AQUIND Limited

AQUIND INTERCONNECTOR

Environmental Statement – Volume 3 – Appendix 3.2 Marine Worst-Case Design Parameters

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

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TABLES

APPENDIX 3.2 MARINE WORST-CASE DESIGN PARAMETERS

1.1 ROUTE PREPARATION

1.1.1.1 Route preparation activities will take a maximum of 30 months. This is because they can generally be no more than a maximum of 1-12 months (depending on activity) before the start of cable installation activities, which will take place intermittently over two years. Table 1 summarises the worst-case scenario in terms of route preparation that is being considered for the Proposed Development. It is anticipated that a combination of these methods will be applied throughout the Marine Cable Corridor.

Table 1 - Route Preparation Worst-Case Design Parameters

Activity	Timing	Disturbance / Footprint	Equipment
PLGR	Maximum of 12 months before each cable installation campaign	The grapnel may be pulled along the seabed for 2 x 108 km of Marine Cable Corridor. Width of grapnel = 1 m Area of disturbance = Approx. 216,000 m^2	Multicat / tug / offshore support vessel
Boulder Removal	Within 2 – 3 months of starting cable installation	The presence of boulders has been identified along 15.6 km (14%) of the UK Marine Cable Corridor. The plough will be used in the first pass, a grab will then be used to pick up any that have not been cleared. Total width of plough = 15 m, may be used to produce a swathe of up to 80 m wide. Area of disturbance = Approx.1,250,000 m^2	Rock grab vessel Plough support vessel Survey vessel

Activity	Timing	Disturbance / Footprint	Equipment
Sediment Clearance through Dredging / Sediment Displacement	Phased to be as close to cable installation as possible	Sediment clearance may be required for the following: • Clearance of sandwaves and large ripples; • At Horizontal Directional Drilling ('HDD') entry/exit points; and • At cable joint location on the seabed (although these are not included in the estimates below because the number and type of joints are not known at this stage). The estimated maximum volume of seabed sediment (that includes the above scenarios) to be cleared is approx.1,754,000 m^3. **Sandwave (and large ripple) clearance:** currently required along an estimated 4.2 km of the Marine Cable Corridor. The width of dredging may vary between 80 m and 160 m (including batter slopes) and depends upon the spatial distribution of the bedform and the depth of dredging. Total indicative area of dredging footprint = Approx. 672,000 m^2	Trailing Suction Hopper Dredger ('TSHD') or Mass Flow Excavation ('MFE')

Activity	Timing	Disturbance / Footprint	Equipment
	At start of HDD operations	Maximum volume of sandwave and large ripple clearance = 1,751,000 m^3. **HDD Entry/Exit Pits:** If required, entry / exit pits may be necessary to position the drill casing and protect the HDD end cap whilst minimising impacts on navigation depth. These will be location specific, but as worst case assumes a single pit (rather than 4 discrete pits) approximately 60 m x 15 m and 3 m deep. Maximum volume of HDD dredging/excavation = 2,700 m^3.	Long-reach excavator (barge mounted or marinised) or MFE
Sediment Deposit	In parallel with sediment clearance	Maximum deposit approx. 1,754,000 m^3 of cleared sediment within Marine Cable Corridor via surface release from barge hatches.	TSHD
Rock / Mattress Placement for uneven seabed	Within 1 – 12 months of cable installation	Placement of rock / mattressing along approximately 500 m (<1%) of marine cable route. Assuming 6 m wide rock berm or mattress covering each cable pair for this distance, footprint of infrastructure = 6,000 m^2 included in Table 3 Non-burial Protection Parameters	Rock placement vessel / mattress installation vessel

1.2 CABLE INSTALLATION

1.1.1.2 Depending on the burial technique adopted, burial of the marine cables can be undertaken simultaneously to cable lay or undertaken pre/post-lay. Table 2 summarises the worst-case scenarios in terms for cable burial along the whole Marine Cable Route.

Table 2 – Cable Burial Worst-Case Design Parameters for Two Bundled Cable Pairs

Activity	Disturbance / Footprint	Equipment
Cable Burial	The worst-case scenario includes the burial of up to 2 x 107.9 km of the marine cables using one or a combination of the following methods: **Non-displacement Plough Trenching – up to 108 km of Marine Cable Corridor, based on Target Depth of Lowering ('TDL')** • Width of plough trench = 0.35 m (non-displacement plough share width) plus 2 x 2 m wide skids • Area of surface disturbance = approx. 940,000 m^2 • Volume of trench disturbed = approx. 80,000 m^3. **Displacement Plough Trenching – up to 108 km of Marine Cable Corridor, based on TDL** • Width of plough trench = 2.5 m (vertical sided trench rather than V-cut plough) plus 2 x 2 m wide skids • Area of surface disturbance = approx. 1,410,000 m^2 • Volume of trench disturbed = approx. 690,000 m^3	Cable Lay Vessel / Barge Anchor Handling Vessel Trench Support Vessel Guard Vessel

