



BEATRICE OFFSHORE WINDFARM TWIN DIRECT PIPE LANDFALLS BOWL

Stockton completed the trenchless installation of two independent 48" x 450m steel landfalls by utilising Herrenknecht's DirectPipe® system (a world-first for this technology) and AVN1000 micro tunnelling machine.

STOCKTON

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DirectPipe® (a hybrid micro-tunnelling and pipe-jack system that lines the tunnel as it advances) was selected due to un-drillable geology.

PROJECT SUMMARY

- 2 x 450m x 48" DirectPipe® installations for high-velocity cables in relation to the Beatrice Offshore Windfarm
- Recovery of TBM using a world-first remote disconnect module, and an array of offshore vessels
- Difficult ground conditions and environmental constraints

THE PROJECT

The BOWL project is one of the largest private investments ever made in Scottish infrastructure and produces 584 megawatts from 84 turbines situated in the outer Moray Firth and powers approximately 450,000 homes at a cost of £2.6 billion to its investors SSE, Copenhagen Infrastructure Partners and Red Rock Power.

The beach area around the landfall site is a designated Site of Specific Scientific Interest (SSSI).

GEOLOGY

Surface alluvial comprising pebbles and cobbles, overlaying bedrock of weathered sandstone, prevented the use of more traditional horizontal directional drilling methods.

DESIGN

Production of weld procedures to BS EN ISO 15614: 2012, specifically for the project utilising a partial penetration weld to guarantee no intrusions. Temporary works designs for two sheet-piled pits measuring 5m deep by 7.5m wide and 20m long. Over-bend design utilising rollers on temporary towers as an engineered solution to reduce plant and labour on site.

World's first offshore disconnect of a DirectPipe® system, utilising a bulkhead door within the TBM to ensure it remained operational for the second drive.

ENVIRONMENT

Due to the geological constraints, DirectPipe® – a hybrid micro-tunnelling and pipe-jack system that lines the tunnel as it advances – was selected as the most suitable methodology, as it is capable of operating through a multitude of ground conditions.

Nexans Norway AS provided entry and exit locations, which then dictated the 750 tonne DirectPipe® system as it is capable of the required 450m landfall distance. For the BOWL landfall, a 48" steel pipe was used as the liner, unlike most pipe jacks, which utilise concrete rings which enables the entire tunnel to be retracted to the surface if required.

When using the DirectPipe® method, the entire tunnelling infrastructure is on one side of the obstacle to be drilled under. This makes the technology ideally suited for sea outfalls/landfalls, with the pipeline pushed directly from land out to sea. Once the required length has been achieved, the AVN machine is recovered from sea. Starting at the launch pit, the spoil was excavated by a fluid-supported Herrenknecht micro-tunnelling machine (AVN).

The pipeline was laid out above ground on roller blocks, and pushed into the borehole during drilling. A pipe thruster delivers the required thrust force, pushing the micro-tunnelling machine and the pipeline in 5m steps forward, with a force of up to 750 tonnes.

TBM RECOVERY

In a world-first, the TBM was recovered from sea utilising a remote disconnect module. Divers were then dispatched to the TBM's location, attaching a lifting beam to the TBM itself. A crane, placed on a jack-up barge, then lifted the TBM out of the water, placing it on a multi-cat for return to Buckie harbour. This process was further complicated by the low depth of water in the area.

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