2 Project Description

Introduction

2.1 The following section describes the cable route, the proposed development and its construction methods. The information is a summary of the data and assumptions used in compiling this environmental report. The input data has been sourced from FAB Link Ltd as well as experience of other similar projects.

2.2 The FAB Link Interconnector project boundaries are shown on Figure 2.1. Two boundaries are presented on this and other plans to accompany the Environmental Report as follows:

- The permanent cable easement boundary landward of sea defences which is contained exclusively within States of Alderney (SoA) land and is primarily contained within existing roads and tracks; and

- The outer limits of the Option area for marine cables (150 m wide) through the intertidal zone (between MLW and MHW) and their shore crossing infrastructure (the landfall) areas within a target zone 100 m wide. Additional temporary cable construction laydown / working areas are shown along the onshore cable route on Longis Common where space allows.

2.3 This report has not sought to locate the landfall infrastructure and related temporary construction areas precisely at this stage and therefore the Option boundary serves as the anticipated limit of deviation within which the permanent cable infrastructure will be sited. The final design of the cable route will not be known until beyond the autumn of 2017 when a contractor has been appointed but some chapter authors have found it necessary to make assumptions about the reasonable (but nevertheless likely) worst case development for their particular impact assessment.

2.4 In summary, the construction methodologies and site locations will be determined in detail by the appointed contractor. FAB Link Ltd and its consultants have progressed the design to a level sufficient to identify the outer boundary of the land required and to confirm that the cable is capable of being constructed.

2.5 The boundaries presented include all land required including access points and compounds. Taken together with the assumptions on construction techniques, programme, traffic and material quantities, this information comprises the ‘design envelope’ for the purposes of this environmental assessment.

2.6 Information within the design envelope is necessarily at a high level, generic (albeit based on real-world examples) and applicable to a range of design scenarios. For example, where a number of different techniques could be used to construct the cable at a given location, the various options are presented. For assessment purposes, the maximum parameters within the design envelope are used where they are considered to be a reasonable worst case unlikely to be exceeded.
Principal Project Requirements

2.7 The principal project requirements for the Alderney onshore cable route to mean low water are as follows:

- The electrical design of the interconnector comprises of two HVDC symmetrical monopoles capable of transmitting up to 700MW each between France and Britain.

- Each monopole is comprised of a converter at either end (Britain and France) linked by 2 HVDC cables and a communications cable.

- The onshore HVDC cable route will run between landfalls at Longis Bay and Corblets Bay through land within the SoA ownership.

- The commencement of the construction phase is planned for 2018 with the interconnector becoming operational between December 2020 and mid-2022.

Cable Route Description and Context

2.8 Consultants Wood Group Kenny conducted a feasibility study into offshore cable routing feasibility (WGK 2014, 2105) between France and Britain via Alderney which included the identification of candidate landfalls. The WGK report appraised the environmental, planning, land use and physical constraints (inclusive of existing accessibility) at each landing site both onshore and offshore, including consideration of nearshore and onshore cable routes.

2.9 The selection of the preferred cable route between the two selected landfalls at Longis Bay and Corblets Bay was made in consultation with SoA as part of the Option negotiations. The interconnector has been purposefully located on existing tracks and roads for the majority of the route in a bid to avoid or reduce the potential for environmental impacts.

2.10 The route chosen is shown on Figure 2.1. The following is a brief description of the cable route and landfalls. The route is depicted in detail at Appendix 2.1 Crossings Schedule and Crossing Schedule Tables.

Corblets Bay

2.11 The landfall construction compound location has been selected for assessment purposes to be behind Corblets Road where there is sufficient space avoiding interaction with the sea defences.

Mannez Road

2.12 The cable route is in two parts leading from Corblets Bay landfall. A cable loop comprising one of the two circuits (two cables in each circuit) will continue along Corblets Road to Mannez Quarry to provide an option for later connection with a converter station. The loop returns along Mannez Road to join its twin which will be routed directly south from Corblets Bay. The works on Corblets Road and Mannez Road can be accommodated within the highway boundary. Buried services are present in the verges.
Longis Common

2.13 The Longis Common route has been selected, in negotiation with SoA, to occupy an existing track which will minimise the impact on the conservation interests of the common both historic and natural. There are several boreholes on the common connected by a network of pipes and cables which will need to be avoided. The southern half of the Longis Common route is located to the east of the extrapolated maximum extent of a wartime burial site. The cable route is located within the predicted extent of an anti-tank minefield which was cleared after the war. In light of both constraints, specialist clearance and excavation will be required.

