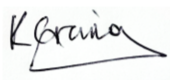
Cambois Connection – Onshore Scheme

Volume 3 Environmental Statement

Chapter 5: Project Description

SSE Renewables

Revision Information					
Rev	**Issue Status**	**Date**	**Originator**	**Checker**	**Approver**
Draft	Draft for Discussion	24/04/2023	JH	SP	AM
R01	Issued for Review	30/06/2023	JH	SP	SP
R02	Issued for Review	05/09/2023	JH	SP	SP
A01	Final for Issue	16/10/2023	JH	SP	SP

Approval for Issue		
Approver's name	**SIGNATURE**	**DATE**
Kerrie Craig		**30/10/2023**
Prepared by:	**SLR Consulting Ltd.**	
Prepared for:	**SSE Renewables**	
Checked by:	**Kate Elliott**	
Accepted by:	**Sarah Edwards**	
Approved by:	**Kerrie Craig**	

Basis of Report

Contents

Tables

Plates

Figures

Acronyms

Acronym	Description
AIS	Air Insulated Switchgear
AIS	Air Insulated Switchgear
AOD	Above Ordnance Datum
BBWF	Berwick Bank Wind Farm
CEMP	Construction Environmental Management Plan
CTMP	Construction Traffic Management Plan
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EMF	Electric and magnetic field
ES	Environmental Statement
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HVDC	High Voltage Direct Current
ICNIRP	International Commission on Non-Ionizing Radiation Protection
MDP	Maximum Design Parameters
MDS	Maximum Design Scenario
MLWS	Mean Low Water Springs
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MSC	Matters Specified in Conditions
MS-LOT	Marine Scotland Licensing and Operations Team
NCC	Northumberland County Council
NSL	North Sea Link
OCT	Open-Cut Trench
OEMP	Operational Environmental Management Plan
PDE	Project Design Envelope
RLB	Red Line Boundary
SEM	Site Environmental Manager

Acronym	Description
SWDS	Surface Water Drainage Strategy
TJB	Transition Joint Bay
TMP	Traffic Management Plan

Units

Unit	Description
km	Kilometres
kv	Kilovolt
m	Metres
m^2	Metres squared (area)
m^3	Metres cubed (volume)

5. Project Description

5.1. INTRODUCTION

1. This chapter of the Environmental Statement (ES) describes the onshore transmission infrastructure and associated works required as part of the Cambois Connection, comprising: Offshore Export Cables, Onshore Export Cables, an Onshore Converter Station and associated grid connection at Blyth in Northumberland, known as 'the 'Project'. The onshore components of the Project, landward of Mean Low Water Springs (MLWS), comprise the Onshore Scheme, which is the subject of this ES.

2. The purpose of the Project is to facilitate the export of green energy from the Berwick Bank Wind Farm (BBWF) (being determined separately), located in the outer Firth of Forth, to the Blyth substation, Northumberland.

3. The Project comprises two proposals, or 'Schemes' which include:

   - **Marine Scheme**: The Applicant is proposing the installation construction of High Voltage Direct Current (HVDC) offshore export cables from within the BBWF array area in the outer Firth of Forth (Scotland) to a proposed Landfall at Cambois, Northumberland (England).
   - **Onshore Scheme:** The Applicant is proposing the construction and installation of a cable Landfall, onshore High Voltage Direct Current (HVDC) export cables, a new Onshore Converter Station and associated High Voltage equipment, High Voltage Alternating Current (HVAC) grid cables (from the new Onshore Converter Station to the existing Blyth National Grid substation near Cambois), including ancillary infrastructure and works to integrate the Onshore Scheme into the National Grid at the existing substation.

4. This chapter provides further description on the design of the Onshore Scheme and the proposed methods and indicative timings for the installation, operation and maintenance, and decommissioning of the various Onshore Scheme components.

5. The details outlined within this chapter provide the basis for the assessment of effects within Technical Chapters 7-15 of this ES.

6. The Marine Scheme is considered within a separate offshore EIA Report that was submitted to Marine Directorate – Licensing Operations Team (MD-LOT) and the MMO as part of the Marine Licence applications required for the Marine Scheme. The Marine Scheme ES provides details of the offshore infrastructure located below (i.e., the seaward side of) Mean High Water Springs (MHWS). This Onshore ES provides the details of the onshore infrastructure located above (i.e., landward of) Mean Low Water Springs (MLWS).

7. For the purposes of this ES, a full description of works above MLWS is provided, however, in some cases, an explanation of infrastructure *below* MLWS may be beneficial to provide wider context. Volume 2, Chapter 1: Introduction provides a summary of the relationship between the Marine Scheme and the Onshore Scheme.

5.2. MAXIMUM DESIGN SCENARIO (MDS)

8. The Applicant has adopted a PDE approach, in line with current best practice and the principles of the Rochdale Envelope[1]. By following a PDE approach, a Maximum Design Scenario (MDS) can be defined for key components of the Onshore Scheme, such as the Landfall, Onshore Cables and Converter Station. Based on this MDS, potential for significant effects can be established and assessed on a realistic (albeit precautionary) basis. Flexibility to respond to emerging environmental and economic circumstances and technological advances is essential if the Onshore Scheme is to proceed and be successful. A degree of flexibility will therefore be built into the design for the application by applying a PDE approach. The PDE approach is used in EIAs to ensure that the 'Maximum Design Scenarios' of a development (those likely to have the most significant effect on the environment) are considered and assessed appropriately. This approach is applied across a wide range of sectors / projects (onshore and marine) where confirmation of final detailed design and the appointment of contractors is subject to a project securing consent.

9. The PDE as described in this chapter of the ES, provides the maximum design parameters for the Onshore Scheme (or minimum where this also has potential to result in the most significant effect on the environment) and has been developed to include a degree of flexibility to accommodate further refinements during the final detailed design stage.

10. For each of the impacts assessed within the Impact Assessment Chapters (Volume 2, chapters 7 to 15), the realistic MDS has been identified for those impacts from the range of potential options associated with the design parameters set out in the PDE and this project description chapter. This approach ensures that each impact is assessed against the maximum design parameters that are of direct relevance to each specific topic / receptor. By employing the MDS approach, the Applicant also retains some flexibility in the final design of the Onshore Scheme, but within certain maximum parameters, which are assessed in this ES.

11. The Applicant has also commissioned a range of onshore environmental surveys to inform the route selection process and the impact assessment. The results of these are presented in Volumes 2 and 3 and are used as the basis for the assessments contained in this ES.

12. Where possible during the EIA process, the MDS of the Onshore Scheme has been refined from that which was presented in the Scoping Report. Stakeholder comments received as part of the EIA Scoping exercise, during consultation meetings, and at public events have also been considered. Volume 2, Chapter 6: Site Selection and Consideration of Alternatives provides a full account of how the Onshore Scheme has evolved.

13. Reflecting the PDE approach taken to the impact assessment, the Applicant is also applying for outline planning permission under Section 92 of the Town and County Planning Act 1990 for the entirety of the Onshore Scheme. Final design details for the various components of the Onshore Scheme will be subject to future application(s) for approval of Reserved Matters by Northumberland County Council (NCC). These Reserved Matters applications will be informed by further environmental, technical and engineering studies based on the final detailed design and engagement with stakeholders and the community.

5.3. LOCATION AND SITE INFORMATION

14. The Onshore Scheme is situated near Blyth and the villages of Cambois and East Sleekburn, in Northumberland, England (volume 4, Figure 1.1). It will be located within the Red Line Boundary (RLB) presented in Volume 4, Figure 1.2, hereafter referred to as 'the Site'. The centre of the Site is 429909.845 E 583696.578N, British National Grid NZ 29311 84281. The Site encompasses approximately 188 ha of land. However, the maximum footprint of the Onshore Scheme as described below will be considerably smaller than the 188 ha and will therefore not utilise the full extent of the Site. Furthermore, once installed, there will be limited permanent infrastructure that will be visible above ground.

15. The Site comprises land to the north of Blyth and to the East of East Sleekburn and includes a mix of coastal amenity, new and legacy industrial uses and residential areas.

16. There are three zones of key infrastructure shown on Figure 5.1:

- The Landfall/HVDC Zone where the offshore export cables reach land;
- The Onshore Converter Station Zone; and
- The HVAC Zone where the grid cables from the Onshore Converter Station connect to the existing Blyth substation.

