Boskalis
Dredging & Marine Experts

PROJECT SHEET

BEACHFIELD UPSTREAM DEVELOPMENT
(BUD) PIPELINE PROJECT

BOSKALIS OFFSHORE: SKILLS, RESOURCES, EXPERIENCE

Boskalis Offshore brings together the offshore skills, resources and experience of Royal Boskalis Westminster. The group's offshore capabilities include seabed rectification works for pipeline/ cable and platform installation, construction of pipeline shore approaches and landfalls, offshore mineral mining, offshore supply and support services and decommissioning services.

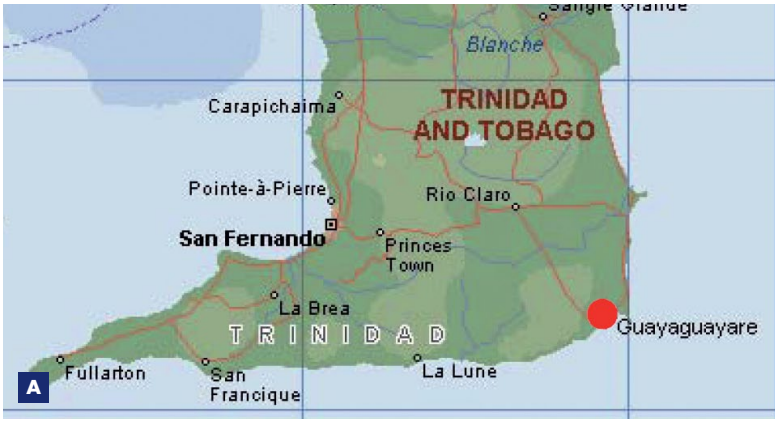
Boskalis provides clients with tailored, project-specific solutions for above dredge related offshore services, as illustrated by the following project summary.

BEACHFIELD UPSTREAM DEVELOPMENT (BUD) PIPELINE PROJECT

The BUD project entails the construction of a 66 kilometre, 36" gas pipeline, 63 kilometres offshore and 3 kilometres onshore underground to the treatment facilities. The offshore pipeline runs from the east coast at Beachfield (Rustville), Guayaguayare, to the "Cassia B" platform complex. At the NGC Abyssinia facilities, 3 kilometres off Beachfield, a new sludge catcher has been developed to separate the liquid or condensate from the natural gas. The condensate is separated from water and metered. The station is also designed to control the pressure of gas, as it enters into the land gas transmission system. NGC's existing 30" and 24" gas pipelines have also been diverted to the new Abyssinia sludge catcher.

FEATURES

Client	National Gas Company of Trinidad and Tobago Limited (NGC)
Location	Guayaguayare, Galeota Point, Trinidad & Tobago
Period	August 2004 - April 2005
Main contractor	Stolt Offshore Services Inc.
Contractor	Boskalis Westminster Overseas / Boskalis Offshore



A Location map
B PGrab dredger "Packman"
C Site overview

Main Contractor Stolt Offshore Services, responsible for the installation of the 63 kilometres 36" offshore gas pipeline, contracted Boskalis for the associated landfall services, consisting of dredging the shore approach trench, preparation of the landfall site, pipeline pull-in services and, upon pipeline installation, backfilling of the trench.

The preparation of the landfall site, including all concrete, construction and piling works were executed with local contractors, to ensure a maximum local content level.

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SHORE APPROACH AT BEACHFIELD

The total length of the trench to be dredged was 8 kilometres, of which 2.45 kilometres also had to be backfilled later on. In the remaining part of the trench the pipeline would be covered by natural backfill.
From Kp 0.0 to Kp 0.200 the required cover of the pipeline was 3 metres, average trench depth 4.5 metres. From Kp 0.200 to Kp 0.400 the trench depth was reduced to 1.5 metres, from where the top of pipe was flushed with the seabed. The soil conditions varied from very soft sandy clay to very stiff clay, which was partly covered with a 1.5 metres thick layer of coral.