Longis Bay

2.14 The Longis Bay landfall construction compound location has been selected for assessment purposes to be on the seaward side of Longis Common Road where sufficient space is available behind the anti-tank wall and avoids known archaeological sites.

Onshore Cable Design Envelope

Cable Parameters

2.15 A typical cross section of a HVDC land cable is shown at Inset 2.1. The cables used in Alderney will have construction similar to this although their dimensions will vary. The overall diameter of these cables will be in the range of 100 to 130mm.

Inset 2.1– Typical cable cross section

- Copper Conductor
- Conductor screen
- XLPE Insulation
- Insulation Screen
- Copper wire screen
- Lead sheath
- Polyethylene over sheath

Onshore HVDC Cable Design Parameters

2.16 For the two monopole HVDC circuits proposed, a total of four cables are required. It is expected that these will be laid in pairs, each pair in a separate trench as shown in Inset 2.2. In some sections of the route, space restrictions may lead to all four cables being laid in a single trench as shown in Insets 2.3 and 2.4. Fibre optic cables will also be laid for control signalling purposes.

2.17 The design envelope parameters of the onshore HVDC cables are presented in Table 2.1 below.
### Table 2.1 Design Envelope Parameters of Onshore HVDC Cables.

<table>
<thead>
<tr>
<th>Element</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cable Trenches</td>
<td>1</td>
<td>2</td>
<td>One trench with four cables or two trenches with two cables each</td>
</tr>
<tr>
<td>Width of trenches at base (m)</td>
<td>0.7</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Width of trenches at top (ground level) (m)</td>
<td>0.7</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Length of onshore cable route (km)</td>
<td>-</td>
<td>1.29</td>
<td>Between joint bays i.e. not including the offshore cables seaward of the joint bays</td>
</tr>
<tr>
<td>Cable diameter (mm)</td>
<td>100</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Type of cable</td>
<td>XLPE or MIND power cables, plus fibre optic cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage (kV)</td>
<td>-</td>
<td>+/- 320</td>
<td></td>
</tr>
<tr>
<td>Temporary strip width (m)</td>
<td>5</td>
<td>25</td>
<td>During construction, contains permanent strip</td>
</tr>
<tr>
<td>Land area temporarily affected (m2)</td>
<td>-</td>
<td>5,100</td>
<td>Based on varying width of temporary strip</td>
</tr>
<tr>
<td>Permanent strip width (m)</td>
<td>3</td>
<td>12</td>
<td>3m in roads, 12m across unconstrained land</td>
</tr>
<tr>
<td>Land area permanently affected (m2)</td>
<td>-</td>
<td>10,000</td>
<td>Based on varying width of temporary strip</td>
</tr>
<tr>
<td>Burial depth (m)</td>
<td>0.7</td>
<td>2.0</td>
<td>To top of cables, target is 1.2m</td>
</tr>
</tbody>
</table>

Inset 2.2  320kV DC Cable Typical Single Circuit Trench Options

![Diagram of cable trench options]
Inset 2.3 320kV DC Cable Double Circuit Trench Options

Inset 2.4 320kV HVDC Single Trench Arrangement Options in Narrow Roads

2.18 Should this arrangement be required, the increased heating effect of having both circuits in close proximity will result in a larger conductor size.

Cable Landfall Parameters

2.19 The landfalls at Longis Bay and Corblets Bay will be constructed by either Horizontal Directional Drilling under the sea defences and beach or open-cut trenching. The open-cut trenching technique may still have an element of trenchless techniques for example under roads and/or sea defences. A brief description of the two techniques is provided below.

Transition Joint Bays

2.20 The offshore and onshore cable circuits are jointed to the marine cables on the landward side of the sea defences/beach in a Transition Joint Bay (TJB). The TJB is an underground chamber constructed of reinforced concrete which provides a secure and stable environment for the cable joints (one chamber per cable joint). The chambers may remain accessible (via access covers)
throughout the operation of the interconnector. The access covers if used will finish flush with the ground and will be similar to appearance to other buried services.

2.21 If the HDD method is used, jointing of the onshore and offshore cables typically occurs at the HDD entry points. However, the TJBs may be established separately. Transition joint bays (or pits) are typically 10-15 m long, 2 m wide and 2-3 m deep. Separation distances between transition pits are typically 5 m.

2.22 A separate transition joint bay is required for each cable i.e. 4 TJBs. Fibre optic cables (one per circuit) may be jointed in one of the HVDC TJBs or in a dedicated pit resulting in a total of up to 6 TJBs at each landfall.