17. The proposed Landfall is located at Cambois North Beach. The proposed onshore cable corridor extends for approximately 2.1 km between the Landfall at Cambois North Beach (see Plate 5-1), via the GigaFactory site (formerly owned by BritishVolt) (see Plate 5-2), to the proposed Onshore Converter Station (see Plate 5.3). The proposed Onshore Converter Station location is situated adjacent to the NSL Onshore Converter Station (Plate 5.4), with Brock Lane bordering the Site towards the south. The HVAC cables will be located in a corridor (approximately 1.5 km) and these cables will connect the Onshore Converter Station to Blyth substation, which is located next to Blyth Port. The western site boundary lies adjacent to the A189; however, the view from the road to the site is also well screened.

18. Cambois beach lies to the east of the Site, serving as the point of Landfall. Moving westwards from the beach, Cambois Links are found at the back of the sand dunes, followed by railway tracks and a road. The road forms part of the small residential area of Cambois, flanked by the Cambois Coastline to the east, and a larger brownfield construction area to the west. This area is the Site of the former Blyth Power Station (closed in 2001) (see Plate 5.1). Planning permission was granted to BritishVolt in 2021 for the construction of a 'GigaFactory' electric vehicle battery factory upon the grounds of the former power station. Subsequently, BritishVolt went into administration and the company, along with land upon which the factory would be built, is in the process of being sold to "Recharge Industries". It has been stated by Recharge Industries that they intend to proceed with the plans for the new factory, although it is currently unknown whether an amended or reduced scheme will be proposed.

19. The Onshore Converter Station site is located in western part of the Site and is situated immediately to the west of the NSL Converter Station, with Brock Lane running east west along the southern boundary of the Site and the A189 forming the western boundary of the Site. The Sleekburn Business Centre lies to the north of the Site adjacent to the former BritishVolt gigawatt battery plant site. A band of mature woodland extends around the perimeter of the entire Onshore Converter Station site except the land adjacent to the NSL Converter Station. The residential area of East Sleekburn lies to the south of Brock Lane and is screened from the road by a strip of woodland planting.

20. Brock Lane continues to pass through the Site, with the former Blyth Power Station land (now Recharge Industries) to the north and the Port of Blyth, and River Blyth located to the south. The National Grid Blyth Substation is located on a parcel of land located between the banks of the River Blyth to south and industrial land uses relating to the Port of Blyth to the north.

Plate 5.1 Site Photo 1: Cambois North Beach

Plate 5.2 Site Photo 1: former Britishvolt site

Plate 5.3 Site Photo: field at proposed Onshore Converter Station

Plate 5.45 Site Photo: NSL Converter Station

21. Ground levels across the Site vary due to the sloping topography (west to east) and due to deeply incised glacial outwash valleys. Outwith the Site boundary, to the south, Sleek Burn joins the River Blyth to form the Blyth Estuary and flows out to join the North Sea.

22. The Site and the surrounding area of the Blyth Estuary has historically been a focus for economic activity in south-east Northumberland, including ship building, port logistics, and energy generation.

23. Available historical information and baseline reporting indicate the majority of the Site has experienced some degree of development, including a power station, coal storage and processing and associated industries e.g., rail, brick works, iron foundry etc. In addition, other developments on the Site include the construction of the A189 road bordering the western edge of the Site and the railway line to the east, which has been present since approximately 1898.

24. A business park and more recently a sewage works, are located northwest of the Site. Other land use in the surrounding area historically has been predominantly agricultural. The Port of Blyth and a Ferry Terminal is located to the southeast of the Site.

25. The Site is also located within the Blyth Strategic Employment Area within the Northumberland County Council Local Plan 2016 – 2036 (adopted 2022). Parts of the Site are also covered by Blyth Estuary Enterprise Zone status.

5.3.1. OVERVIEW OF THE ONSHORE SCHEME

26. As illustrated in Plate 5.5 below, the Onshore Scheme for the Project includes the following:

- Landfall works at Transition Joint Bays;
- HVDC onshore export cables within a cable corridor between the Landfall and the new Onshore Converter Station for a cable corridor length of up to 2.1 km;
- A new Onshore Converter Station;
- HVAC onshore grid cables from the Onshore Converter Station to the National Grid Blyth substation within a cable corridor length of up to 1.5 km; and
- Associated ancillary infrastructure.

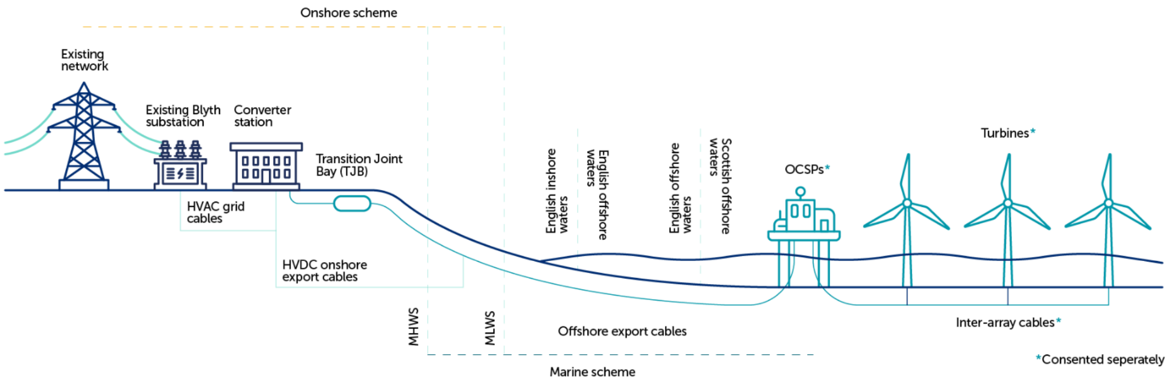


Plate 5.6 Overview of key project components

27. As discussed in section 5.2, certain details relating to the Onshore Scheme are still to be finalised subject to further detailed design following the acquisition of information on ground conditions across the Site, ongoing engineering design work and the procurement of cable and Onshore Converter Station suppliers. Detailed design work will be completed post-consent and will be subject to future application(s) for approval of Reserved Matters.

28. As such, the Site boundary (Volume 4 Figure 1.2) forming the basis of the application for outline planning permission includes flexibility to allow for the final locations and design details of the various

components of the Onshore Scheme to be defined post outline planning permission having been granted. These further details will be consented by way of Reserved Matters approvals granted by NCC.

29. The PDE for the Onshore Scheme upon which the impact assessment has been based is described below. A summary of the infrastructure required for the Onshore Scheme, is provided in Table 5.1 below. The values shown represent the realistic worst-case values for the purposes of the EIA ('the maximum design scenario'). Whilst the design parameters are frozen, measurement may be classed as approximate as development of construction techniques may influence this, however maximum and minimum parameters are presented as appropriate. Further detail on specific MDS parameters relating to the design, construction, operation and maintenance and decommissioning of each component of the Onshore Scheme is provided in section 5.5.

Table 5-1 Infrastructure required for the Onshore Scheme and Maximum Design Parameters

Infrastructure	Number	Maximum Design Parameters
Landfall		
Landfall trenchless technology ducts (e.g., Horizontal Directional Drill) (HDD)	Up to four	0.3 to up to 2.5 m diameter Up to 2.4 km duct length per cable (up to 9.6 km total)
Transition Joint Bays	Up to four	Up to 6 m width per TJB Up to 25 m length per TJB
Construction compounds (trenchless technology and TJBs)	Up to two	Up to 15,000 m^2
HVDC Cable Corridor		
Onshore HVDC cables (Landfall to Onshore Converter Station)	Up to four	Up to 525 kV Up to 2.1 km in length per cable
Onshore HVDC cable trenches (including working corridor for installation) – open cut*	Up to four	2 m width per trench (Four trenches - one cable per trench) 12 m width trench (One trench - four cables per trench) Working corridor up to 110 m width Up to 2.2 m depth
Onshore HVDC cable corridor–trenchless technology ducts	Up to four	Working corridor up to 110 m Up to 15 m depth from ground level to top of duct
Joint Bays (HVDC cable route)	Up to 16	Up to 16 m total length Up to 6 m width
Onshore HVDC cable corridor construction compounds	Up to eight	Up to 37,800 m^2
Onshore Converter Station		
Onshore Converter Station footprint	One station comprising multiple buildings within the overall envelope	Up to 290 m length by 275 m width. Maximum building height of 30 m + platform level (maximum total height 45.2 m AoD), not including any earthing finial or external electrical equipment.
Onshore Converter Station platform	One	Up to 300 m length by up to 300 m width; platform level up to 15.2 m AoD.
Onshore Converter Station construction compounds	Two	Up to 20,400 m^2
Outfall from the Onshore Convertor Station site into Sleek Burn	One	Surface water will be discharged into the River Blyth, via an underground outfall to the Sleek Burn, in an arrangement similar to the NSL Converter Station. It is assumed flows will enter the Sleek Burn adjacent to the existing NSL outfall. Working corridor up to 10 m width.
Sustainable Urban Drainage (SuDS)/ Attenuation Ponds	Up to two	This will confirmed by detailed design.
HVAC Cable Corridor		
Onshore HVAC cables (Onshore Converter Station to Blyth substation)	Up to 12	Up to 400 kV Up to 1.7 km length per cable

