorised based solely on engineering considerations as: Category A (Limited constraints identified at this stage); Category B (Some constraints, needs further investigation) or Category C (Less suitable with significant constraints, would require additional investigation).

2.6.1.7 To inform the site ranking exercise, site characteristic parameters were identified and each site was scored against each parameter. The parameters considered for site selection were as follows:

- Nature of beach (e.g. probable thickness of sediments, rock outcrops, operational space);
- Back of beach topography (e.g. presence of steep gradients, watercourses);
- Marine approach (e.g. presence of skerries, bathymetry, wrecks in the nearshore); and
- Inland access (e.g. proximity of roads and road condition).

2.6.1.8 The parameters were weighted in terms of their priority. The 29 sites were categorised from A-C with ‘A’ being the most feasible sites and ‘C’ being the least feasible. The resulting categorisations are shown in

2.6.1.9 Table 2.1.

Table 2.1 - Potential Landfall Categorisations

Location	Category	Location	Category
West Bay	A/B	Highcliffe	B/C
Freshwater Beach	A/B	Barton on Sea	B
Hive Beach	A/B	Milford on Sea	B
Cogden Beach	B	Solent	B/C
West Bexington	B	Lepe	B/C
East Bexington	B	Lee on the Solent	A/B
Weymouth	B	Browndown	A/B
Overcombe	B	Southsea	A/B
Ringstead	B/C	Hayling	A/B
Worbarrow Bay	C	East Wittering	A/B
Swanage	B	Selsey	B
Studland	B	Pagham	B
Boscombe	B/C	Bognor Regis West	B/C
Southbourne	B	Bognor Regis East	A/B
Mudeford	B		

2.6.1.10 Following this first round of landfall assessments, nine 'category A' sites were visited and evaluated in more detail. The preliminary search area was then further narrowed down to six sites from Lee-on-the-Solent in the West to Selsey in the East, and therefore includes sites from Hampshire and West Sussex. Those sites were:

- Lee on the Solent;
- Browndown;
- Southsea (now referred to as Eastney, see 2.6.1.11);
- Hayling;
- East Wittering; and
- Selsey (due to its close proximity).

2.6.1.11 Section 2.6.3.2. provides further information on the two locations at Lee on the Solent.

2.6.1.12 Following a site visit, the eastern beach area at Southsea it was considered to be a more appropriate location, therefore this option was moved further to the east and renamed appropriately to Eastney to reflect the town closer to the potential landfall site. This move considered several factors including the marine constraint of the outfall pipe (eastern location gives easier access) and onshore space availability (more space available during construction at an eastern location). This location formed part of the Onshore Cable Route that was selected (see 2.7.1.17).

2.6.2 DESKTOP STUDY ON ONSHORE ROUTES – Q2 2016

To provide information for landfall selection it was considered that some preliminary terrestrial routing would inform the process. This was conducted in Q2 2016. The routes developed were:

- Lee on the Solent to Lovedean;
- Browndown to Lovedean;
- Eastney to Lovedean;
- Hayling to Lovedean;
- East Wittering to Lovedean; and
- Selsey to Lovedean.

2.6.2.1 Preliminary routes were developed within a Geographical Information Systems ('GIS') computer software package. This software determined the shortest route between Lovedean substation and each potential landing site, in turn using a European road network dataset, using the following criteria:

- Short terrestrial routes preferred;
- Minimising impacts on landowners/occupiers;
- Onshore Cable Route preferably following the roads, but avoiding motorways;
- Onshore Cable Route preferably minimising the number of rail/ waterway/ motorway crossings; and
- Avoidance of environmental constraints, where practicable.

2.6.2.2 Based upon the above described methodology it was concluded that Eastney and Hayling were the preferred options. In parallel during Q2 2016 site visits of all six sites, referred to in section 2.6.1.10, were conducted (see 2.6.3.2) and a landfall constraints workshop was held (see 2.6.4).

2.6.3 SITE VISITS OF THE SIX SHORT-LISTED SITES

2.6.3.1 A site visit was conducted for the 6 shortlisted landfall sites in April 2016. In addition to the criteria mentioned in Section 2.6.1.3 and 2.6.1.7, during the preparation for the landfall visits, and the visits themselves, the following additional criteria was investigated:

- Site area e.g. restrictions, sediment to bury cable through;
- Accessibility to site e.g. places heavy plant can access the site;
- Working Space e.g. sufficient room for pulling the cable into position;
- Special features in vicinity of site e.g. sand waves, fish traps;
- Environment e.g. designations, flooding, erosion;

- Leisure activities e.g. tourist area, pleasure craft;
- Tide e.g. tides at time of visit, any concerns;
- Weather, sea and swell e.g. prevailing direction;
- Fishing activity e.g. evidence of activity near the sites;
- Marine traffic activity e.g. shipping lanes; and
- General facilities e.g. nearest ports, local facilities.

2.6.3.2 During the site visit, two possible sites were identified at Lee on the Solent and subsequently named Lee on the Solent 1 and Lee on the Solent 2, therefore the total number of landfall sites under consideration at this stage was seven. The seven sites included:

1. Lee on the Solent 1;
2. Lee on the Solent 2;
3. Browndown;
4. Southsea (now referred to as Eastney, see 2.6.1.10);
5. Hayling;
6. East Wittering; and
7. Selsey (this option was considered due to its close proximity).

2.6.3.3 Refer to Plate 2.6 - Landfall Location Optionsfor the locations of the initial landfall site options considered, numbered in line with the list in Section 2.6.3.2.