2.23 The design of the landfall installation method will be determined by the appointed contractor. The minimum number of cable ducts would be 2 i.e. one each containing a cable circuit and its communications cable. Alternatively each cable to be received in the TJB may have its own duct i.e. a maximum of 6 ducts.

2.24 Duct separation will increase seaward of the TJBs to at least 10m centres within the intertidal zone. Cable circuits laid in the seabed beyond MLW have a much greater separation. For the purposes of assessment it has been assumed that the marine cables could occupy the full 150m wide option area in the intertidal zone (above MLW).

Open-cut trench

2.25 Open cut trenching is a method whereby a trench is excavated across the beach using conventional earth moving equipment. The cable is then pulled ashore from the cable laying vessel into the trench, the trench backfilled and the ground re-instated. For most landfalls, the trench can be divided into two sections, the nearshore intertidal section, which can be excavated by land based equipment, and the offshore sub tidal section which has to be excavated by specialist dredging equipment or using post installation burial techniques.

2.26 The detailed design will take account of any expected beach erosion/transport to minimise the risk that the cables become exposed during the operational lifetime (40-50 years) of the cables. Ducts will be installed to enable the trench to be closed up before the cable is installed. A conceptual cross section diagram is provided below at Inset 2.5

Inset 2.5 – A conceptual profile of duct installation under the Corblets Bay beach (open cut method)
2.27 It has been assumed that a maximum of 4 cable conduits / ducts would be required at 5-10 m centres for the conductors and potentially two more for the fibre-optic communications cables. Installation across a beach section would involve opening trench shored at intervals to prevent the trench from collapsing. Vehicular access both sides of the trench and materials storage would mean that a fenced construction corridor across the beach of up to 30m would be required.

2.28 At Longis Bay, the nature of the beach (sand over peat) is such that any peat from the trench would need to be removed and replaced with a competent bedding material such as sand. The trench would be reinstated over the ducts with the native upper sand layer such that no visible difference is discernible.

2.29 In the nearshore region i.e. below mean low water, ducts usually have a burial depth in the order of 2-3m below minimum beach level taking into account variations in beach erosion profiles and security/integrity of the cable. A depth (conservative) maximum burial depth of 3m has been assumed for Longis and Corblets. Where adequate burial depth cannot be achieved, alternative protection may be applied to the cable, such as cast iron shells, mattresses and/or rock-placement.

2.30 The conduits may need to extend from the transition pit to a point beyond the intertidal zone (perhaps 100m from high water mark) in order to facilitate the ‘pull-in’ from the cable laying vessel.

2.31 Following reinstatement of the beach, the cables would be pulled-in, in pairs, at a later date to suit the offshore and onshore installation schedules. For each pair, a smaller work site would be established around the relevant conduit entry points as required.

2.32 A single cable lay vessel (CLV) would be deployed to install two cables (one circuit) concurrently. Over the offshore section of the route, the cables are bundled together or at least surface-laid as a pair for later burial. At the landfall, the cables are pulled ashore individually through the associated conduits, each by a separate pull-in winch.

Open Cut Trench – Programme Duration

2.33 It is assumed that conduit installation operations would take place within normal working hours, spanning a 12 hour period and that the works would be conducted both outside of the peak summer holiday season and period of most frequent and violent storms equating to a target period of March to June. The total trenching and conduit installation task duration is likely to be carried out over approximately two months at each landfall. The separate cable pull-in operation typically takes 2-3 days and the jointing operation could take approximately 3 weeks.

Access Requirements and Vehicle Movements

2.34 It is expected that vehicle types utilising the public highway during construction would be very similar to a cross-country cable section i.e. a mixture of cars, vans, articulated HGVs and rigid HGVs including concrete trucks. Excavation equipment, dumpers and cranes would operate within the works. Additionally, vehicle movements generated during the separate cable pull-in and jointing operation would include HGVs bearing winches, cranes, cars and vans.
2.35 Movements on the highway would be generated by construction staff, articulated HGVs and rigid HGVs associated with the compound construction, site mobilisation, site operations, materials deliveries, cable pull-in, site demobilisation and site reinstatement. No abnormal indivisible loads are expected for the landfall installation.

2.36 The HGV traffic generated by an open cut landfall option are likely to comprise deliveries of:

- Conduits
- Fencing
- Temporary tracking
- Concrete and reinforcing for the joint bays

2.37 This is in addition to the equipment and facilities required to establish the compound and its accommodation together with delivery of plant and machinery.

