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2020 AWARD FOR SIGNIFICANT CONTRIBUTION TO SUBSEA PIPELINE PROJECT

Entry Form

Entry Deadline: Friday, 17th April 2020

1. **Brief title of entry:** **Bacton Combined Outfall**
2. **Company name:** **North Norfolk District Council, Van Oord UK, Royal HaskoningDHV, Shell UK Ltd and Perenco UK Ltd**

3. **Precis of your entry for inclusion in the Awards Lunch booklet (50 words):**

The North Norfolk coastline has undergone progressive coastal erosion which has put pressure on communities, infrastructure and business in the coastal zone. To provide long term protection to the Bacton gas terminal a coastline stabilization project was implemented which included the extension or replacement of existing outfall discharges beyond the sandscaping.

4. **Summary of entry:**

The North Norfolk coastline has undergone progressive coastal erosion, the cliffs are made of soft deposits, mainly sand and soft clays, which are very vulnerable. The Bacton Gas Terminal is situated on the North Norfolk coast with infrastructure near the cliff edge, within the cliff and under the beach. It is an item of nationally important critical infrastructure, supplying up to one third of the UK's gas demand from the North Sea extraction fields and from the continent. The Bacton Gas Terminal infrastructure includes three existing outfalls that currently discharge below the low tide level. Implementing the sand scaping project would have buried the existing outfalls under approximately 6-7m of sand as well as significantly extending the location of low water offshore. Therefore, the extension or replacement to facilitate discharging beyond the extent of the sandscaping, was incorporated into the project scope to maintain the existing outfall discharges for the remaining life of the terminal

The challenges that confronted the project team on this project were as follows:

- Working in proximity to existing infrastructure and eroding cliff
- Design and Install the diffuser protection dome in shallow water in the near shore.
- Design and Install interconnecting pipeline at the top of the beach including management of transient pressures and air
- Environmental constraints and public interface
- Restrictions on pipe stringing yard, storage and access to the working area.

The preferred option for the project was to combine all three existing outfalls into a single outfall discharging beyond the sandscaping. To overcome the first challenge, the connections to the existing outfalls and the alignment of the interconnecting pipeline were located such that they were outside the influence zone of the existing cliffs and gabion revetment. Excavation depths were also minimized where possible. The routing of the interconnecting pipeline posed specific challenges in its position and alignment as it had to cross multiple existing incoming gas pipelines, all at different depths, and the existing outfalls were also varying diameters, materials and depths.

The diffuser was located in the nearshore with high wave energy, this required additional weight and structural stability for the protection dome. This was achieved with a multi-section dome to keep within the marine plant lifting capabilities. Preparation of the outfall pipeline was undertaken in Great Yarmouth as there was insufficient working area available at Bacton. The pipe was then towed to site for installation using the float and flood technique.

The project team also ensured that wider socio-economic and environmental considerations played a full part throughout the design process. This concerned the potential for impacts on designated habitats, which informed decisions about the scheme footprint and outfall alignment, but also wider benefits. The interface with the public



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and local communities was also a critical activity during the scheme design and particularly during the construction phase. The installation of the combined outfall system was completed at the end of summer 2019. The successful completion of this project and the wider coastal protection works will allow stormwater and processed effluent to be safely discharged throughout the remaining design life of the Bacton gas terminal.

4. **Signed:**
5. **Date:** 17th April 2019
6. **Company contact name:** Martin Berry, Royal HaskoningDHV
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Email: martin.berry@rhdhv.com



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Detailed Description of Entry: Bacton Combined Outfall

The North Norfolk coastline has undergone progressive coastal erosion, the cliffs are made of soft deposits, mainly sand and soft clays, which are very vulnerable. The Bacton Gas Terminal is situated on the North Norfolk coast with infrastructure near the cliff edge, within the cliff and under the beach. It is an item of nationally important critical infrastructure, supplying up to one third of the UK's gas demand from the North Sea extraction fields and from the continent. The Bacton Gas Terminal infrastructure includes three existing outfalls that currently discharge below the low tide level. Implementing the sand scaping project would have buried the existing outfalls under approximately 6-7m of sand as well as significantly extending the location of low water offshore. Therefore, the extension or replacement to facilitate discharging beyond the extent of the sandscaping, was incorporated into the project scope to maintain the existing outfall discharges for the remaining life of the terminal

The challenges that confronted the project team on this project were as follows:

- Working in proximity to existing infrastructure and eroding cliff
- Design and Install the diffuser protection dome in shallow water in inter tidal zone.
- Design and Install interconnecting pipeline at the top of the beach including management of transient pressures and air
- Environmental constraints and public interface
- Restrictions on pipe stringing yard, storage and access to the working area.