Activity	Disturbance / Footprint	Equipment
	Jet Trenching – up to 20 km of Marine Cable Corridor • Width of jet trench assumed to be configured to 0.35 m between jet swords, 0.5 m overall • Width of tracks = 0.8 m x 2 • Area of surface disturbance = approx. 84,000 m^2 • Volume of trench disturbed = 2 (pairs of cables) x 0.5 m (overall jet sword width) x target depth of lowering = approx. 85,000 m^3 **Mechanical Trenching – up to 108 km of Corridor** • Width of trench = 0.5 m • Width of both tracks = 4 m • Area of surface disturbance = approx. 972,000 m^2 • Volume of trench disturbed = approx. 120,000 m^3 **Grounding of Vessels** **As a worst case, vessels may be up to 120 m LOA and up to 33 m beam.** A maximum of 2 vessels would be grounded at any one time (at low tides) between Kilometre Point ('KP') 1.0 and 4.7, for a period up to a maximum of 4 weeks. **Area of disturbance = 7,920 m^2** **Moorings** As a worst case, all burial methods may require the use of anchor spreads. The worst case is assumed to be an 8-point mooring, based on 5t Stevpris	

Activity	Disturbance / Footprint	Equipment
	anchors (individual maximum anchor area approximately 9.7 m^2). In a worst case, the anchor could be moved every 400 m, therefore 270 movements (per pair, therefore total of 540), therefore a total area of approx. 42,000 m^2.	

NON-BURIAL PROTECTION

1.1.1.3 Table 3 summarises the worst-case scenarios in terms of non-burial cable protection measures along the whole length of the Marine Cable Corridor using one or a combination of the measures.

Table 3 – Non-Burial Protection Measures along the Marine Cable Corridor Worst-Case Design Parameters for Two Bundled Cable Pairs

Activity	Duration / Timing	Disturbance / Footprint	Equipment
Non-burial Protection		Non-burial protection along approx. 11 km (10%) of the Marine Cable Route using one or a combination of the following cable protection measures. An allowance has also been added to include an additional 10% (11 km) non-burial contingency if further non-burial protection is required during maintenance/repair activities during the first 15 years of operation. Worst Case Scenario is therefore 11 km + 11 km = 22 km **Concrete/frond mattressing** – Width of protection = 6 m per cable pair Height of protection = 0.3 m Worst Case Scenario therefore 2 x 11 km x 6 m	Mattress installation vessel Rock placement vessel

Activity	Duration / Timing	Disturbance / Footprint	Equipment
		Indicative maximum footprint of mattressing for construction-phase remedial protection= 132,000 m^2 **Rock Placement** - Width of protection = 15 m per cable Height of protection = 1.5 m Worst Case Scenario therefore 2 x 11 km x 15 m Indicative maximum footprint of construction phase remedial protection =330,000 m^2 These parameters do not include protection used as HDD exit pits or for the cable crossing design.	
Atlantic Crossing Protection (pre-lay berm) (Post-lay)	Within 2 – 12 months of cable installation, with crossing construction undertaken before and after cable installation	One pre-lay rock berm, which will be covered by the post lay berm eventually, approximately 100 m long and 30 m wide. Total footprint (total for two cable pairs) = 3000 m^2 Height of rock berm = 1.5 m Installation of two post-lay rock berms. Each berm up to approximately 30 m wide and 600 m long. Height of berm above seabed (or pre-lay berm) up to 1.5 m Total maximum footprint (pre-lay and post-lay berm) = Approx. 37,800 m^2	
Horizontal Directional Drilling Exit/Entry Point	After HDD and installation of end caps, until cable installation.	Rock or mattress protection may be installed at HDD exit/entry points. These may be as 4 discrete locations or as a single berm covering all 4 exit points.	

Activity	Duration / Timing	Disturbance / Footprint	Equipment
Protection Measures	Non-burial protection could be in place for up to 12 months. It would be removed as part of the cable pull / installation process.	Height of temporary protection= up to 0.5 m – will be located in existing pit to ensure navigable depth is maintained. Length of protection= up to 15 m Width of protection = up to 60 m Total footprint of protection = Approx. 900 m^2 Prior to cable pull, protection is more likely to be rock bags than rock berms, but after cable pull the rock bags would be recovered and replaced with a permanent rockfill within the pit. This would be 60 x 15 x 3 m = 2700 m^3.	

1.3 LANDFALL INSTALLATION

1.1.1.4 Table 4 summarises the worst-case design parameters for Landfall installation.

Table 4 – Landfill Installation Worst-Case Design Parameters

Activity	Duration / Timing	Disturbance / Footprint	Equipment
HDD	44 weeks	**Intertidal Area** HDD will pass under intertidal area below seabed surface from TJB to marine entry / exit point. No footprint/disturbance between the ends. **Marine works to install HDD ducts** Four individual ducts will be drilled. Jack-up barge will be placed at up **to four** locations. Typical jack-up barge will possess 4 legs, each leg approximately 1.4 m diameter. Temporary casing support frame	Jack up barge Drilling rig (on Jack Up Barge) Safety Vessel Crew Transfer Vessel Tug Anchor Handling Vessel

Activity	Duration / Timing	Disturbance / Footprint	Equipment
		comprising 4 trestles spaced up to 12 m apart at each location. Each trestle has a footprint of 3 m^2. 1200 m^3 of drilling fluid per duct. Total of 4,800 m^3 for four ducts. Drilling fluid will be made up of water (>90%), bentonite (~7%), Xanthan gum (<0.5%) to ensure it meets with Cefas' requirements. Ducts will be spaced approximately 15 m apart. Exit point to be defined, but likely between KP 1.0 and 1.6. 36" casing driven approximately 24 m into the seabed at an angle of 10-12 degrees, therefore reaching a maximum depth of approximately 5 m below seabed level.	