Infrastructure	Number	Maximum Design Parameters
Onshore HVAC cable trenches – Open Cut	Up to four	Up to 12m width per trench Up to 125 m width working corridor Up to 2.2 m depth
Onshore HVAC cable – trenchless technology ducts	Up to12.	Working corridor up to 200 m Up to 15 m depth
Onshore HVAC construction compounds	Up to 8	Up to 32,980 m^2
Joint Bays	Up to 24	Up to 16 m total length 6 m width
Access roads and material storage		
Permanent access road	One of two options: existing NSL access or new access from Brock Lane	Up to 8 m width This will confirmed by detailed design.
Temporary access roads	Two for HVDC route Three for HVAC route	Up to 12 m width Length to be confirmed by detailed design.
Material storage area (all areas)	Up to 15	Up to 65,980 m^2

*Cables may be laid in a different arrangement within the bounds of the Maximum Design Scenarios, e.g., two trenches with two cables per trench. This will be defined based on further design work following the application submission.

30. An extension of the Blyth substation is being developed by National Grid, which was subject to a separate planning application, consented in March 2023. However, the potential cumulative impacts on relevant environmental receptors of the Onshore Scheme and the Blyth substation have been considered within chapters 7 to 15 of this ES. Further relocation of local infrastructure may be required following confirmation of cable route and completion of detailed design. The existing overhead line and underground cables within the Onshore Converter Station Zone may be required to be permanently diverted and whilst the approach to this has not yet been agreed this may include it being undergrounded as well as diverted. These works will be completed by the Distribution Network Operator (Northern Powergrid) of the asset, with the approach still to be agreed. These will be subject to future application(s) as required.

5.4. ONSHORE SCHEME DESCRIPTION

5.4.1. CABLE LANDFALL AND TRANSITION JOINT BAYS

5.4.1.1. Landfall

31. The Landfall location at Cambois forms the interface between the Marine Scheme and Onshore Scheme where the Offshore Export Cables will be brought ashore (as shown on Volume 4, Figure 5.2). The Landfall corridor is approximately 0.7 km wide at Cambois beach, at the widest point between the River Wansbeck and the Port of Blyth. The final location of the Landfall at Cambois is still to be determined but will be located within the wider Landfall corridor. The maximum working corridor at the Landfall (once the preferred location has been identified) will be up to 110 m. This will

accommodate a trenchless technique (e.g., horizonal directional drilling (HDD)) to bring up to four HDVC Offshore Export Cables ashore.

5.4.1.2. LANDFALL INSTALLATION

32. The development of a Landfall will require construction work within the onshore environment (i.e., above MLWS) as well as work within the marine environment work (i.e., below MHWS). This ES assess works landward of MLWS. Works seaward of MHWS are described and assessed in the Marine Scheme ES, which was submitted on 28th July 2023 and are assessed cumulatively with the Onshore Scheme in this Onshore Scheme ES.

33. The Offshore Export Cables will be installed at the Landfall using a trenchless technology such as HDD, as shown in Plate 5.8. This involves installing an underground cable duct by drilling a bore from one point to another. The Offshore Export Cables are then installed through the duct(s). It is likely that the bores will be drilled from a trenchless technology compound which will be located above MHWS (onshore) to an agreed ‘punch out’ location in the nearshore marine area (below MLWS), therefore completely bypassing the intertidal area.

34. The drill rig required to create the trenchless technology boreholes will be located onshore, landward of MHWS. A temporary construction compound will be established containing the drill rig, an electrical generator, water tank, mud recycling unit, other construction equipment and machinery, storage areas, a temporary site office, car parking and welfare facilities. The drilling installation would commence from above the MHWS, with the trenchless technique exit point (punch out location) located at least 250 m seaward of MLWS. There will be up to five exit pits, each 20 x 5 m, for up to four cable ducts (with one spare in case of failure) due to trenchless cable installation at the Landfall.

35. The trenchless technique exit pits are expected to be located between the -2.5 m Lowest Astronomical Tide (LAT) and -10 m LATs, at least 250 m seawards of MLWS. As such, no works are planned to take place in the intertidal area. Given that there will be no requirement to excavate an open trench at any location between MLWS and MHWS, any direct interactions with the intertidal zone will be avoided as illustrated in Plate 3-2.

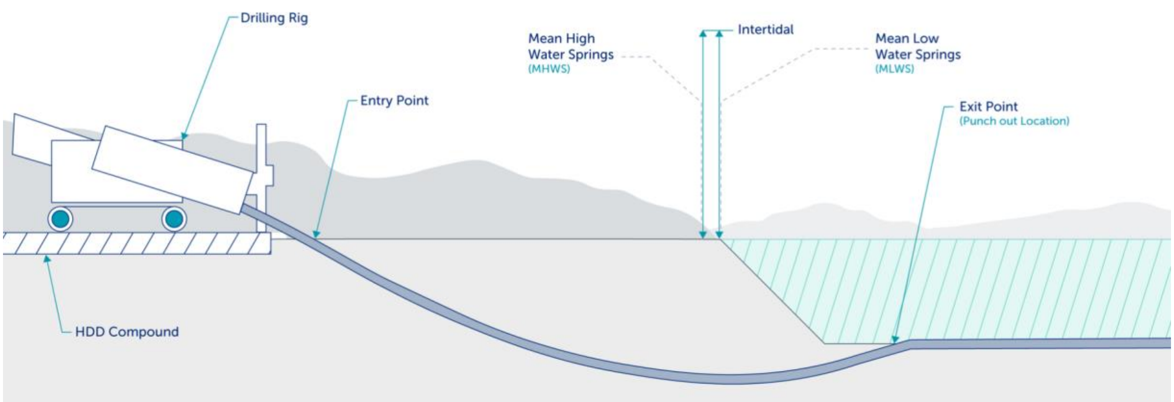


Plate 5-1 Depiction of indicative trenchless installation methodology for Landfall (e.g. HDD)

36. Once the cable ducts have been drilled, the Offshore Export Cables will be brought ashore, pulling the cables through the ducts from a barge that will be located in the nearshore area. Once onshore,

the Offshore Export Cables will be connected to the Onshore HVDC Export Cables in underground chambers (TJBs).

5.4.1.3. Transition Joint Bay

37. The TJB will consist of a buried concrete chamber (see Plate 5-4) with maximum dimensions (per TJB) of 6 m wide and 25 m length. Up to four TJBs will be required for the Onshore Scheme. Once installed, the only infrastructure that will be visible above ground will be the manhole covers (up to eight in total) which are required to gain access to the link boxes associated with the TJB for maintenance purposes.

38. The permanent infrastructure beneath ground typically consists of:

- Cable anchor block(s);
- Concrete slab (covering the extent of the TJB and anchor block); and
- TJB.

39. The construction pit for the TJB will be larger than the TJB itself. A concrete slab base would be formed within the TJB construction pit to accommodate the TJB and anchor block.

5.4.2. HVDC ONSHORE UNDERGROUND CABLES (LANDFALL TO CONVERTER STATION)

40. The cable system will be HVDC and will include fibre optic cables. Up to four Onshore HVDC Export Cables with a nominal operating voltage of up to +/- 525 kV will be installed. The cables will connect the Offshore Export Cables to the Onshore Converter Station and will be installed within a duct. The total length of the Onshore HVDC Cable corridor is up to 2.1 km. The MDS assumes that a separate trench will be required for each cable (up to four trenches). Each trench will be up to 2 m wide and up to 2.2 m deep. Subject to further detailed design and ground conditions, it may be possible that the trenches could be constructed as one wider trench. In this case there would be one wider trench for the four cables up to 12 m wide and up to 2.2 m deep.