Plate 2.6 - Landfall Location Options

2.6.4 LANDFALL CONSTRAINTS WORKSHOP – MAY 2016

2.6.4.1 Following the landfall site visits, a multidisciplinary landfall constraints workshop was held (disciplines included cable engineering, marine geotechnical engineering, onshore geotechnical engineering, environmental/planning and HVDC/electrical engineering). The aim of the workshop was for all interested parties to engage in considering the impact of the constraints for UK Landfall options, to enable preferred sites to be identified.

2.6.4.2 Following the landfall constraints workshop, in May 2016, the following locations were discounted:

- Lee on Solent 1 – space constraints for onshore construction and offshore installation, poor/congested marine approach, concerns over marine archaeology;
- Selsey – insufficient space for this site to be considered as a landfall location;

- Lee on Solent 2 – constraints on marine installation space, congested marine approach, large number of vessel tracks on approach to landfall, close in proximity to a Site of Special Scientific Interest ('SSSI'); and
- Browndown – constraints on marine installation space, poor/congested marine approach, potential higher UXO risk, concerns over marine archaeology.

2.6.4.3 Therefore, the preferred landfall locations were identified as Eastney, East Wittering and Hayling.

2.6.5 PORTSMOUTH CITY COUNCIL ('PCC') FEEDBACK – APRIL 2017

2.6.5.1 Following a meeting with PCC in April 2017, queries were raised on the proposed Eastney landfall. PCC requested exploring the option of landing further east along Eastney beach (south-east of Fort Cumberland site) or for the Marine Cable Corridor approach to extend into the estuary and land at Eastney Ferry Terminal before Horizontal Directional Drilling ('HDD') across to Milton Common.

2.6.5.2 The alternative location at Eastney beach was located between two outfall pipes at the entrance to Langstone Harbour. The channel width at this location and water depths indicate this location would be likely to be unsuitable for vessel access during construction works. The narrow channel would limit the access to this location to allow for direct pull-in operations and the cable routing on the approach to the landfall would be very challenging. Therefore, this alternative more eastern location at Eastney beach was discounted.

2.6.5.3 The landing point at the Eastney Ferry Terminal was also discounted as an alternative location due to the limitations that the construction vessels would impose upon vessel traffic in this narrow channel, including recreational traffic (i.e. the requirements to block other shipping movements in this region during construction works). This was not considered a practicable alternative option and was hence discounted from the landfall optioneering process.

2.6.6 UK TERRESTRIAL ROUTES AND LANDFALL WORKSHOP – JUNE 2017

2.6.6.1 Hayling Island, Eastney and East Wittering were shortlisted as potential landfall locations, however, Hayling Island was soon discounted due to the environmental and technical constraints associated with the DC cable route crossing from Hayling Island to the mainland. It was also considered that Hayling landfall would have been more challenging and technically complex from a marine installation perspective. Eastney and East Wittering were subsequently shortlisted to the final stage of the landfall selection process.

2.6.6.2 Plate 2.7 shows Cable Route 3D (blue) and Cable Route 1D (pink). Cable Route 1D, which was considered during the workshop, starts at East Wittering Landfall, travelling through fields near Earnley, along roads B2198 - A286 - A259 - B2146-B2147 - B2148 - B2149 then through Lovedean town to the indicative Converter Station location.

2.6.6.3 Route 3D, which was also considered during the workshop, is shown below as starting at Eastney Landfall and following along roads A288 - A2030 - B2177 - A3 - B2150 then following country roads or fields to the indicative Converter Station location.