2.38 HGVs, tippers, low-loaders, etc. would access the site between the hours of 0700 and 1900 hrs

Table 2.2: Summary of Open Cut Construction Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Conduits</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Working Hours</td>
<td>12 hours a day Monday to Friday and typically 0800 till 1300 on Saturdays</td>
</tr>
<tr>
<td>Compound Area</td>
<td>50 m x 50 m</td>
</tr>
<tr>
<td>Construction programme</td>
<td>Up to 2 months</td>
</tr>
<tr>
<td>Pull in programme</td>
<td>Up to 3 weeks</td>
</tr>
</tbody>
</table>

Horizontal Directional Drilling

2.39 Horizontal Directional Drilling (HDD) to install the landfall is a technique whereby a hole is drilled from the shore under any sea defences or beach to a point a suitable distance offshore, usually several hundred metres. A pipe is inserted into the drilled hole which is then used as a duct into which the cables are installed. A typical schematic of a HDD site is shown in Inset 2.6 and an example of typical drill site is shown in Plate 2.1
2.40 Depending on the size of the conduit and the ground conditions encountered the drilling operations will take place in a series of stages:

- Drill initial pilot hole (approximately 250mm in diameter)
- Increase the pilot hole to a larger diameter in stages using “reaming/hole opening” techniques (an operation that may be repeated a number of times to suit the diameter of the conduit)
- For cable installations, a messenger (draw) wire is inserted within the conduit (for subsequent cable pull in operations) or may be blown in afterwards using compressed air.

2.41 The cable would then be installed from the Cable Laying Vessel (CLV) by winching from a position behind the beach entry point of the HDD duct.

Plate 2.1 – HDD equipment in use

2.42 HDD operations utilise drilling fluids and additives such as bentonite, to assist in maintaining the integrity of the drilled hole and to transport the cutting materials out of the hole as drilling progresses. The choice of drilling mud and any additives required will be selected on the basis of
drilling performance and environmental constraints. The majority of drilling fluids are biodegradable and have no harmful effect on the surrounding environment.

2.43 The cables would need to be landed in separate bores; therefore up to four bores may be constructed. The installation of ducts is required so that HDD operations are separated from cable installation, i.e. cables can be pulled through the ducts in a separate operation. Therefore a minimum of four ducts would be required.

2.44 Based on other projects with similar drill lengths, it is envisaged that the HDD operation would require the use of a large or maxi HDD rig of 25 to 60 tonnes.

2.45 It is assumed that only one drill rig would be employed for the HDD operations and that the location of this would be moved following completion of each bore.

2.46 A non-saline water supply is generally required on site for making drilling fluid, to lubricate the drill and also remove the drill cuttings. It is assumed that water would be regularly delivered to site by tanker during the HDD construction period.

2.47 The construction site would use low level, inward and downward facing floodlights to provide sufficient light for personnel to move around the site and operate machinery safely. The lights would be mounted and directed to minimise the light escaping beyond the site boundary.

2.48 A temporary mud lagoon will be required to capture and recycle the mud during the drilling process and to ensure it does not exit the site. On completion of the HDD works, the lagoons would be drained into a tanker and the arisings disposed of at a suitably licensed waste management facility.

2.49 A temporary compound area (approximately 50 m x 50 m) will contain all necessary plant and equipment plus parking and welfare facilities required for the landfall construction works.

2.50 HDD boreholes will be required at the landfall site to enable ducts to be installed through which the cables can be pulled from a cable laying vessel positioned near the shore. The depth of each individual HDD borehole would be determined by preliminary geotechnical surveys at the site prior to construction and would vary depending on the soil type and strength and the local geology.

2.51 All existing underground services would be located, marked, and protected as necessary. Any services that may conflict with the proposed installations or site operations would be exposed to prove their exact location and appropriate measures taken to protect them from damage and to ensure the safety of site operations.

**HDD Programme Duration**

2.52 It is assumed that site preparation would take place within normal working hours, spanning a 12 hour period and that the drill operations would run 24hrs once started. The entire duration including set up, will be carried out over a two to six month period, depending on the required duration of drilling and works in areas that facilitate public access to the beach would be conducted outside of the peak summer holiday season (July and August).
Access Requirements and Vehicle Movements

2.53 It is expected that vehicle movements would be generated by construction staff, articulated HGVs and rigid HGVs associated with the compound construction, site mobilisation, drilling equipment mobilisation, drilling operations, site operations, drilling equipment demobilisation, site demobilisation and site reinstatement.