41. Where trenchless technology e.g., HDD is required along the onshore HVDC cable route e.g. to cross existing infrastructure or other sensitive features, there would be up to four ducts with a maximum depth of up to 15 m from ground level. The maximum working corridor width would be up to 110 m. It is noted that these cable trench arrangements described are worst-case scenarios, and that cables may be laid in a different arrangement within the limits of the MDS, e.g., two trenches with two cables per trench. This will be defined based on further design work following the application submission.

42. The onshore HVDC cables will be delivered to site on cable drums which will be transported as abnormal loads either on the road network or by sea. Each cable drum would typically hold between 500 m to 1,000 m of cable. Once on site the separate lengths of cable will need to be installed and joined together in the cable joint Bays. Typical dimensions cable drums would be approximately 4.5 m in diameter and 3.5 m width. Each drum would typically weigh around 34,000 kg.

43. Joint bays will also be required along the onshore cable route. These are generally similar to the TJB located at Landfall, as discussed above. Joint bays are buried concrete structures with maximum dimensions 6 m width, 16 m length, with height to be confirmed by the detailed design process (noting these are buried structures). It is expected that joint bays will be required at approximately 500 - 1000 m intervals. The exact locations of the joint bays will be determined by a number of factors, including the final cable specification, cable drum transportation limitations (i.e., weight) and access. This will be refined further during the detailed design phase. It is likely that up to 16 joint bays may be required along the onshore HVDC cable route.

44. In addition to the joint bays there will also be requirements to install communications boxes (comms boxes) and links boxes along the onshore HVDC cable route. These are usually positioned adjacent to the joint bays; however, can sometimes be located up to 25 m away to allow more favourable positioning. This would be reviewed and agreed during detailed design. Comms boxes and links boxes will also be buried structures with manhole covers.

45. The only above ground infrastructure that will be visible following installation of the onshore HVDC cables, joint bays, comms boxes and links boxes will be the manhole covers required to gain access to the comms boxes and link boxes.

5.4.3. ONSHORE CONVERTER STATION

5.4.3.1. Onshore Converter Station Design

46. The Onshore Converter Station will be contained within a permanent secure fenced compound and will comprise the electrical infrastructure required to convert HVDC electricity into HVAC electricity for connection into the National Grid via the Blyth substation (see section 5.4.1 below).

47. Due to the proximity of the Site to the coast, most of the electrical infrastructure will be housed within the series of interconnected buildings to prevent exposure to saline air. Depending on the final design of the Onshore Converter Station, some electrical equipment may also need to be housed outdoors. There will be a requirement to install electrical equipment on the roof of the buildings such as a lighting conductor. This is not included in the maximum building height which relates specifically to the maximum roof height of the building mass.

48. The total number, size and configurations of the buildings will depend on the final design of the Onshore Converter Station but are expected to include the following:

- HVAC switching buildings– these will house the switchgear required to connect the HVDC cables to the electrical equipment required for the conversion to HVAC;
- HVDC Converter Halls – these will house the equipment required to convert electricity from DC to AC;
- Transformer buildings or enclosures;
- Control equipment buildings;
- Other buildings containing filtering equipment and other electrical infrastructure;
- Buildings containing spare parts;
- Operations and controls buildings;
- Welfare facilities buildings, if required; and
- Diesel generator required in case of emergency power outage.

49. The Onshore Converter Station will consist of one station comprising multiple buildings within the overall envelope, which will not exceed 30 m in height (maximum roof level) and will have a maximum footprint 90,000 m^2, including the platform (area of hard standing up on which the Onshore Converter Station will be positioned). The platform will also include additional areas of hardstanding for the storage of spare transformers, cable drums and further High Voltage and Low Voltage ancillary equipment, to be defined at the detailed design stage. The Onshore Converter Station finished platform level will have a maximum height of 15.2 m AoD, meaning that the maximum overall height will be no more than 45.2 m AOD, not including any external electrical equipment located on the exterior of the building, for example lighting rods.

50. The building may contain GIS (Gas Insulated switchgear) or AIS (air insulated switchgear) and it may use monopole or bipole HVDC configurations. Both GIS and AIS, or a hybrid option, will be considered as part of the detailed design.

51. The Onshore Converter Station will contain indoor and outdoor equipment, typically including the following:

- Converter valves;
- Converter transformers;
- Reactors;
- High speed switches and disconnect switches;
- DC choppers;
- DC and possibly AC filters;
- Cable terminations;
- Control and protection equipment;
- Firewalls;
- AC circuit breakers;
- Cooling systems; and
- Any further ancillary equipment required for control and instrumentation purposes.

52. Equipment which may be placed outdoor includes, typically:

- AC and DC switch yard equipment and associated ancillary / auxiliary equipment;
- Transformers;
- Cooling equipment;
- Enclosures for transformers for environmental protection.

53. The switch yards could be installed outdoors. However, all equipment can be placed indoors to protect from the saline environment due to its proximity to the sea.

54. For the purposes of assessment, this ES has presented and judged the attributable effects of the Onshore Converter Station in a neutral merlin colour. Consideration of the colour and finish of the Onshore Converter Station will form a component of the detailed design process, when a finalised layout option is confirmed, and be informed by any locally appropriate building vernacular.

55. The Onshore Converter Station will have an operational life of 35 years. Within this, only control equipment is expected to require inspection and replacement during that period. However, in the unlikely event of damage to electrical equipment during a fault, larger pieces of electrical equipment may require to be replaced e.g., transformers. This would be a fully planned piece of work with all relevant stakeholders engaged.

56. In its permanent (operational state), security fences and gates will be constructed and maintained around the complete Onshore Converter Station site. Internal security/separation fencing may also be required, and vehicle and personnel gates will be incorporated within the fences.

57. Exterior and interior lighting shall be provided to allow for the safe movement and operation of equipment. The expectation is that 24-hour lighting would be the MDS. It is anticipated that low level task lighting could be used to undertake routine operational maintenance tasks after dark. Where possible, glare and the spread of upward light will be minimised to reduce sky glow and minimise visual intrusion within the open landscape. Access and egress routes for entrances, walkways and emergency exits will be permanently lit to ensure these can be safely identified and navigated during hours of darkness.

58. It is anticipated that the Onshore Converter Station will be connected to mains water and sewage supplies though there may be a requirement for an isolated sewage system (septic tank) which would be located within the Onshore Converter Station Zone.

5.4.3.2. Onshore Converter Station Permanent Access

59. A permanent access will be formed to the Onshore Converter Station for access during the construction and operational phases. Two possible options have been identified: through the existing access to the NSL Onshore Converter Station or as a new access from Brock Lane. The permanent access road will be a surfaced carriageway road. It may be a private road and will include appropriate drainage. Final junction design off Brock Lane will be agreed with NCC and relevant stakeholders.

60. Permanent roads around the perimeter of the Onshore Converter Station and internal roads will be constructed to provide access to the different building units for regular and ad hoc maintenance activities and for the delivery of materials to site. Car parking spaces (including disabled spaces) will be provided at the Onshore Converter Station in accordance with NCC Car Parking Standards. These will be for operations staff that will monitor and maintain electrical equipment and plant at the Onshore Converter Station.

5.4.3.3. Site Drainage

61. A Surface Water Drainage Strategy (SWDS) has been prepared for the Onshore Converter Station (Volume 3, Technical Appendix 11.2)

62. Surface water will be discharged into the River Blyth, via an outfall to the Sleek Burn, in an arrangement similar to the NSL Converter Station. It is assumed flows will enter the Sleek Burn adjacent to the existing NSL site outfall.

63. The outfall pipe for discharge of surface water drainage collected on the convertor station site will include appropriate headwall/ apron structure, non-return flap and energy dissipation measures. The outfall pipe will be sized to permit flow from the Onshore Convertor Station drainage network during an appropriate design event with an allowance for future climate change.

64. The construction of the culvert will include an appropriately sized headwall comprising standard construction materials (such as pre-cast concrete). The culvert and headwall will be constructed on top of a suitably designed foundation, formed within the riverbed, and will exit at a sufficient height (mAoD level) above sea levels to account for tidal effects and surcharge events. The foundation for the outfall pipe is likely to extend into the riverbed. Protection, such as rock armour, will be used at the outfall location to mitigate against the effects of scour due to tidal movements and/or during periods of high discharge.

65. As surface water runoff from the Onshore Convertor Station is effectively flowing into a tidal waterbody, runoff does not require attenuation and free discharge into the estuary is possible whilst having negligible impact on flood risk. Attenuation of flows is not required and SuDS features are therefore only required to manage water quality of the runoff derived from the Onshore Converter Station. Attenuation ponds to manage pollutant levels are included as part of the MDS.