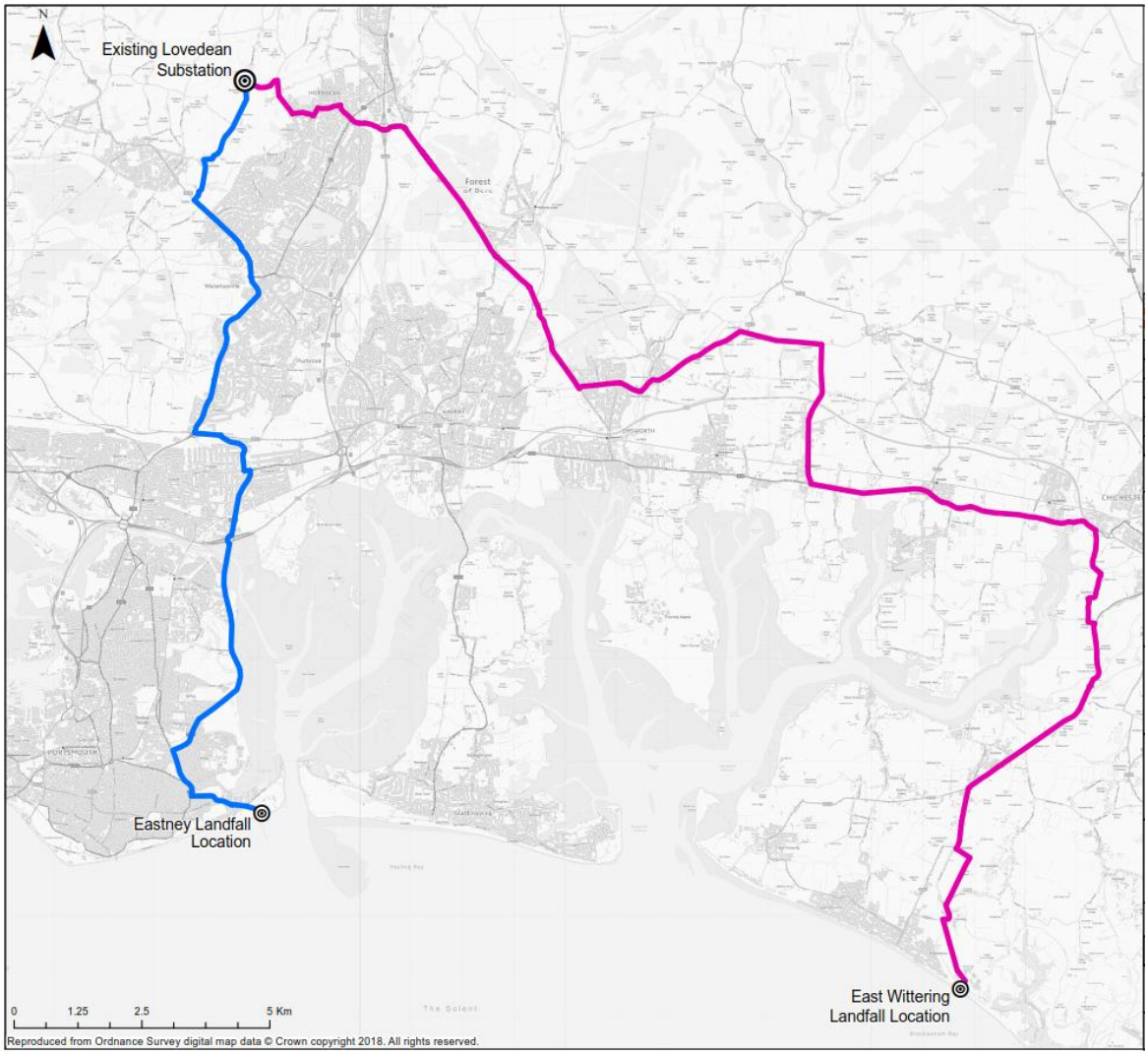


Plate 2.7 - Cable Route 3D (blue) and Cable Route 1D (pink)

2.6.6.4 In June 2017, a UK Terrestrial Routes and Landfall Workshop was held within the project team with the aim of determining the UK Landfall and cable route that should be taken forward in the UK planning application. This meeting concluded that Route 3D was preferable, but that its associated landfall at Eastney presented some technical challenges for installation (for details on the numbering convention/DC cable route site selection, see Section 2.7). Consequently, it was agreed that further work in relation to the installation methodology would be required, to give a greater level of confidence in the feasibility of this landfall.

2.6.7 FEEDBACK FROM HDD CONTRACTORS/CABLE INSTALLATION CONTRACTORS – JULY/AUGUST 2017

2.6.7.1 During July and August 2017, the Applicant engaged with cable installation contractors and HDD contractors to identify the preferred UK Landfall site, alongside further data collation on the marine environment, land ownership and environment.

2.6.7.2 HDD contractors and cable installation contractors concluded that Eastney and East Wittering were considered to be similar from a marine installation perspective. Therefore, the deciding factor was the Onshore Cable Corridor considerations (which had subsequently been narrowed down to Route 1D and Route 3D).

2.7 SITE SELECTION – UK DC CABLE ROUTE

2.7.1 PRELIMINARY DESKTOP STUDY

2.7.1.1 As discussed in Section 2.6.2.1, preliminary cable routes were developed based on previously selected landfall options via GIS modelling.

2.7.1.2 The automatically generated routes created in the preliminary desktop study were further investigated and developed through an additional desktop study conducted in February 2017.

2.7.1.3 This desktop study investigated potential DC cable routes from the three shortlisted Landfall locations (Eastney, Hayling Island and East Wittering) to Lovedean substation to allow a preferred route to be identified.

2.7.1.4 The DC cable route desktop assessment work was broken down into several stages:

- Desktop route study;
- Utility mapping;
- Ground conditions review of crossing points; and
- Site visit/walkover.

2.7.1.5 Plate 2.8 – DC Cable Routes Investigated in Desktop Study shows the eleven variations of routes (including Hayling Island) considered during the desktop study.