2.54 There will therefore be a mixture of cars, vans, articulated HGVs, rigid HGVs, cranes and drilling rigs. The cranes and drilling rigs may be up to 60 tonnes in weight, however, they are transported in sections using vehicles that are of similar dimensions to rigid HGVs. Therefore, such vehicles would not be classified as abnormal indivisible loads (AIL) by account of their dimensions or weight and there are no abnormal indivisible loads expected.

2.55 The vehicle movements generated by the landfall have been estimated at this stage using experience of working on other similar sites.

2.56 It is expected that the complete landfall construction operations would last up to 6 months and could typically generate around xx HGV movements per day when drilling is taking place plus potentially 40 car movements per day. These estimates are based on experience of other similar projects and are suitable for the purposes of these assessments at this stage.

2.57 All HGVs, tippers, low-loaders, etc. would access the site only between the hours of 0700 and 1900 hrs, with the potential exception of craneage during mobilisation and demobilisation operations.

Table 2.3: Summary of Landfall HDD Construction Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of bores</td>
<td>2 - 6</td>
</tr>
<tr>
<td>Working Hours</td>
<td>24 hours a day Monday to Friday and typically 0800 till 1300 on Saturdays</td>
</tr>
<tr>
<td>HDD Compound Area</td>
<td>50 m x 50 m</td>
</tr>
<tr>
<td>Construction programme</td>
<td>Up to 6 months</td>
</tr>
<tr>
<td>Approximate drill length</td>
<td>Up to 1000 m</td>
</tr>
</tbody>
</table>

2.58 The design envelope parameters for each landfall are presented in Table 2.4.

Table 2.4 Design Envelope Parameters for the each landfall

<table>
<thead>
<tr>
<th>Element</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Cut Shore-Crossing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Cable Trenches</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Burial Depth (m)</td>
<td>0.5</td>
<td>3.0</td>
<td>Below firm stratum of mobile sediments</td>
</tr>
<tr>
<td>Element</td>
<td>Minimum</td>
<td>Maximum</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Width of seabed affected (per trench) (m)</td>
<td>1.0</td>
<td>9.0</td>
<td>9m where rock-berm installed</td>
</tr>
<tr>
<td><strong>Horizontal Directional Drill</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Cable Ducts</td>
<td>2</td>
<td>6</td>
<td>Including separate duct for Fiber Optic</td>
</tr>
<tr>
<td>Diameter of ducts (m)</td>
<td>0.3</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Length of ducts (m)</td>
<td>300</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Burial depth of cables (m)</td>
<td>1.0</td>
<td>30</td>
<td>To be determined in detailed profile design of HDD</td>
</tr>
<tr>
<td><strong>Transition Pits</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Transition Pits</td>
<td>2</td>
<td>4 - 6</td>
<td>Minimum of one required per HVDC cable plus optional 2 additional for Fibre Optic</td>
</tr>
<tr>
<td>Area per Pit (m$^2$)</td>
<td>-</td>
<td>30</td>
<td>Based on 15 x 2m</td>
</tr>
<tr>
<td>Total Area for all Pits (m$^2$)</td>
<td>-</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Depth (m)</td>
<td>2.0</td>
<td>3.0</td>
<td>Below ground level</td>
</tr>
</tbody>
</table>

**Auger Bore / Thrust Bore**

2.59 An auger bore is a trenchless installation technology which results in a permanent steel carrier pipe for the cable ducts being installed horizontally beneath an obstruction i.e. a road, railway, service or watercourse.

**Methodology**

2.60 The methodology of a typical auger bore consists of:

- The start and finish points of the drill must be excavated to the required depth of the drill
- The auger drill is used to cut through the soil within a solid pipe which is extended as the drill continues along the desired path
- The drill is removed from the outer pipe which is left within the excavation

2.61 Auger boring is also sometimes referred to as ‘pipe-jacking’ or ‘thrust-boring’ because the outer permanent carrier pipe is pushed forward using hydraulic rams as the auger proceeds.

2.62 Typical uses for auger boring are for crossing railways or similar crossings where the drill is required to have a very limited settlement after drilling, as is associated with HDD's. The technique can also be utilised over shorter distances than HDD as there is no required entry and exit angle to achieve the specified drill profile.
Requirements

2.63 The following key design requirements should be considered for auger boring:

- Temporary works design and relevant methodology, and risk assessments would be required for the excavation of the pits at the entry and exit points of the crossing.

- Future access after installation would require an excavation down to the pipes if a fault occurs.

Limitations

2.64 This method of trenchless crossing is restricted in length to crossings of up to 75 -100 m. This is due to the control methods utilised in maintaining a straight installation and thus achieve the desired finishing position.