66. It is important to note that for licensable activities below MHWS on the Sleek Burn, a Marine Licence will be required from the MMO under the Marine and Coastal Access Act 2009. The Applicant is aware of all licensing requirements and will engage with the MMO to discuss this and formally apply in due course. The approach to obtaining a Marine Licence from the MMO, separate to the planning application to NCC, is required due to the lack of detailed design information associated with the

surface water outfall on the Sleek Burn (noting also that the approach is consistent with that which was followed by the adjacent North Sea Link converter station development).

5.4.1. HVAC ONSHORE GRID CABLES (ONSHORE CONVERTER STATION TO BLYTH SUBSTATION)

67. The Onshore Converter Station will be connected to the 400kV substation at Blyth via up to twelve HVAC cables, and fibre optic cables. The HVAC cables will have a nominal operating voltage of up to +/- 400 kV. The total length of the HVAC cable route is approximately 1.5 km.

68. The MDS for the HVAC cables assumes that groups of three cables will be buried in a separate trench (up to four trenches). Each trench will be up to 12 m wide including temporary slopes (up to 5 m not including temporary slopes). Buried joint bays, comms boxes and links boxes will also be required for each cable. The joint bays will be 6 m wide and 16 m long. The maximum working corridor width would be up to 125 m. Where trenchless technology e.g., HDD, is required there would up to twelve ducts each with a maximum depth of up to 15 m from ground level. The maximum working corridor width where trenchless technology is used would be up to 200 m. It is noted that these cable trench arrangements described are worst-case scenarios, and that cables may be laid in a different arrangement within the limits of the MDS, e.g., two trenches with two cables per trench. This will be defined based on further design work following the application submission.

69. It is expected that joint bays, comms boxes and links boxes will be required at approximately 500 - 1000 m intervals, with the precise locations partially dictated by the length of cable that can be transported on a cable drum, and locations which have appropriate access. The maximum number of joint bays required along the HVAC cable onshore route is 24.

5.5. CONSTRUCTION

5.5.1. CONSTRUCTION ACCESS

70. Prior to the commencement of construction, a Construction Traffic Management Plan (CTMP) will be prepared, in consultation with NCC Highways Department. This will set out all construction access arrangements, including agreed access points, delivery routes and times.

71. Where required, temporary access routes (refer to The PDE for the Onshore Scheme upon which the impact assessment has been based is described below. A summary of the infrastructure required for the Onshore Scheme, is provided in Table 5.1 below. The values shown represent the realistic worst-case values for the purposes of the EIA (‘the maximum design scenario’). Whilst the design parameters are frozen, measurement may be classed as approximate as development of construction techniques may influence this, however maximum and minimum parameters are presented as appropriate. Further detail on specific MDS parameters relating to the design, construction, operation and maintenance and decommissioning of each component of the Onshore Scheme is provided in section 5.5.

72. Table **5-1**) will be constructed within the Site to facilitate construction vehicle access to the Landfall, Converter Station, HVDC and HVAC onshore cable routes. Public Road Improvements (PRIs) may be required along sections of the existing public road network to accommodate the construction and abnormal load traffic. These improvements are likely to consist of road alignment improvements, street furniture removal and road widening, including any other measures considered necessary and as agreed with NCC. Following construction, the areas will be reinstated to their original condition, unless otherwise forming part of the final permanent development.

73. Potential construction access points have been identified in locations to minimise impacts on the local road network as far as possible. Temporary access roads within the Site will be formed of crushed stone / hard standing / tarmac or tracked and will be maintained for the duration of the construction period as required. Following construction, the temporary surface will be removed and the previous land use reinstated.

74. There will be a variety of vehicles requiring access to the Site throughout the construction period. These will include flatbed trucks for the delivery of construction materials and equipment, plant such as excavators, bulldozers, cranes, Heavy Goods Vehicles (HGVs), cars and vans for use by construction staff.

75. The location of final access routes and final traffic numbers and vehicle types will be dependent upon the final design of the Onshore Scheme and will be influenced by factors such as final Landfall location, final onshore cable routes (HVDC and HVAC) including requirements for use of trenchless techniques or open cut trench installation techniques and final Onshore Converter Station design including final ground levels, drainage design, ground excavations etc. Consequently, it is not possible to include final traffic numbers / vehicle types as part of this application. However, for the purpose of informing the traffic and transport assessment, reported in Chapter 12 of this ES, indicative vehicle numbers and proportions of the types of vehicles comprising the estimated total numbers have been provided based on the PDE presented in this chapter. These estimated numbers and proportions by vehicle type will be subject to refinement / change as the Onshore Scheme progresses to final design. The CTMP will include details of all traffic movements and vehicle types during construction and operation based on the final design for the Onshore Scheme. The Applicant will ensure that all vehicles will be routed as agreed with NCC and relevant stakeholders, to minimise disruption and disturbance to local residents.

5.5.1.1. Beach Access

76. Landfall activities are anticipated to involve construction utilising trenchless techniques (i.e., HDD). This will involve drilling from land under existing infrastructure, including road, utilities, railways, and beach areas. During construction it is expected that access to the beach will be maintained and signage may be employed at this time to advise of the works.

5.5.2. LANDFALL CONSTRUCTION

5.5.2.1. Trenchless Technology (e.g., Horizontal Directional Drilling)

77. As described in section 5.4.1.2, trenchless technology is an installation methodology which avoids direct interactions within the intertidal zone. Trenchless technology can be carried out via a marine or shore-led methodology. It is anticipated that a shore-led approach is most likely to be adopted. One method of trenchless technique which has been investigated for the Landfall construction is Horizontal Directional Drilling (HDD). A typical methodology for this is described below.

78. HDD involves drilling a hole (or holes) along an underground pathway from one point to another, through which the Offshore Export Cables are installed, without the need to excavate an open trench.

To achieve this a drill rig is located onshore, landward of MHWS. A working area would be established containing the drill rig, electrical generator, water tank, mud recycling unit and temporary site office. The drilling installation would commence from above the MHWS, with the HDD exit point (punch out location) located seaward of MLWS between 500 m and 2,400 m from the HDD entry point. The HDD exit pits will be below MLWS and, as such, no works will take place in the intertidal zone. A drilling fluid, such as Bentonite, is pumped into the drilling head during the drilling process to stabilise the hole and retrieve the drilled material. Once the drilling is complete, cable ducts may be installed from land and pushed out, or towed into position by a vessel offshore and pulled in. The offshore export cables are then pulled through the pre-installed ducts from the cable lay vessel by land-based winches.

79. The HDD works comprise the following main stages:

   a. A pilot hole will be drilled from onshore to offshore.

   b. Once the pilot hole has been completed, the reaming process will commence, increasing the diameter of the pilot hole to accommodate the safe installation of HDD duct. The reaming process will continue back and forth for a number of passes to achieve a minimum bore diameter. During the drilling procedure, drilling fluid is continuously pumped to the drill head to act as a lubricant. Solids are removed from the returning fluid, and the spoil is transported off site or into the mud pit (landward of the MHWS) to settle.

   c. A jack-up vessel or MFE dredger will be used at the at the HDD exit point to create an HDD exit punch out.

   d. The HDD reamer is then disconnected from the drill pipe and recovered.

   f. The High-Density Polyethylene (HDPE) liner pipe will be pre-assembled and then floated in, connected to the drill pipe, and pulled onshore from the offshore end through the pre-drilled bore into position.

   g. Steps a to f are then repeated for each Offshore Export Cable Circuit.

   h. Trenches are then excavated from the HDD entry points above the MHWS to the Transition Joint Bay and ducts installed and backfilled; (this is covered as part of the Onshore Scheme).

   i. HDD construction equipment and plant is then demobilised from site.

   j. The ducts are then proved ready for cable pull in and messenger wires are installed.

   k. Cables will then be installed in the ducts by pulling onshore through the ducts from the offshore cable lay vessel to the Transition Joint Bays.

80. Once commenced, the HDD drilling activities may be required to operate continuously over a 24-hour period until each bore is complete to minimise the risk of the bore failure (see section xx for further detail). Subject to further construction planning and availability of drilling rigs, drilling may be carried out concurrently to accelerate the construction works programme.

81. The maximum design envelope parameters for the trenchless technology (e.g., HDD) process are detailed in Table 5-2 .

5.5.2.2. Trenchless Technology / TJB Construction Compound

82. Trenchless techniques will be carried out from within a temporary compound which will also be used to install the TJBs. Depending on the final design there could be several separate trenchless technology / TJB compounds or one large trenchless technology / TJB compound. Regardless of

final design arrangement the maximum footprint of the trenchless technology / TJB compound will not exceed 15,000 m^2.