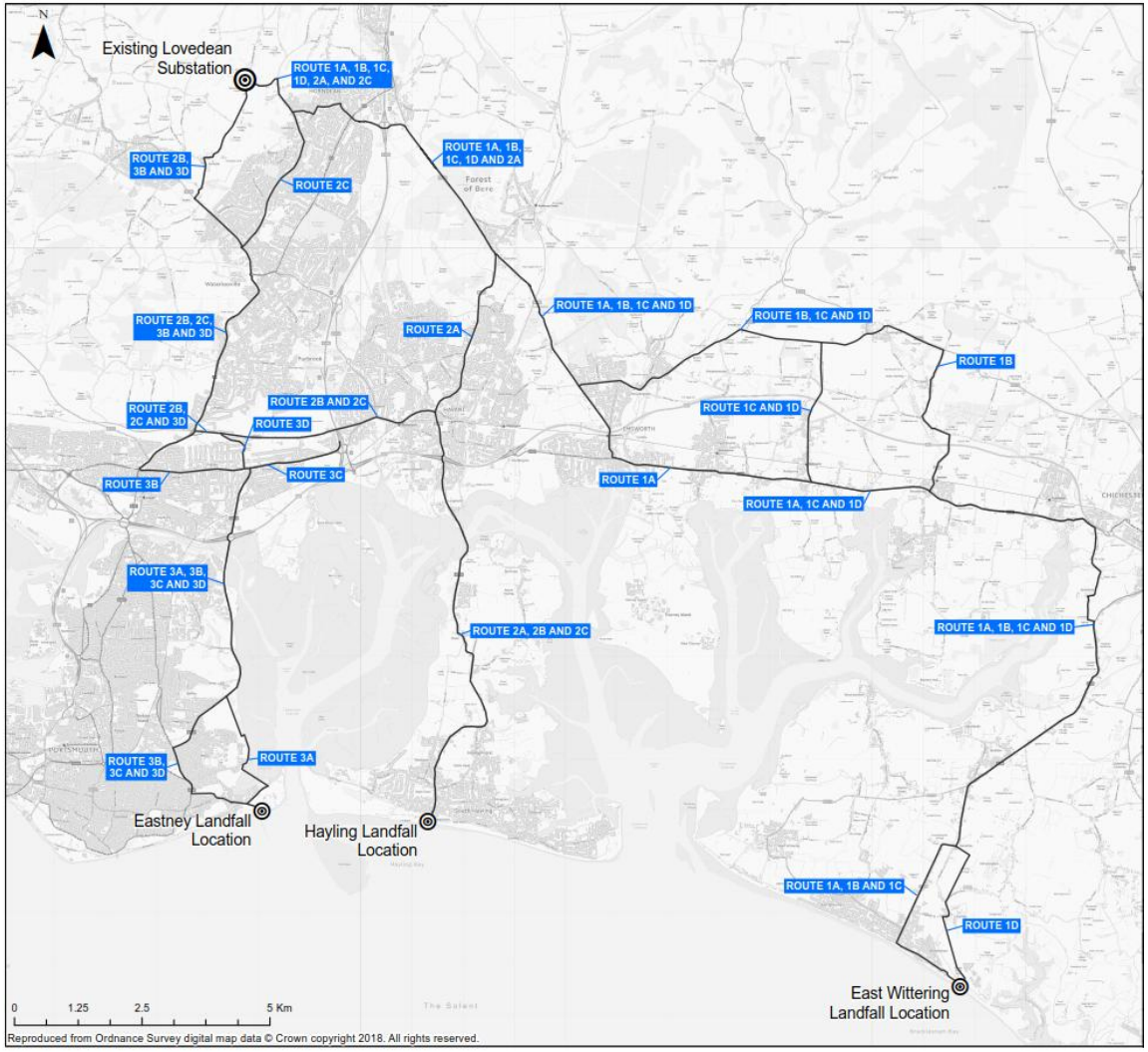


Plate 2.8 – DC Cable Routes Investigated in Desktop Study

2.7.1.6 Eleven variations on three basic routes were considered, of which four were identified as possible i.e. constructible.

2.7.1.7 The shortlisted routes were identified as Route 1B, Route 1C, Route 1D and Route 3D (where the number ID represents the landfall site (1 = East Wittering; 3 = Eastney) and letter ID represents the route taken i.e. A = option A, B = option B etc.).

2.7.1.8 Along the majority of the cable route, the assumption was made that both pairs of cables are laid in the same road. At some locations along the route, optionality has been included to split the cable route into two separate routes (each of one pair of cables).

2.7.1.9 In general, all the cable routes followed the existing roads network, except where deviations off-road for HDD crossings may be needed and where there may have been a need to deviate around constraints that exist within the road. In addition, consideration was also given to shortening certain sections of the road routes by crossing fields or open areas that were not otherwise designated or protected under environmental, ecological or heritage legislation.

2.7.1.10 This desktop study deemed the cable routes from Hayling Island not technically feasible as a suitable crossing from Hayling Island to the mainland could not be identified. It was considered that the cables would not be able to be attached to Langstone Bridge or placed within the bridge deck and as traditional trenching techniques would disturb the protected and environmentally sensitive estuary, the only other alternative option for this crossing was to use HDD techniques to allow the cable to be placed without disturbing the estuary. However, the HDD itself is complex due to insufficient land requirements either side of the estuary for the HDD plant. The bathymetry of the Langstone Harbour entrance (which would need to be crossed, when coming from Hayling island) was also considered very steep as it drops quickly over a relatively short distance (i.e. around 12-14 m). Therefore, from a design solution perspective, routes from Hayling Island were considered to be more complex and impractical at this stage hence discounted.

2.7.1.11 Crossing to the mainland via Portsdown Hill Road Bridge also proved infeasible as the area is heavily developed with numerous residential properties on either side of this bridge, therefore there were no suitable setup or exit points for the HDD equipment to be constructed in the immediate areas. Given the bridge deck thickness and existing services it is also unlikely to be practicable to position cables in the bridge deck. Therefore, all three routes from Hayling Island were discounted at this stage (Routes 2A, 2B and 2C).

2.7.1.12 One of the routes from East Wittering (Route 1A) was also discounted at this stage as it was considered impractical to cross Slipper Mill Pond, a wildlife nature reserve (SINC without significant disturbance to the surrounding area and HDD techniques were not deemed possible. The three remaining East Wittering routes (Routes 1B, 1C and 1D) were shortlisted alongside one Eastney cable route, Route 3D.

2.7.1.13 Routes 1B, 1C and 1D were the longest of all the cable routes with the largest number of HDD crossings and were discounted for this reason.

2.7.1.14 In addition, routes 1B, 1C and 1D are in a rural setting, which from an engineering perspective is beneficial as it would avoid the constraints associated with urban areas such as existing services and structures, however from an environmental perspective it will likely encounter a greater number of ecological, landscape and other features and therefore has the potential to cause greater impact to the natural environment.

2.7.1.15 Routes 1B, 1C and 1D all pass through ancient woodland on the B2149. It was observed that there are narrow road verges at this location. If excavation outside of the carriageway and verge footprint is required this may involve the removal of some trees and is likely to damage tree roots. Ancient woodland is irreplaceable and it can be challenging to provide suitable mitigation. These routes would also require crossing Chichester Harbour Area of Outstanding Natural Beauty ('AONB').