2.65 There are several inherent limitations of using auger boring as a trenchless technique to install cables which include the following:

- Geology – when drilling in softer material such as sand there is a risk of bore collapse at the face of the cutting edge, especially if wind-blown sand is encountered and there is a loss of control at the drill head.

- Thermal ratings – At an increased burial depth below ground surface (compared with open cut trenching), a negative impact on cable thermal ratings can be expected. To allow for this, the cable ducts are surrounded in the carrier pipe by bentonite to reduce the higher thermal resistivity associated with trapped air.

- Future maintenance access – having completed the overall bore, the interface between the carrier pipe and outer bore is filled with pressurised bentonite or concrete sealing them from future access.
Plate 2.2 – Typical Examples of Auger/Thrust Boring
Table 2.5: Summary of Auger Bore Construction Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of bores</td>
<td>4</td>
</tr>
<tr>
<td>Working Hours</td>
<td>12 hours a day Monday to Friday and typically 0800 till 1300 on Saturdays</td>
</tr>
<tr>
<td>Compound Area</td>
<td>50 m x 50 m</td>
</tr>
<tr>
<td>Construction programme</td>
<td>Up to 2 months</td>
</tr>
<tr>
<td>Approximate drill length</td>
<td>Up to 100 m</td>
</tr>
</tbody>
</table>

**Trench and Duct Parameters**

2.66  As described above under project requirements, the cable route will be fully ducted. The ducts will be made from High Density Polyethylene with an overall diameter of up to 250mm and 15-25mm wall thickness.

2.67  The cable circuits will typically be laid in one trench each circuit. The dimensions of the trenches will be finalised at the detailed design stage to take into account the physical constraints of the route and the thermal resistivity of the soils found along the route. Thermal resistivity will be measured at sites selected along the route.

2.68  Ducts will be installed in the trenches in advance of cable insertion. The ducted trenches will be backfilled first with a thermally stable backfill such as a weak sand/cement mixture (cement bonded sand (CBS) and then backfilled.

2.69  For the cable sections along roads, the ducted trenches will be backfilled with compacted aggregate and the road pavement re-instated to the same standard as the original road.
Crossing Types and Parameters

- Utilities
- Roads, the railway line, tracks and public rights of way
- The Longis Anti-Tank Wall
- Corblets Bay sea defences

2.70 The trenchless crossing method called HDD has been described above and may be used to install the landfalls. Individual ducts may be installed for each cable, i.e. six in total, or alternatively two larger ducts may be installed each with three smaller sub-ducts. The smaller ducts are typically HDPE of up to 300mm diameter, the larger option would use steel pipes up to 750mm diameter. A separate smaller duct will be installed to house communications cables. These HDD installed ducts will typically be separated by 5m or more.

Inset 2.7 – Typical Cross Section HDD or Auger Bore - landfall (HVDC)

2.71 Other roads, utilities and watercourses are likely to be crossed at surface using a variety of techniques. Typical crossing arrangements are described below.
Inset 2.8 – Selection of typical crossing types

Utility Crossing (HVDC)

There are sections of the cable route where it will be necessary to narrow the cable construction RoW over short distances in order to avoid constraints such as habitats, obstacles or adjacent land titles. The typical construction methodology will be adapted so that only the width of the haul route is required with the cable trenches excavated beneath it. An example of a constrained cable construction method is provided at Inset 2.10 below.

Cable Route Installation

General Requirements

The following parameters were identified by FAB Link Ltd and its engineers for the installation of HVDC cables onshore in Alderney:
• Cables would be installed into pre-laid ducts

• A temporary haul road will be required across much of Longis Common

• The cable construction area must accommodate all temporary land requirements including access and storage

• 40 x 40m compounds on level (or levelled) ground would be required at each landfall

Cross Country Cable Installation

Civil Works

2.74 Preparation of the cable route to accept the cables primarily involves the installation of ducts along the route. Some road improvement works may be required and accesses to be developed.

Duct Installation

2.75 The installation of cable ducts follows the following main steps and is generally carried out in a linear fashion along the cable route:

Duct installation in roads:

• Establishment of traffic management measures including road closures, diversions and/or alternate line working;

• Demarcation of work area including segregation from traffic, clearly marking the location of existing infrastructure;

• Accurate marking of trench location by surveyor;

• Excavation of trench and removal of material from site;

• Installation of trench protection to prevent collapse and ensure safety of personnel;

• Pouring and compaction of aggregate in trench bottom as required according to ground conditions;

• Lowering of ducts into trench and positioning;

• Back-filling lower part of trench with thermally stable back-fill – usually a weak concrete mix;

• Fitting of concrete protective slabs;

• Installation of plastic warning tapes;

• Backfilling and compaction to relevant road construction standard;

• Re-instatement of road surface consistent with existing road construction;
• Re-instatement of any road markings as required.