83. The trenchless technology / TJB construction compound will house the trenchless technology (e.g., HDD) drill rig and other equipment, machinery and plant including excavators, bulldozers and cranes. The trenchless technology / TJB construction compound will also house temporary portable cabin structures to be used as the Site office and welfare facilities, including toilets, kitchens, and the provision of sealed waste storage and removal. Temporary construction compounds will also be used for the storage of infrastructure components, parking for vehicles, storage for tools and small parts, as well as oil and fuel storage and an electrical generator.

84. The surface of the construction compound will be crushed stone. As with the rest of the temporary works, topsoil will be relocated, stored and reinstated following the completion of works. Earthwork movements will be detailed and controlled under the Earthworks Management Plan (EMP).

85. Secure temporary fencing and lighting will be erected around the trenchless technology / TJB construction compound. The security fencing will define the working area, protect any sensitive areas, and prevent third party access. Access gates will be installed that are suitable for both personnel and for movement of plant and equipment.

5.5.2.3. Maximum Design Scenario (MDS) for Cable Landfall (Trenchless Technology and TJBs)

86. The MDS for the Landfall infrastructure and installation using trenchless technology (e.g., HDD) are provided in Table 5-1 below.

Table 5-2 MDS for Trenchless Technology at Landfall (above MLWS)

Parameter	Maximum value
Maximum number of cables	4
Maximum number of Transition Joint Bays (TJBs)	4
Maximum dimensions of TJBs (per TJB)	6 m width 25 m length
Maximum length of trenchless technology (onshore to offshore)	2.4 km per cable
Maximum number of trenchless technology ducts*	4
Maximum diameter of trenchless technology ducts (per duct)	0.3 m to 2.5 m
Maximum depth of trenchless technology ducts	30 m
Maximum footprint of trenchless technology / TJB construction compound	15,000 m^2

* Maximum number of permanent trenchless cable ducts assumed. Should during trenchless landfall installation a bore fail through encounter of unforeseen ground conditions or other failure, a spare bore may be required.

5.5.3. ONSHORE HVDC and HVAC CABLE INSTALLATION

87. For the majority of the onshore HVDC cable route between the Landfall and the Onshore Convertor Station and the HVAC cable route between the Onshore Converter Station and the Blyth substation the cables will be installed using Open Cut Trenching technique. However, at certain locations where there is a requirement to cross existing infrastructure i.e., roads or railway lines, or other sensitive

features i.e., watercourses and areas of woodland it might be necessary to use trenchless techniques such as HDD. Both methods are discussed below.

5.5.3.1. Open Cut Trench (OCT) Technique

88. As discussed above, the MDS assumes scenarios of separate trenches for each cable (up to four onshore HVDC cables and trenches and up to twelve HVAC cables and trenches) as well as one trench within which all the cables will be buried. It is noted that these cable trench arrangements described are worst-case scenarios, and that cables may be laid in a different arrangement within the bounds of the MDS, e.g., two trenches with two cables per trench. This will be defined based on further design work following the application submission. The maximum dimensions of the trenches for the HVDC and HVAC cable routes are presented in Tables 5-2 and 5-3. The cables will be contained within ducts that will be placed into the trench and buried where possible to depths of up to 2.2 m. Fibreoptic cables will also be placed in the trenches (separate ducts).

89. The cables will be installed in discrete sections along both the onshore HVDC cable route and the HVAC cable route. Installation works at each section will consist of several activities including construction of associated temporary access roads, installation of pre-construction, temporary and post construction land drainage where necessary, excavation of the onshore cable trench, laying of ducts, backfilling of materials to subsoil level, onshore cable pulling and laying, onshore cable jointing, topsoil back filling and full reinstatement to the previous land use where appropriate. The onshore cables will also go through testing and commissioning phases.

90. Before installation works begin at each section, the topsoil across the working corridor will be removed using mechanical excavators and stored along the cable working corridor for replacement once the works are complete. If required, aggregate (on a geotextile base where soft ground is encountered) may be laid over a section of the exposed subsoil for the temporary access road. Mechanical excavators will be used to dig the cable trench. Once complete each section of the onshore cables (stored on a drum) will be lifted from the delivery truck and placed into position at the end of the trench. The onshore cables will then be winched through the open trench, to a joint bay at the end of the section.

91. Once the onshore cables are installed, the trench will be backfilled with stabilised backfill (i.e., cement bound sand) and granular/reinstated excavated material, protective covers (where appropriate) and warning tapes, to avoid damage during any future excavations. Following completion of trench backfill, native material (i.e., topsoil) will be replaced. Previously excavated material will be used to backfill the cable trench wherever possible to minimise the amount of material to be disposed of off-site. Any stockpiling of excavated material along the onshore cable corridor will be sited within the designated material storage areas within the Site.

92. Where cables are installed using open cut trenching, there will be a requirement for features such as fences, hedgerows, woodland strips, walls located within the working corridor to be removed prior to the cables being installed. However, such features will be fully reinstated where practicable once the installation works are complete (for example, fences and walls will be rebuilt and any gaps in the hedgerow or woodland will be replanted).

93. An illustration of the OCT cable installation technique is presented in Plate 5-7 below.

Plate 5-7 Example photograph of OCT technique

94. An illustration of cable joint installation is presented in Plate 5-8 below.

Plate 5-8 Example photograph of the construction of a joint bay

95. The MDS for OCT technique for installation of the HVDC cables between the Landfall and the Onshore Converter Station is presented in Table 5-3 below.

Table 5-3 MDS for OCT parameters (HVDC Cables – Landfall to Converter Station)

Parameter	Maximum value
Maximum length of HVDC cable route (km)	2.1 km
Maximum number of HVDC cables	4
Maximum number of HVDC cable trenches	4
Maximum width of HVDC cable trench (m)	2 m width per trench (Four trenches - one cable per trench) 12 m width trench (One trench - four cables per trench) 110 m working corridor
Maximum depth of HVDC cable trench (m)	2.2 m

96. The MDS for OCT technique for installation of the HVAC cables between the Onshore Converter Station and Blyth Substation is presented in Table 5-4 below:

Table 5-4 MDS for OCT parameters (HVAC Cables – Onshore Converter Station to Blyth Substation)

Parameter	Maximum value
Maximum length of HVAC cable route (km)	1.5 km
Maximum number of HVAC cables	12
Maximum number of HVAC cable trenches	4
Maximum width of cable trench (m)	12 m width per trench 125 m working corridor
Maximum depth of cable trench (m)	2.2 m

5.5.3.2. Trenchless Technology (HDD)

97. As discussed above, at certain locations along the both the onshore HVDC cable route and the HVAC cable route it might be necessary to use trenchless technologies to cross existing infrastructure or other sensitive features. Some forms of trenchless techniques include pipe jacking, direct pipe and HDD.

98. Onshore HDDs are similar to HDDs used at the Landfall except the ducts are installed by drilling underground between two onshore points. Trenchless technology e.g., HDD is used to reduce the need to excavate an open trench between two points.

99. The drilling/installation process will comprise the following stages:

   a. A small diameter pilot hole will be drilled for the purpose of defining the path of the duct into which the cable is to be installed. Separate pilot holes will be drilled for each cable.
   b. A reamer will then be pulled back through the pilot hole enlarging the diameter of the hole as it progresses. This may have to be repeated a number of times, depending on the nature of the ground through which it passes, in order to enlarge the pilot hole diameter sufficiently to accommodate the duct.
   c. The ducts will then be attached to the reamer and pulled through the widened pilot hole. This operation may be done with the onshore cable inside the duct or alternatively after the duct is installed, the onshore cables may then be winched through the ducts.

d. When cable pull-through is complete, the onshore cables will be secured in place.

100. The MDS for onshore HVDC trenchless technology solutions (e.g., HDD) are provided in Table 5-1.

5.5.3.3. Cable Bridge (NSL Crossing)

101. Where the HVDC cables cross the NSL cables there may be a requirement to install a cable bridge if further engineering work determines that a trenchless technology solution is not possible.