2.7.1.16 Route 3A was subsequently ruled out during the initial feasibility stages due to the technical challenges associated with crossing Milton Common. Route 3B was also abandoned as this route was the similar to Route 3D with a diversion west on Havant Road (at the Farlington Avenue junction) and this diversion was no longer considered required. Route 3C was abandoned as it was concluded that after exiting a major roundabout, the motorway was unable to be crossed using HDD or trenching due to spatial constraints. Therefore, Route 3C was abandoned during the initial route study.

2.7.1.17 Route 3D, see Plate 2.7, was selected as the preferred Onshore Cable Corridor and Landfall location and was progressed to the next phase of investigation and planning. In summary, Route 3D proposed running the DC cables from the Landfall via A288, A2030, B2177, A3, B2150 and via country roads or fields to the indicative Converter Station location. Three crossing points requiring HDD were identified as moderately difficult but possible. This route was the shortest of all those investigated at approximately 18.6 km in length.

2.7.2 FEEDBACK FROM PUBLIC CONSULTATION – JANUARY 2018

2.7.2.1 Route 3D predominantly followed the existing road network to avoid impacting the natural environment. However, feedback from the public consultation events held in January 2018 led to certain aspects of this route being questioned due to their impacts on the local area (including the impact on the local transport system during the construction period). Added to this, changes in the environmental status of certain land parcels have also initiated further consideration of the cable route options.

2.7.2.2 One particular issue raised by PCC was whether the use of Langstone Harbour was considered as part of the landfall optioneering process. This area is constrained by international designations, including the Chichester and Langstone Harbours Special Protection Area ('SPA') and Ramsar site and Solent Maritime Special Area of

Conservation ('SAC') and part of Solent and Isle of Wight Lagoons SAC, all of which are internationally protected sites (Natura 2000 sites).

2.7.2.3 Langstone Harbour is also designated as a Site of Special Scientific Interest ('SSSI') which are of national importance. Other nationally important sites that surround the Harbour include Farlington Marshes Local Nature Reserve ('LNR'), West Hayling LNR, Hayling Billy LNR and the Kench, Hayling Island LNR. There are also some surrounding sites of local importance including Farlington Marshes Site of Importance for Nature Conservation ('SINC').

2.7.2.4 Article 6(2) within Natura 2000 requires AQUIND to: *"Avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types".* In the case of priority habitats, projects and plans that are likely to give rise to adverse effects can only proceed "if the evoked public interest concerns human health and public safety or overriding beneficial consequences for the environment, or if, before granting approval to the plan or project, the Commission expresses an opinion on the initiative concerned".

2.7.2.5 Accordingly, the existing environment protection regulations encourage all developments to avoid such areas.

2.7.2.6 Furthermore, the vessels typically used to lay the undersea cable cannot operate in the Harbour entrance due to its limited width, while the Harbour's limited depth and sedimentary composition renders it too instable for the use of onshore cable installation technologies and machinery. At its narrowest, the harbour entrance is <250 m wide (approximately 134 m between channel buoys). Water depths vary from 5-14 m LAT in the entrance channel, then shallowing significantly. Maximum actual depth, at Spring tides, is approximately 5.8-9.5 m for the main accessible channel. The channel is, therefore, likely to be too shallow for a Dynamic Positioning cable installation vessel (where a minimum of approximately 12.5 m for draught would be required) and too narrow for a barge (a corridor 100-200 m either side of the cable would be required for barge mooring spread). Barge movement is typically limited to approximately 400 m between re-positioning of the anchors, which would make the entrance channel difficult to navigate.

2.7.2.7 Trenching in extensive tidal mudflats is likely have significant environmental impacts on protected areas. In terms of programme, the construction period would also be likely to last longer in this area due to the complexity of such works on soft marshlands and the working constraints created by tidal windows, shipping activities and environmental factors, thus prolonging the disturbance to protected areas. Trenching operations would be particularly disruptive to any vessel traffic in this narrow channel – including recreational traffic, the Hayling Ferry, and marine aggregate vessels transiting to Langstone (vessels of draughts of about 4.5 m can berth at MHWS). Therefore, Langstone Harbour was not considered further past the optioneering stage

of the Proposed Development, and deviations in to this area are not considered in this PEIR.

2.7.2.8 Areas in which deviations were considered included:

- King's Pond area, see Figure 2.1;
- Portsea Island mainland crossing (to avoid crossing via the bridge/ roundabout on Havant by-pass to an area west of the Eastern Road on Portsea Island), see Figures 2.2 and 2.3;
- Reintroducing options around Milton Common area, see Figure 2.4; and
- Alternatives to avoid the busy Portsmouth roads, (i.e. Eastney Road, Milton Road), see Figure 2.4.

2.7.2.9 In conclusion, the deviations around the King's Pond area resulted in the need for additional roads to be included in the route option (i.e. Mill Road, Martin Avenue and additional areas of Anmore Road). This provided an alternative means of routing, should the HDD/trenching techniques through the King's Pond field areas prove impracticable.

2.7.2.10 In addition, the crossing from Portsea Island to the mainland was relocated to avoid the need for the cable route to utilise the bridge structure. These areas were investigated and HDDs were considered feasible from either the industrial park (south of the estuary/east of Eastern Road) or from Anchorage Park (south of the estuary/west of Eastney Road) to Farlington playing fields.