*Duct installation in agricultural land:*

• Survey and marking out of access locations from the public highway;

• Survey and marking out of construction corridor and marking the presence of any underground services;

• Preparation of access, for example by hedge removal and gate installation, minor earthworks, preparation of haul roads or installation of track-way or bog-mats, upgrade of existing farm tracks;

• Installation of stock-proof fencing as appropriate;

• Installation of additional land drainage to minimise the impact of construction operations on the land and aid faster recovery after remediation;

• Removal of topsoil and stock-piling to side of construction corridor, topsoil and sub-soil will be stored separately to ensure the high quality topsoil is replaced on the surface;

• Marking out of trench location;

• Excavation of trench and removal of excess material from site;

• Pouring and compaction of stabilising aggregate;

• Lowering and positioning of ducts;

• Partial backfill with thermally stable material (weak-mix concrete)

• Installation of concrete of GRP protective slabs;

• Installation of plastic warning tapes;

• Re-instatement of trench with original material;

• Replacement of topsoil and levelling;

• Seeding or other re-instatement as agreed with landowner;

• Removal of stock-proof fencing after remediation is mature.

2.76 A haul-road formed from crushed rock or temporary roads in the form of aluminium track, wooden or plastic mats will be installed to enable the necessary plant and equipment to be safely moved along the easement and minimise damage to the land. These roads will be removed after construction and the whole site returned to its original condition. Plate 2.3 show examples of construction haul roads made of imported tracking.
Transition Joint Bay Construction

2.77 Transition Joint Bays (TJBs) will be constructed along similar processes to the duct installation with the following additional steps.

- After excavation and installation of compacted aggregate:
- Steel reinforcing will be placed;
- Formwork will be installed;
- Concrete will be poured.

2.78 The TJBs will generally be constructed away from the public highway as they need to remain open until after the cable has been installed. Where this is not possible they will have either reinforced concrete covers installed or temporary steel plates laid over them to allow the free-movement of traffic during periods that the joint bay is not being worked in.

2.79 Following installation of the cables and completion of jointing activity, the joint bays will be back-filled with weak sand-cement mix concrete covers installed and then the ground re-instated.

Cable Installation

2.80 Cables are installed by winching them into the pre-installed ducts.

2.81 The cable joint locations are nominated as either drum sites or winch sites, usually alternately along the route. The drum sites generally require better access than the winch sites due to the larger loads to be delivered to site.

2.82 At the drum sites, cable drums are set up on powered drum stands that control the speed of installation and tension in the cable. The tension has to be carefully managed to avoid damage to the cables. Plate 2.4 below depicts a typical powered cable drum stand.
2.83 Depending on the length of the pull, a linear cable engine may be installed close the entrance to the duct, this equipment pushes the cable into the duct, helping to reduce the pulling tension. For extremely long or complex (lots of bends) cable sections, linear cable engines may be installed at intermediate locations to reduce the overall pulling tension. Plate 2.5 below depicts a typical linear cable engine.

**Plate 2.5 Typical linear cable engine**

2.84 At the winch sites, powerful winches are set up. The winch wire is pulled through each duct in turn by a lightweight rope that is first “blown” through the duct using compressed air. The winch wire is pulled through and attached to a pulling eye that is installed on the end of the cable in the factory. The cables are lubricated as they enter the duct using a biodegradable lubricant. Each cable pull (one duct in one section) is normally completed in a day. For the fibre optic cables, these are normally installed in separate smaller ducts by blowing only.

**Cable Jointing**

2.85 Jointing of high voltage power cables is a significant task. Each joint typically takes several days to complete, each joint bay may be actively being worked on for over a month.

2.86 Cable jointing is sensitive to moisture and the atmosphere around the cables during the jointing operation must be carefully controlled for humidity. In order to achieve this a “jointing tent” is established over the joint bay and climate control equipment is installed. An alternative to a tent is a shipping container especially adapted with removable floor panels to fit over the joint bay and
containing the climate control equipment along with the cable jointing apparatus. Inset 2.9 shows a diagram of a typical cable joint arrangement.