The solution

The preferred option for the project was to combine all three existing outfalls into a single outfall discharging beyond the sandscaping. To overcome the first challenge, the connections to the existing outfalls and the alignment of the interconnecting pipeline were located such that they were outside the influence zone of the existing cliffs and gabion revetment. Excavation trench depths were minimized where possible especially where the connections to the existing outfalls were required. The routing of the interconnecting pipeline posed specific challenges in its position and alignment as it had to cross multiple existing incoming gas pipelines, all at different depths, and the existing outfalls were also varying diameters, materials and depths. Due to varying and intermittent nature of the outfall discharges, an assessment of transient conditions and air transportation was undertaken and additional ventilation for air release provided.

The diffuser was located in the intertidal zone with high wave energy, this required additional weight and structural stability for the protection dome. This was achieved with a multi-section dome to keep within the marine plant lifting capabilities. This sectional dome was also developed to minimize the quantity of diving time during installation. Preparation of the outfall pipeline was undertaken in Great Yarmouth as there was insufficient working area available at Bacton, Concrete weights were fixed to the a 350m pipe string prior to being towed to site for installation using the float and flood technique. Following completion of the outfall installation, connection to the existing outfalls and commissioning , the sandscaping commenced with nourishment of 1.8 million m³. of material in front of the gas terminal and spread out over approximately 3.5km in front of the Villages of Bacton and Walcott.

The project the team also ensured that wider socio-economic and environmental considerations played a full part throughout the design process. This concerned the potential for impacts on designated habitats, which informed decisions about the scheme footprint and outfall alignment, but also wider benefits. The interface with the public and local communities was also a critical activity during the scheme design and particularly during the construction phase. The installation of the combined outfall system was completed at the end of summer 2019. The successful completion of this project and the wider coastal protection works will allow stormwater and processed effluent to be safely discharged throughout the remaining design life of the Bacton gas terminal

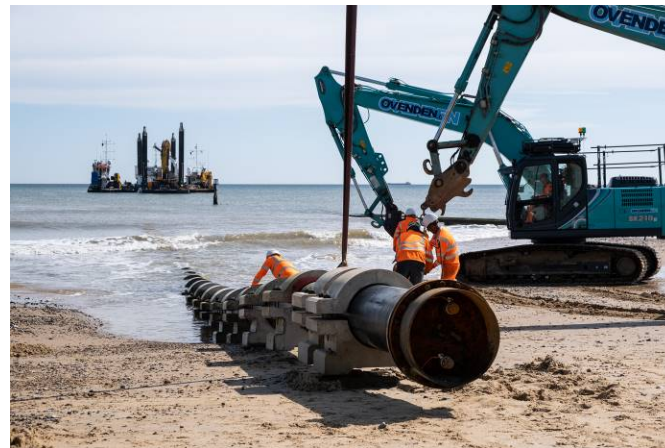


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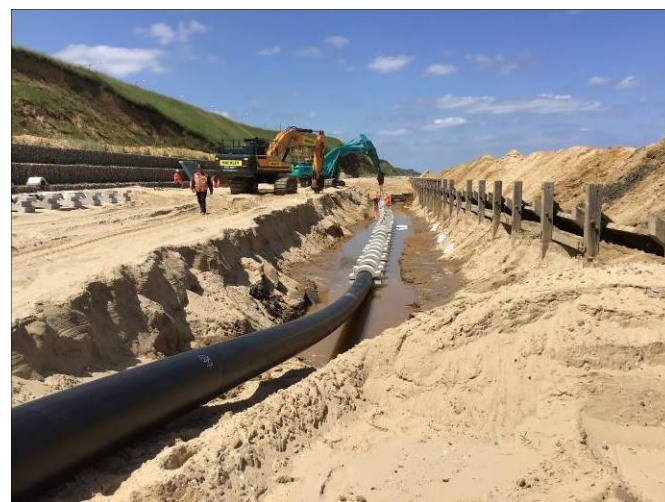
Supporting Information: Bacton Combined Outfall



Pipe preparation in Great Yarmouth



Outfall Pipe installation



Interconnecting Pipe Installation