2.7.2.11 Potential cable swathes across Milton Common were investigated as an alternative means of routing from Eastern Road. Ground Investigation ('GI') works were undertaken at Milton Common to understand the feasibility of trenching here, given that historically the area was a landfill site. Based on the findings of the GI, it was considered that the route options that cut across the middle of Milton Common were high risk from a land contamination and construction point of view and hence discounted. In comparison, the route options which track the southern and western perimeters of Milton Common (following Moorings Way and Eastern Road) encountered thinner deposits of made ground (landfill). It was therefore considered that the route options tracking the periphery of Milton Common should be taken into consideration during the route optioneering.

2.7.2.12 Another option investigated to cross Milton Common was to follow the raised public path on the eastern side of the Common. Further investigations are ongoing to ascertain the viability of this route and the methodology that could be employed.

2.7.2.13 Alternative routes were investigated as a means of avoiding the busy Eastney Road and Milton Road, following on from discussions with PCC in March 2018 regarding the impacts of trenching. These options included routing through the allotment gardens located south of Locksway Road or the neighbouring road network in this area. An option to HDD underneath the allotments to the coastal path on Milton

Common was ruled out as this would have to pass underneath residential dwellings. The options to route the cables through the allotments/alleyways between houses onto Locksway Road is still considered viable, as is HDD from south of the allotments to the car park south of Locksway Road, and a route via Locksway Road/Ironbridge Road.

2.7.3 FINAL ONSHORE ROUTE – DCO CONSULTATION

2.7.3.1 Therefore, the Onshore Cable Corridor identified for the PEIR includes the majority of the "consultation route" (as presented to the public in January 2018), with some additional alternatives, that are subject to ongoing studies, to assess their practicability. Numerous assessments/investigations have informed the onshore route being discussed in this DCO consultation, including initial desktop studies; procured utility information; highway boundary information; ground investigation results; HDD feasibility studies; environmental surveys and public engagement feedback.

2.7.3.2 A further appraisal is ongoing which will be informed by feedback from stakeholders as part of this consultation and environmental information identified during the assessment process to inform the final route. This will be reported in the ES.

2.8 SITE SELECTION – MARINE CABLE CORRIDOR

2.8.1 BACKGROUND

2.8.1.1 Due to their inter-related nature, the Marine Cable Corridor selection process was undertaken in parallel alongside the UK and French Landfall selection process. Following the identification of the landfall sites, the Marine Cable Corridor between Eastney in the UK and Pourville in France was identified. The Marine Cable Corridor was further refined as part of iterative optioneering and feasibility studies. Whilst the marine cable route within the Marine Cable Corridor has been further refined through marine surveys and route engineering, the final detailed route will not be determined until the EPC Contractor undertakes their design, which may have subsequent minor alterations based on the findings of the pre-installation survey, seabed preparation and final actual installation operations.

2.8.2 ROUTE DEVELOPMENT STAGES

2.8.2.1 The route selection process has been, and will continue to be, developed through the following stages:

- Initial feasibility – August 2014 (as described in Sections 2.4.1 and 2.4.2);
- Identification of constraints relating to grid connection, onshore routes, and landfalls:
  - Preliminary High-Level Study – August 2016 (see Section 2.8.3);
  - Marine Cable Route Report – June 2017;

- Marine Surveys: Q3 2017 – Q2 2018 (see further detail of the outcomes of these surveys provided in Chapter 3 Description of the Proposed Development (section 3.2.4) and Chapter 8 Intertidal and Benthic Ecology and Appendix 8.1 Benthic Ecology Survey Report.):
  - Benthic Ecology Surveys Q3 2017 – Q1 2018;
  - Geophysics Survey Q4 2017 – Q1 2018;
  - Geotechnical Survey Q2 2018 – Q3 2018;
  - Lab Testing and Reporting Q3 2018 – Q4 2018;
- Route Engineering Q3 2018 – 2020:
  - Route Engineering;
  - Cable Burial Risk Assessment ('CBRA');
- Consent Conditions (2019 – 2020); and
- EPC Design and Pre-Installation Survey (2020 onwards).

2.8.3 PRELIMINARY HIGH-LEVEL STUDY – AUGUST 2016

2.8.3.1 In parallel with the landfall studies, a preliminary high-level study was undertaken in August 2016.

2.8.3.2 A preliminary marine cable study area was therefore established based on the extremes of these landfalls (UK and France) (see Section 2.6), but with a further additional western constraint due to the planned IFA2 Interconnector. See Plate 2.9 – Marine Cable Study Area in which the study area is shown in brown.

2.8.3.3 The following marine constraints were then applied to the study area to select a preferred survey corridor:

- Dredging areas;
- Aggregate extraction;
- Offshore wind farm locations;
- Transport activity;
- Cables and pipelines;
- Wrecks, obstructions and foul areas;
- Rock outcrop; and
- Marine Conservation Zones ('MCZs').