102. A cable bridge is a structure used to ensure safe transition of cable(s) / services from one location to another (i.e., over roads, railways, watercourses or other assets). Cable bridges can take a number of structural forms, often constructed of concrete, steel or composite materials (such as GRP). Subject to detailed design, they are generally formed through the construction of foundations, abutments, headwalls and wingwalls. Depending on location, the structures can be fenced off or left open to ensure public rights of way are retained and access for future construction, maintenance and inspection works carried. It is anticipated that the detailed design of the cable bridge will be agreed and confirmed with NCC and the Environment Agency.

5.5.3.4. CONSTRUCTION COMPOUNDS, SECURITY FENCING, NOISE / DUST ABATEMENT AND MATERIAL STORAGE

103. A number of construction compounds will be required along both the HVDC and HVAC cable routes. The final number and location of the construction compounds will be determined once contractors are appointed, and the final cable routes are defined (at detail design). Table 1-1 provides further information on the number and dimensions of construction compounds which may be required in different infrastructure zones.

104. Construction compounds are expected to be required at:

- All locations where trenchless technology (e.g., HDD) is required;
- The trenchless technology (e.g., HDD) or cable bridge crossing of the NSL cables; and
- Other locations (not specified).

105. The construction compounds will house all equipment, machinery and plant including excavators, bulldozers and cranes. The construction compounds will also house temporary portable cabin structures to be used as the site office and welfare facilities, including toilets, kitchens, and the provision of sealed waste storage and removal. Temporary construction compounds will also be used for the storage of infrastructure components, parking for vehicles, storage for tools and small parts, as well as oil and fuel storage and an electrical generator.

106. Construction compounds will be required at trenchless technology e.g., HDD locations. These construction compounds will also house the HDD drill rig, an electrical generator, a water tanker, and a mud recycling unit. Drilling mud, containing bentonite (a naturally occurring absorbent clay) and fresh water, will be used to aid the drilling process. Drilling mud will be recycled on site within a contained system throughout the drilling process to minimise fresh water usage. Upon completion of the installation process, surplus drilling mud will be reused on site.

107. The surface of the construction compound will be crushed stone. As with the rest of the temporary works, topsoil will be relocated, stored and reinstated following the completion of works.

108. Secure temporary fencing and lighting will be erected around all construction compounds. The security fencing will define the working area, protect any sensitive areas, and prevent third party access. Access gates will be installed that are suitable for both personnel and for movement of plant and equipment.

109. In sensitive locations e.g., in close proximity to residential areas, additional noise abatement and dust management measures will be included as part of the construction compounds to minimise local disturbance (noise) and dust emissions / mud on local roads. The final design of the noise and dust abatement measures will be agreed with NCC.

110. The material storage and lay down areas will be established through stripping of the topsoil and subsoil material, depths of which will be governed by the design / required bearing capacities at these locations. Prior to construction, an Earthworks Management Plan will be produced and shared for approval by NCC. This will detail how the soils will be stripped, segregated, stored, and reinstated following completion of the works.

111. The MDS for the HVDC and HVAC onshore cable route construction compounds and material storage areas are provided in Table 5.5 below. The size of the construction compounds will be dependent on cable installation methodology, however the MDS is presented here for the purposes of the EIA.

Table 5-5: MDS for HVDC Onshore Cable Route Temporary Construction Compounds and Material Storage

Parameter	Maximum value
Maximum number of HVDC construction compounds	8
Maximum footprint of HVDC construction compounds	37,800 m^2
Maximum number of HVDC material storage areas	7
Maximum footprint of HVDC material storage areas	28,800 m^2

112. The MDS for the HVAC onshore cable route construction compounds and material storage areas are provided in Table 5.6 below.

Table 5-6: MDS for HVAC Onshore Cable Route Temporary Construction Compounds and Material Storage

Parameter	Maximum value OCT
Maximum number of HVAC construction compounds	8
Maximum footprint of HVAC construction compounds	37,800 m^2
Maximum number of HVAC material storage areas	6
Maximum footprint of HVAC material storage areas	28,780 m^2

5.5.4. CONVERTER STATION CONSTRUCTION

113. Construction of the Onshore Converter Station will include the activities outlined below.

5.5.4.1. Site Preparation and Establishment

114. Once temporary construction access to the Onshore Converter Station site has been established (section 5.6.1) site preparation works will commence. These will include vegetation clearance, development of internal site access and the construction of temporary facilities including parking, site offices, storage containers, welfare facilities, construction/laydown areas, waste laydown/sorting

areas, a bunded fuelling area, and a double bunded chemical / fuel storage area, the development of electricity, water supplies, drainage and electricity, and the erection of security fencing.

5.5.4.2. Earthworks

115. The Onshore Converter Station site will be cleared and levelled using excavation and construction machinery. An Earthwork Management Plan (EMP) will be produced outlining the strategy for material management across the Site. This will include handling and/or export of any contaminated material as informed by future ground investigation. This will also include earthworks for the construction of the SUDS pond and landscaping works.

5.5.4.3. Construction Access

116. It is anticipated that two access tracks will be required along the HVDC cable route as well as the HVAC cable route, one either side of the cable trenches. Any construction access track along the HVDC cable route and HVAC cable route would be expected to be 12 m wide.

5.5.4.4. Construction

117. Construction of the Onshore Converter Station will require the following:

- Construction of spread foundations to support small structures;
- Construction of hardstanding areas i.e., pavements and car parking;
- Construction of foundations to support the high loads of the transformers, reactors and other HV electrical plant;
- Construction of a finished platform through completion of earthworks operations to provide a level substation footprint. The exact depth and volume of cut and fill soil which is associated with the flat platform will be determined following more detailed investigations. Depending on the topography this may require the construction of retaining structures;
- Installation of utilities and services;
- Construction of permanent drainage (SuDS pond);
- Construction of permanent access roads to the Onshore Converter Station and SuDS pond;
- Construction of Onshore Converter Station infrastructure including switchgear buildings;
- Landscaping and restoration of land adjacent to the Converter Station;
- Construction of surface water and foul water drainage provision; and
- Installation of fencing, site floodlights and security measures.

5.5.4.5. Construction Compounds

118. Construction compounds and material storage areas will also be required at the Onshore Converter Station site. There will be up to two compounds of a maximum footprint of 20,400 m^2 each and up to two materials storage areas, each of up to 8,400 m^2.

119. The MDS for the Onshore Converter Station site construction compounds and material storage areas is provided in Table 5.7 below.

Table 5-7 MDS for Temporary Construction Compounds and Material Storage Areas at the Onshore Converter Station

Parameter	Maximum value
Maximum number of construction compounds	2

Parameter	Maximum value
Maximum footprint of construction compounds	20,400 m^2
Maximum number of material storage areas	2
Maximum footprint of material storage areas	8,400 m^2

5.6. COMMISSIONING

120. Following completion of all construction works there will be a period of commissioning and testing.

5.6.1. HABITAT MANAGEMENT, SITE REINSTATEMENT AND LANDSCAPE WORKS

121. The Applicant has committed to retain areas of woodland within the Site (refer to Technical Appendix 7.2 Volume 3). This equates to 11 ha. Aside from these areas the remaining woodland within the Site and shown on the figure as 'Woodland at Risk of Removal' may be removed in order to accommodate the Onshore Scheme. This equates to 25 ha which is removed in the MDS. However, there are two matters of note in relation to this. First, the cable corridor is a maximum of 200 m in width within the HVAC Zone and 110 m width within the Landfall and HVDC Zone. Second, the route of the cable corridor will be designed considering technical and economic factors, which are likely to mean the HVDC and HVAC corridors will take a relatively direct route to create the required links. Therefore, the installation of the HVDC and HVAC cables is considered unlikely to require the removal all of the remaining 'at risk' woodland within the Site.

122. Post construction, site reinstatement will include the removal of the Site construction offices and temporary facilities, land reinstatement and landscape works. Temporary compound areas will be reinstated by replacement of the subsoil and topsoil and by planting where appropriate.

5.6.2. STAFFING AND EMPLOYMENT

123. The number of staff on site will vary according to the construction phase and activities being undertaken. Staff levels will be at their highest during the Onshore Converter Station earthworks and civil engineering works phases. Staffing levels will generally decrease as construction is progressed through to the commissioning phase. Between 15 and 38 net additional jobs per annum would be expected to be generated during the construction, and commissioning stage of the Onshore Scheme in Northumberland. This total includes direct jobs, those in supply chain industries, and those created through multiplier effects.

124. The appointed contractor will employ a Site Environmental Manager (SEM) or an Environmental Clerk of Works (ECoW) who will be responsible for the preparation and implementation of the Construction Environmental Management Plan (CEMP) ensuring that mitigation measures identified in this ES are appropriately implemented. The SEM or ECoW will be supported by environmental specialists such as ecologists and archaeologists as required.

