Optimising Wellhead and Conductor design to overcome soft soil challenges in the Norwegian sector of the North Sea

Client:

North Sea Operator

Product:

Semi-Sub Conductor Analysis

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Overview

When our client was planning semi-sub drilling operations for a North Sea exploration well, they faced the challenge of ordering expensive wellhead and conductor equipment while managing very soft soil conditions. They required a solution that was both cost-effective and reliable, with the ability to minimise operational risks.

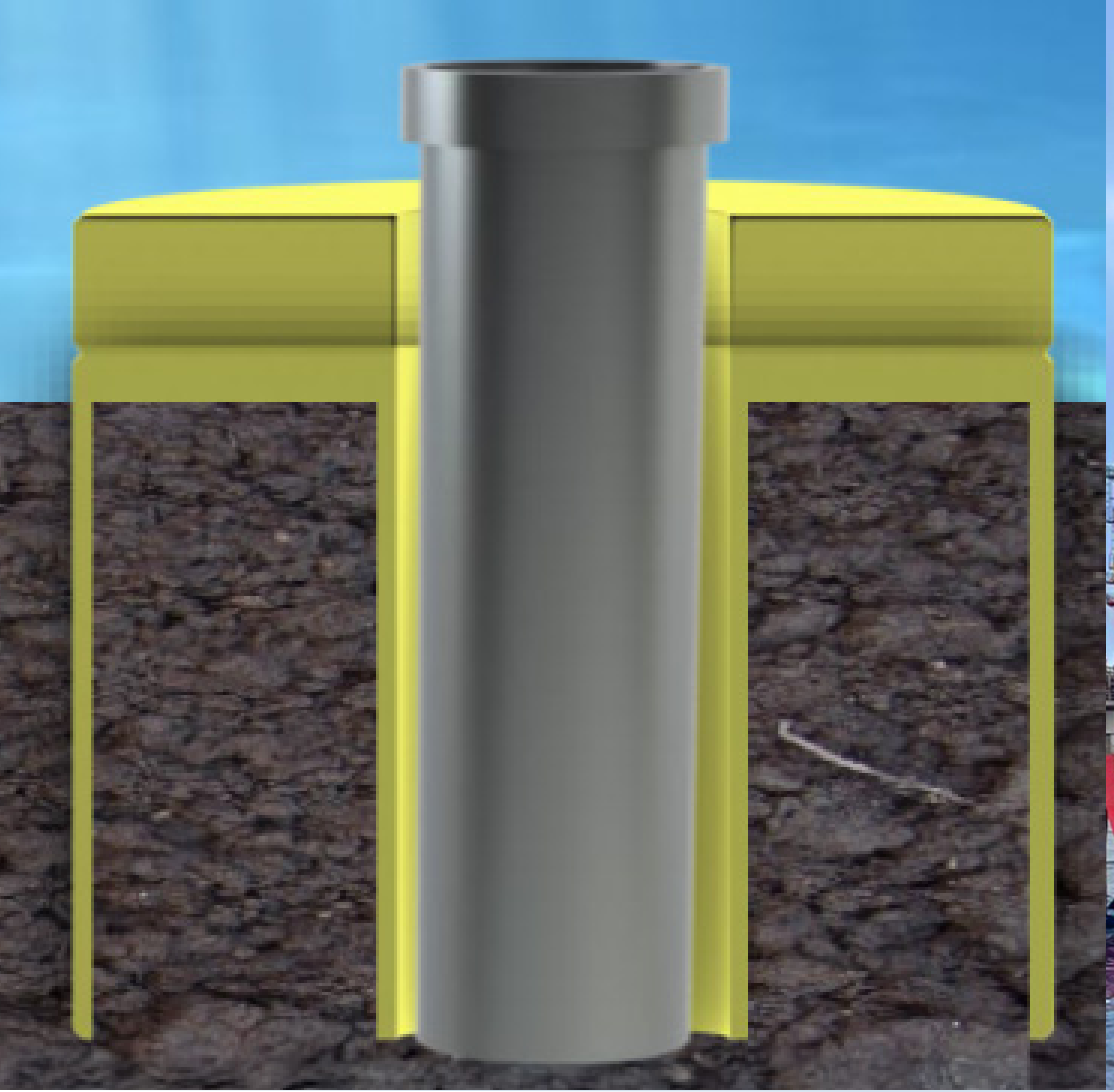
We conducted a detailed analysis to compare wellhead designs and optimise them for the specific conditions of the site. This analysis enabled the client to confidently procure the most suitable equipment at a fraction of the expected cost, avoiding costly delays. In addition, we provided a solution to mitigate the impact of the soft soil conditions, saving valuable rig time and significantly reducing operational risk.

Background

The client intended to drill an exploration well using a semi-submersible rig in a water depth of 1400 m in the Norwegian sector of the North Sea. We were tasked with resolving two key issues during the planning phase of the well.

The first issue was determining the optimal configuration among three proposed wellhead and conductor designs. Each design offered different operational benefits and cost implications. The client wanted to optimise the well design and deliver cost savings to the project.

The second issue involved very soft soil conditions at the well location. The client intended to jet the conductor to reduce rig time, but due to the soft soil, it would take a long time for the soil surrounding the conductor to consolidate. This delay meant the conductor wouldn’t be able to carry the weight of the subsea equipment and casings for several days, potentially causing significant rig downtime.



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Solution

To address the client's concerns, we conducted a comprehensive analysis to optimise the wellhead and conductor casing design for the specific soft soil conditions. Drawing on our extensive data library and making informed assumptions, including rig details (even before a rig had been contracted), we were able to complete the design promptly. This allowed the wellhead and conductor to be procured ahead of schedule, ensuring that drilling could proceed as planned. The analysis also confirmed the robustness of the design, significantly reducing the project's risk well before rig contracts were in place.

To mitigate the challenges presented by the soft soil, we recommended pre-installing a Conductor Anchor Node (CAN) to increase the axial capacity of the well. This adjustment ensured the conductor could be jetted with confidence, as our analysis confirmed that this operation would not compromise the CAN foundations.

Results

Involving us early in the design phase allowed the client to confidently select the optimal wellhead and conductor design, ensuring significant cost savings while maintaining performance standards. By confirming the design's robustness early on, we helped de-risk the project, enabling the procurement of essential equipment ahead of schedule and ensuring the well was drilled on time without delays.

We also addressed the challenge of soft soil conditions by recommending the pre-installation of a CAN to increase the well's axial capacity, which allowed the client to proceed with conductor jetting operations confidently. This solution reduced rig downtime, optimised efficiency, and ultimately helped the project stay on track.

Key outcomes include:

- **Cost Savings:** Delivered optimal wellhead and conductor equipment at a fraction of the expected cost.
- **De-risked Project:** Minimised procurement and operational risks through early confirmation of design robustness.
- **Enhanced Efficiency:** Mitigated soft soil conditions, saving valuable rig time and improving project efficiency.
- **Large Operating Envelope:** Enabled operations in more challenging environmental conditions, reducing downtime.
- **Timely Procurement:** Ensured early procurement of long-lead items, keeping the project on schedule.