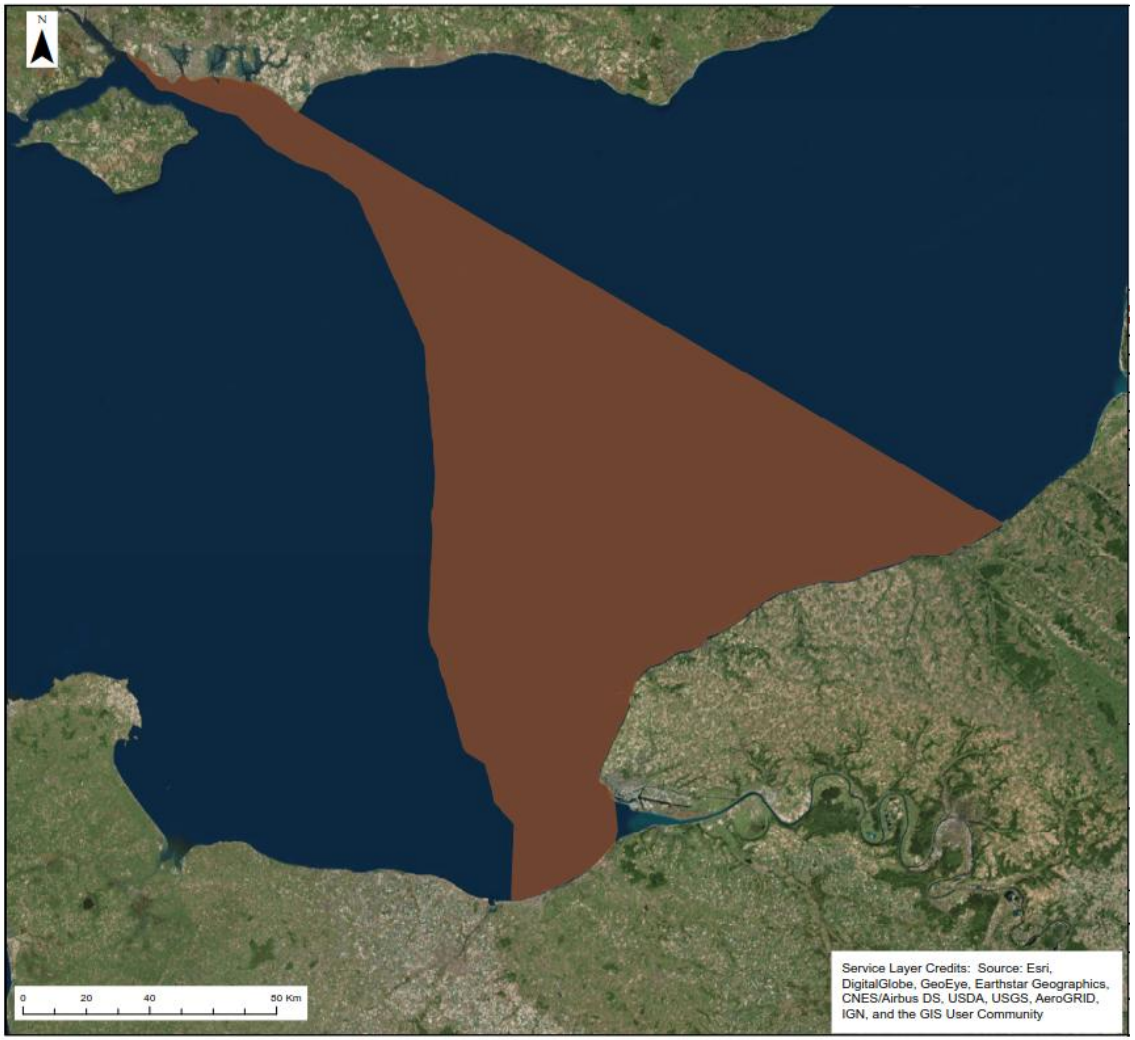


Plate 2.9 – Marine Cable Study Area (area shown in orange)

2.8.4 DETAILED DESKTOP STUDY

2.8.4.1 A more detailed marine cable route study was undertaken in 2017. This considered a wide range of parameters, including other sea users (e.g. fishing, shipping), geological/seabed conditions, environmental /heritage constraints, and other seabed uses/constraints (in service and out of service cables, outfalls, UXOs, etc.). The desktop study resulted in the refining of route options on the basis of the criteria used.