5.6.3. HOURS OF WORKING

125. Planning permission will be sought for 24-hour, 7 days per week construction working hours. The 24-hour construction period is anticipated to be only necessary for the trenchless technique (e.g., HDD) crossing solutions and other continuous operations. This is on the basis that the trenchless installations (drilling and ducting) need to be completed as a continuous activity from the entry point to the exit point. Predominantly, this is to maintain integrity of the borehole (i.e., reduce risk of

collapse), but also to allow for the operations to be continuously monitored to avoid exceedance of agreed settlement limits as part of the planned methodology. Once the boreholes are drilled (and ducts installed) the ducts will maintain the borehole integrity. Dependant on the location of the trenchless crossing the cable installation may also need to be completed in a single operation, and back grouted to fully encapsulate the cables within the ducts. Whilst 24-hour working is generally necessary at these locations, this shall be reviewed with the relevant stakeholders and asset owners at detailed design stage. At this stage, opportunities to reduce these working times shall be considered and adopted where feasible.

5.6.4. GENERAL CONSTRUCTION INFORMATION

5.6.4.1. Environmental Management

126. During construction, the appointed Contractors will be required to develop and implement a detailed site-specific CEMP. The CEMP will as a minimum, set out the requirements to implement the mitigation measures identified within this ES. It will also set out a variety of control measures for managing the potential environmental effects of construction works including control and management of noise, dust, surface water runoff, waste, and pollution control. In addition, the Site environmental management will be audited by the developer and appropriate specialist environmental consultants.

5.6.4.2. Contractor Responsibilities and Communication

127. Contractors and their subcontractors will be required to conform to all relevant legislative and statutory requirements and comply with British Standards and relevant codes of good practice during construction works.

128. Communication will be undertaken with local residents and communities who may be affected by or interested in the works. Typical communications shall include the delivery of leaflets to local residents and businesses, newspaper advertisements and the establishment of a ‘freephone’ telephone number for interested persons to call with questions or observations on the works.

129. The approach to communication during the works is intended to ensure that potential causes for complaints or disturbance are avoided where possible, and that if any issues of concern arise, there is a mechanism for communicating with the developer.

5.6.4.3. Construction Waste and Spoil

130. Subject to geotechnical testing, excavated materials will be re-used on site wherever possible. Where waste materials are to be disposed of off-site, this will be at licensed waste disposal facilities in accordance with a Site Waste Management Plan (SWMP). The SWMP will be prepared by the Contractor in consultation with the Environment Agency.

5.7. OPERATION AND MAINTENANCE

131. This section provides an overview of the main activities which are anticipated to be associated with the operation and maintenance phase of the Onshore Scheme.

132. Once operational, the Onshore Converter Station may have a small workforce on site and the Site will be subject to infrequent inspections and maintenance visits whilst in operation. Access will be required to the Proposed Development for potential operation and maintenance activities 24 hours

per day, 365 days per year. The frequency and duration of maintenance visits will be dependent on the manufacturer's recommendations for the equipment installed.

133. Annual checks, on foot, will be required along the onshore cable corridor during operation. Access would normally be along the agreed onshore cable corridor. In the unlikely event that there is any failure of onshore cables, a fault finder with test gear would locate the fault along the onshore cable corridor section. Once located, the area around the fault would be excavated and the fault repaired. If the onshore cable cannot be repaired, a new length of onshore cable would be inserted and jointed to replace the failed section.

134. The most common failure mode in onshore cables is due to external mechanical damage (e.g., diggers and spades) which can be avoided by marking the locations of onshore cables on service maps. The likelihood of a breakdown in insulation due to other problems is very low, particularly for onshore cables installed in ducts such as the proposed onshore cables. In the unlikely event of a failure, the cable will be replaced between joint bays so to minimise any disturbance and only in the very unlikely event of catastrophic failure will the cable require to be accessed at the point of failure between joint bays.

135. Planting trees and other deep-rooted vegetation over the onshore cables or within 3 m of the onshore cable trench will be restricted, to prevent encroachment by vegetation.

136. Onshore substation security will likely comprise of CCTV, access control systems and security fencing. Permanent lighting at the substation will also be installed to aide security and facilitate safe access during hours of darkness.

5.8. DECOMMISSIONING

137. The anticipated operational life of the Onshore Converter Station and cables is approximately 35 years from final commissioning of the wind turbines. This life expectancy could be extended dependent on the operation of the component parts which will be subject to ongoing inspection. At the end of the operational lifetime of the Onshore Scheme, the operator of the Onshore Scheme will develop and agree a solution for the onward handling of the onshore infrastructure with the regulator. This decision will be based on the advice from the regulator at the time and informed by the prevailing environmental regulatory requirements at that time, and relevant best-practice.

138. Decommissioning of the Onshore Converter Station would involve the main components being dismantled and removed for recycling or disposal in accordance with the relevant waste disposal regulations. Decommissioning of underground cables would involve disconnection from operational cable, with options for leaving redundant cable in-situ or removal. Removal would involve similar activities to installation.

139. The approach to decommissioning will align with regulatory guidance, requirements, and industry best practices at the time of decommissioning and will be agreed with the relevant stakeholder and regulatory bodies.

140. A decommissioning plan and supporting decommissioning environmental management plan will be prepared prior to commencement of decommissioning and will be subject to its own environmental assessment.

141. A CEMP will be prepared and issued to all contractors working on the Project prior to the start of construction. An outline CEMP has been submitted as part of this application (Volume 4, Appendix 5.2).

5.9. INDICATIVE PROJECT PROGRAMME

142. An outline of the programme for construction of the Onshore Scheme is given below to provide indicative commencement and completion dates, together with estimated durations of key construction activities.

143. Until detailed design of the Onshore Scheme is progressed and further refined pre-construction, this programme is indicative and subject to further refinement, but is used to inform assessment of construction phase impacts for the Onshore Scheme.

144. The indicative outline construction programme includes the following:

- Commencement of construction expected in Q4 2025 and completion of construction expected in Q4 2029;
- Site preparation/ enabling works for an estimated duration of up to 15 months;
- Landfall construction for an estimated duration of up to 24 months;
- Onshore Cable (HVAC and HVDC) installation for an estimated duration of up to 18 months;
- Onshore Converter Station construction for an estimated duration of up to 18 months; and
- Outfall installation for an estimated duration of up to 9 months.

145. Whilst the site preparation works will occur for the duration of the construction phase, these will not be continuous. There are expected to be periods when site preparation, Landfall and cable installation and onshore convertor station construction works occur concurrently.

5.10. EMISSIONS

146. Under the EIA Regulations[2], a description of emissions from a development and the likely significant effects resulting from those emissions is required. This includes anticipated residues, emissions, and wastes, such as pollutants, noise, light, vibration, heat and radiation. A Climate Assessment (Greenhouse Gas Emissions) of the Onshore Scheme has been carried out and is reported in Technical Appendix 5.1.

147. As demonstrated in the assessment, there are several emissions which may occur as a result of the installation or operation and maintenance phases of the Onshore Scheme. This includes electric magnetic fields (EMF), heat and noise, noting that all emissions are highly localised based on the nature of the Onshore Scheme.

148. Residues, emissions and wastes will be controlled and mitigated, as required, to minimise any potential adverse effects on the surrounding environment. Compliance with relevant regulatory measures and adherence to industry best-practice is considered to manage any potential impacts.

149. All of the equipment for the Onshore Scheme capable of producing EMFs will be assessed in accordance with the provisions of the UK Government's Code of Practice on Compliance, which is compliant with International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidance (ICNIRP 1998).

[2] The Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

5.11. References

The Planning Inspectorate (2018) *Advice Note Nine: Rochdale Envelope* [online]. Available online at: Advice Note Nine: Rochdale Envelope | National Infrastructure Planning (planninginspectorate.gov.uk) Accessed 27/03/2023

SSER (2022). *Scoping Report - Berwick Bank Offshore Wind Farm Cambois Connection - Firth of Forth*. November 2022. Available online at: https://marine.gov.scot/node/23205. Accessed on: 27 March 2023.

UK Government (1989) *Electricity Act 1989.* Available at: https://www.legislation.gov.uk/ukpga/1989/29/contents Accessed on 27 March 2023.

UK Government (1990) *Town and Country Planning Act 1990*. Available at: https://www.legislation.gov.uk/ukpga/1990/8/contents Accessed on 27 March 2023.