2.87 The key steps are:

- cutting the two cables to be jointed to length;
- stripping back the various layers of sheath, screen and insulation;
- preparing the conductor for jointing and then jointing either by a compression ferrule or sometimes by welding;
- assembling a pre-fabricated joint housing around the cables that is then filled with an insulating material such as silicone rubber.

**Inset 2.9 Typical arrangement of a joint in an XLPE Cable**

![Diagram of a cable joint](image)

2.88 During operations, as the cable temperature changes, the cables elongate and contract. If left un-checked, over time this movement will cause the joints to fail. Therefore, either side of the joint the cables are physically restrained either by mechanical fastening to the joint chamber and/or by ‘snaking’ in the trench.

Specialist Sections – Installation in Constrained Corridor Widths

2.89 In certain parts of the onshore cable route, the width available for construction is limited. For example, the narrow section of Longis Common route.

2.90 The detailed construction plans will be prepared by the contractor for each situation, however a sequence is described below in response to sections where the available width for construction may be restricted to approx. 5m. A cross section schematic of the HVDC construction across Longis Common is presented in Inset 2.10.
## Inset 2.10 Proposed sequence of works for installing cables in a narrow construction RoW

<table>
<thead>
<tr>
<th>STAGE 1</th>
<th>2.5m wide Haul Road</th>
<th>A haul road is established across half the width of the permanent easement. The road would most likely be constructed as a temporary track made from timber or aluminium.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5m Permanent Easement</td>
<td></td>
</tr>
<tr>
<td>STAGE 2</td>
<td>2.5m wide Haul Road</td>
<td>The trench is excavated in layers and shored by trench supports. Material is removed along the haul road.</td>
</tr>
<tr>
<td></td>
<td>Trench Supports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5m Permanent Easement</td>
<td></td>
</tr>
<tr>
<td>STAGE 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The duct installation is completed including use of stabilised backfill and backfilling with the native soil. The trench supports are removed as the backfilling process progresses.

**STAGE 4**

Once backfilled, the haul road would be moved to the other half of the easement in preparation for the second trench construction.

**STAGE 5**
2.91 The above method is only suitable for short sections as there is no room to store excavated material within the construction RoW meaning it is hauled away to be returned later upon backfilling the trenches.

Programme

2.92 A draft construction programme is presented below. The main periods encompassing the above onshore cable route activities are:

- Civil Works – 6 months
- Cable Installation & jointing – 2 months

2.93 The above activities overlap by 1 - 2 months.

2.94 Construction activities would usually be undertaken during normal working hours of 07:00 to 19:00 on weekdays and 07:00 to 13:00 on Saturdays. However, some operations may require work to take place outside these times. For example, abnormal loads may be encouraged to travel overnight to avoid causing disruption to traffic marine activities may be dependent on the tides.
Transport and Access Strategy

2.95 A detailed transport strategy will be developed by the appointed contractor. However, it is possible at this stage to identify the two landfall construction compounds as also providing storage of materials and equipment.

2.96 Vehicle types associated with the cable route construction are generally standard HGVs and vans although some larger loads are possible. For example, a cable drum transport vehicle may be used with a diameter of up to 4.5m and weight of 40T. A load of this size would be classed as an abnormal load.

2.97 The transport impact assessment is presented in this document at Chapter 5.

Construction Environmental Management

2.98 The principal contractor will be required to produce a Construction Environmental Management Plan (CEMP) detailing the commitments and responsibilities for safeguarding the environment during the construction phase.

2.99 A draft Code of Construction Practice (CoCP) has been produced at Chapter 11 of this document as a baseline and to record the commitments to the environment already made in the design process up to application submission.

2.100 In addition to the CEMP, other documents are required as part of the integrated Construction Management System (CMS) which will be consulted upon prior to construction start. These include (but are not limited to):

- Traffic Management Plan
- Pollution Incident Control Plan
- Resource Efficiency Plan
- Site Waste Management Plan
- Stakeholder Communications Plan

2.101 The contractors are likely to also participate in the Considerate Constructors scheme.
Appendix 2.1

Utilities Plan
Legend
- Straightened route across the common
- Temporary Working Area 10m
- No Excavations Area
- Post
- Substation
- Overground LV
- Underground HV
- Underground LV
- Water pipes
- Telecoms
- Borehole
- Stone

Client: FAB Link Ltd.
Project: Alderney Environmental Report
Title: Utility map

Status: DRAFT
Drawn By: CR
PM/Checked By: MR
Job Ref: OXF7729
Scale: 1:3,400
Date Created: JUL 2016
Figure Number: 1
Rev: -