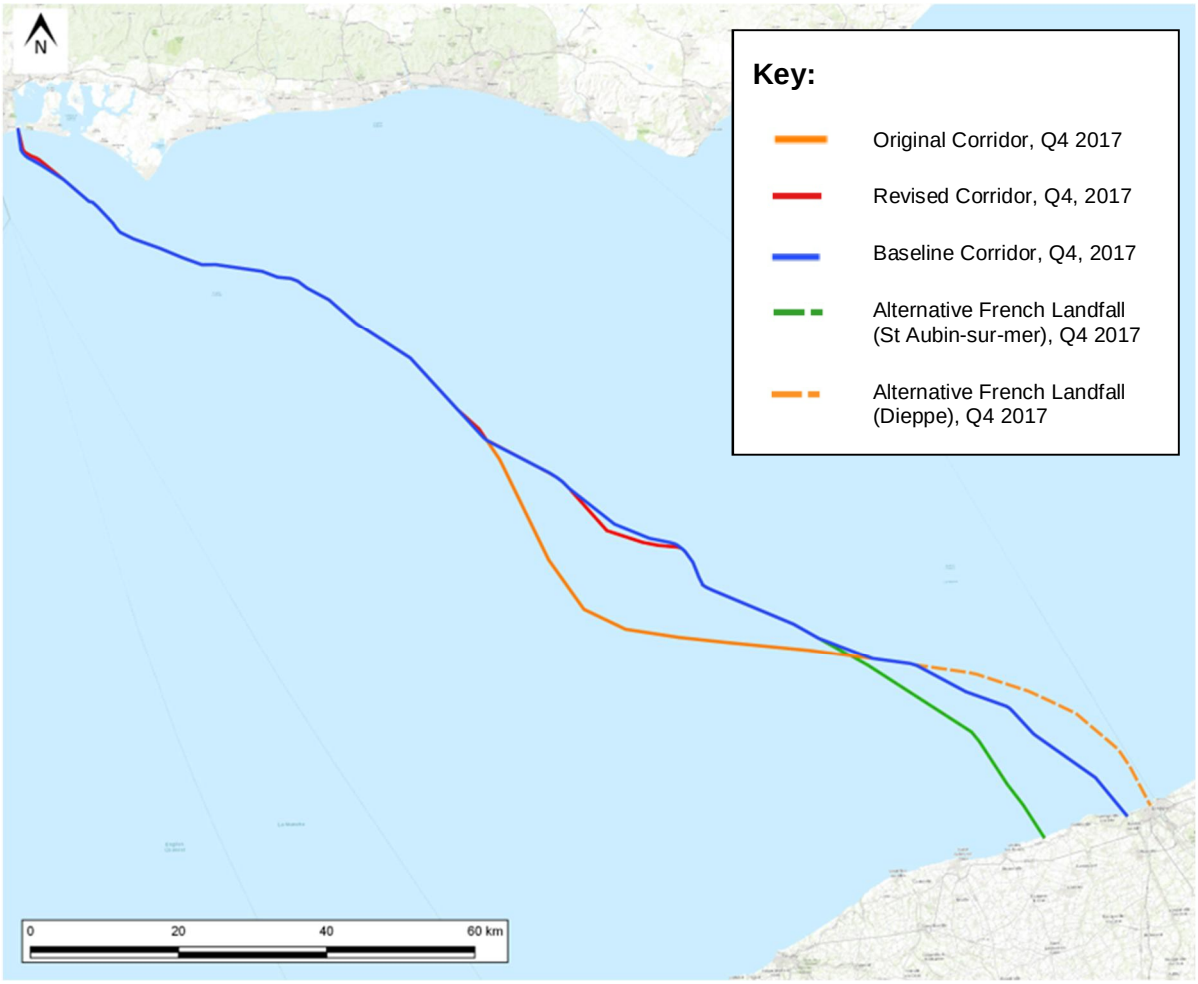
2.8.4.2 Preliminary criteria were developed to define a preliminary survey corridor and preliminary route position list. These included:

- Minimum turning radius of 500 m;
- Minimum distance of 50 m from any outfall pipe;
- Minimum distance of 500 m from IFA2 Interconnector cables (western limit);
- Straight for at least 1,000 m from UK Landfall location heading towards deeper water;
- Cannot pass through anchorages, offshore wind farm sites or dredging areas;
- Cross in service cables at 90 degrees (for 500 m either side);
- Cross shipping channels/lanes at 90 degrees where possible;
- Where possible, keep bathymetry consistent;
- Where possible, keep within sandy areas (rather than gravel or rock);
- Where possible, avoid environmental designations; and
- Avoidance of wrecks.

2.8.4.3 Discussions with stakeholders, and site visits to landfalls were also undertaken in this period.

2.8.5 MARINE CABLE CORRIDOR DEVELOPMENT – QUARTER 4 2017

2.8.5.1 The option to shorten the route was identified in Q4 2017. The original route (see orange line in Plate 2.10 - Marine) avoided the central Channel dredging areas and crossed the main shipping corridors at approximately 90 degrees.



OpenStreetMap - © OpenStreetMap (and) contributors

Plate 2.10 - Marine Cable Corridor Options

2.8.5.2 The revised Marine Cable Corridor (red line in Plate 2.10 - Marine) was identified which passes through a gap in the dredging areas. Whilst crossing the shipping corridors at less than 90 degrees, the revised route is significantly shorter, thereby reducing environmental impacts, seabed occupation, and time taken during construction (with reduced health and safety risks and reduced operational impacts on other sea users).

2.8.5.3 The route was further optimised closer to shore and approximately halfway along the route (see blue line in Plate 2.10 - Marine), following discussion with The Crown Estate, the dredging industry and fishermen. The nearshore revision avoided, as far as possible, the former Horsetail dredging area, and moved the route closer to IFA2 to avoid rocky seabed/fishing grounds and minimise 'sterilisation' of the seabed between the two proposed cables (AQUIND Interconnector and IFA2). The blue baseline route represents the Marine Cable Corridor that is presented for assessment within this PEIR.

2.8.5.4 There were three French Landfall locations under consideration at the start of the marine survey study in October 2017, however after further optioneering only one, Pourville, was surveyed.

2.8.6 MARINE SURVEYS NOVEMBER 2017 TO AUGUST 2018

2.8.6.1 The Marine Geophysics Survey was undertaken from November 2017 to March 2018, with the Geotechnical Survey from May to August 2018, outputs of which are detailed in Chapter 3 - Description of the Proposed Development. Once the geophysical and geotechnical data has been fully integrated, the CBRA will be developed which will further inform route development and corridor refinement. The EPC Contractor will undertake pre-installation surveys and route engineering that will determine the preferred final corridor.

2.9 CONCLUSIONS

2.9.1.1 The studies undertaken during this process took place in parallel with each other, with all aspects of the system considered together as part of the decision-making process.

2.9.1.2 The recommendations are for a UK Landfall at Eastney, a grid connection point at Lovedean substation with the Converter Station to be built to the west of the substation and the Marine Cable Corridor passing to the east of the IFA2 cable route. These site corridors/options are shown to be the most preferable from the environmental and engineering studies undertaken.

REFERENCES

National Grid, ESO 2016. Connection and Infrastructure Options Note

National Grid, ESO 2016. Connection Offer in Respect of AQUIND Interconnector at Lovedean 400KV Substation (Ref: A/AQUINDII5163O6-EN(2))