The dredging operations were carried out under the harsh conditions of the continuous easterly Atlantic Ocean swell. Trailing suction hopper dredger "Barent Zanen" completed the offshore section from Kp 2.450 to Kp 8.000. The dredged materials were deposited at a designated dumping and borrow area. The near shore trench, with a length of 2.45 kilometres, was dredged by backhoe dredger "Cornelius" and grab dredger "WD Dredgewell". The dredged materials were site cast for later use as backfill materials. Prior to the installation of the pull cables the grab dredger "Packman" cleaned the trench from siltation.

The beach section of the trench was dredged by land based equipment, operated from a rock groin (causeway), which extended 85 metres into the sea. The dredged materials were temporarily stockpiled on shore. Apart from a stable platform for the land based equipment, the causeway offered a protection for the open cut in the beach and for undesired siltation as well.

LANDFALL AT BEACHFIELD

At the landfall site a stable concrete base was constructed to accommodate the two linear winches, with a pull capacity of 300 metric tons each, and the reel winders. The winches and reel winders were anchored to a 10 metres wide wall of sheet piles.

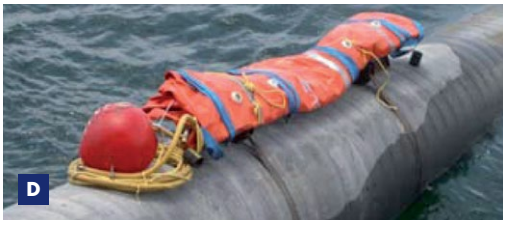
PIPE PULL

Upon installation of the linear winches and completion of final trench maintenance, the pull wires were laid, first using a messenger wire between the wire lay barge and the winches. The wire lay barge was equipped with an eight point mooring system, enabling the barge to install the pull wire accurately in the centre of the trench. With an existing 48" live gas pipeline at a distance of 100 metres on the south side, the multicat "BKM 101", equipped with various positioning systems, handled the barge's anchors accurately and safely.

After connecting the pull wire to the pull head, the pipeline was pulled ashore from Stolt Offshore's lay barge "DLB 801". After approximately 52 hours the pull head of the 1,200 metres long landfall pipeline section reached the final destination.

BACKFILL

Upon completion of the pipe pull, the near shore trench was backfilled by grab dredger "Packman" and the beach section by the land based equipment to the required levels and original state, using the stockpiled materials.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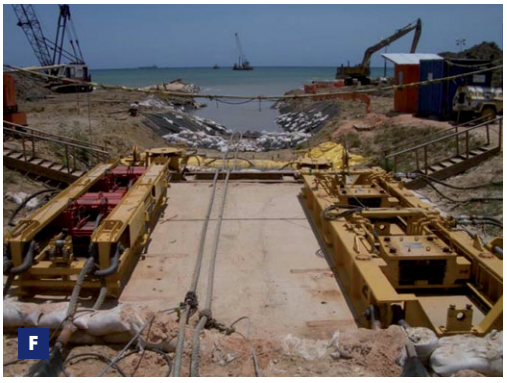
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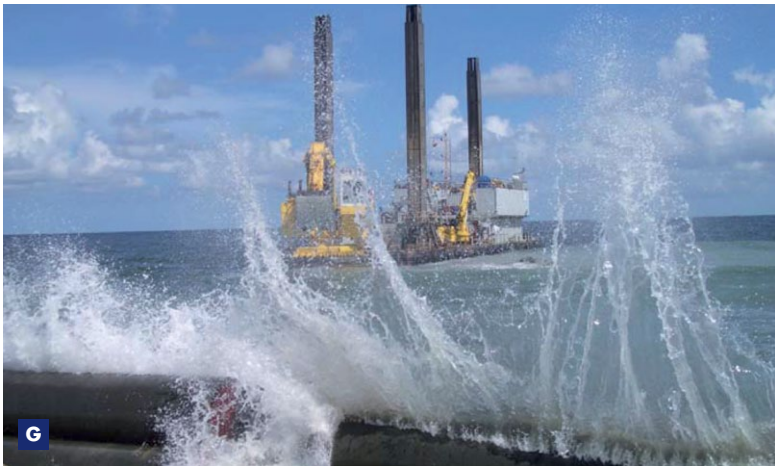
G

D Buoyancy bag arrangement
E Pipe pull completed
F Pull wires and winch
G Backhoe dredger "Cornelius" trench dredging

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