

PROJECT SHEET

ICHTHYS LNG PROJECT – GAS EXPORT PIPELINE
SHORE APPROACH, DREDGING, PIPE-PULL AND ROCK INSTALLATION WORKS

INTRODUCTION

Owner INPEX Operations Australia Pty Ltd is developing LNG process facilities on Blaydin Point near Darwin, Northern Territory of Australia.

Boskalis' scope of work for this project included:

DESIGN AND ENGINEERING

Boskalis was responsible for the design of the trench slope based on the seabed and geophysical data available in each section.

SHORE APPROACH CONSTRUCTION

The shore approach construction consisted of 2,000 linear meters of intertidal dredging, 500 m of mangrove crossing by means of a cofferdam and 500 m of open trench through a mudflat. Following completion of the dredging activities, a shore pull of 3,000 linear meters using a 600 t linear winch was undertaken.

Boskalis Subsea Services executed the removal of the buoyancy modules from the pipeline.

The shore approach works consisted of the following:

- Setup of on shore site, including temporary access roads, lay down areas and office accommodation
- Design, fabrication and installation of rollers inside the trench
- Provision and installation of a 600 t socket passing linear winch
- Provision and installation of a 3,300 m long pulling wire
- Removal of 20x buoyancy modules from the pipeline
- Rock installation and backfilling
- Site reinstatement and rehabilitation

The shore approach works commenced in February 2014 and were completed in October 2014.

FEATURES

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| Client | Saipem Portugal Comercio Maritimo Sociedade Unipessoal, Lda |
| Location | Darwin, Northern Territory, Australia |
| Period | 2012 - 2015 |
| Subcontractor | Boskalis Australia Pty Limited |



A Shore approach during construction
B SSDV Ndeavor

PRE-LAY DREDGING

The pre-lay dredging works consisted of the following activities:

- Shore crossing and near-shore dredging
- Onshore dredge disposal
- Near-shore dredge disposal
- Stockpiling, disposal and treatment of acid sulphate soils
- Plume monitoring

The dredging works required the excavation of a 15 km long and 5 m wide trench from -24 m LAT to the onshore tie-in point at +8 m LAT.

The dredging works commenced in October 2013 and were completed in June 2014 during which time some 381,000 m³ of material was removed. The offshore dredging work was undertaken with two backhoe dredgers (BHDs) and a trailing suction hopper dredger (TSHD). The onshore works were executed using dry equipment.



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The majority of the material was deposited at a material relocation area at sea while around 28,000 m³ was used to backfill the onshore trench. The material consisted of gravel, sand, silt or stiff clay with underlying rock material.

The TSHD Queen of the Netherlands initially removed the sediments and undertook some direct dredging of the underlying rock material, but the majority of the underlying material was removed by the BHD Baldur.

ROCK SUPPLY AND INSTALLATION

The rock supply & installation works included the following activities:

- Quarrying / procurement of rocks of specified grade
- Transportation of rocks to Darwin Harbour temporary stockpile area
- Load out of rocks onto offshore marine vessels
- Rock installation

The required rock was quarried approximately 100 km from Darwin and transported by Boskalis to the temporary stockpile areas. A total of 1,479,503 km were driven by a fleet of road trains. Rock quarrying and supply to the temporary stockpile areas commenced in July 2013 and was completed in October 2014. Rock load-out and installation of approximately 680,000 tons of rock was executed between November 2014 and February 2015.

The rock was re-handled by dry equipment and loaded onto the multi-purpose vessel Ndeavor, which was equipped with side stone dumping units, and undertook the rock placement using dynamic positioning to allow for precise placement of the material.

SURVEY AND POSITIONING

Boskalis was responsible for all survey and positioning services required for the onshore and

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offshore scope of work, including pre and post dredging surveys, shore pull wire as-laid survey, as laid pipeline surveys, as installed backfill and rock installation surveys and land site reinstatement surveys.

ENVIRONMENT

In close cooperation with in-house Engineering agency Hydronomic, Boskalis prepared the Dredging and Spoil Disposal Management Plan (DSDMP). This was a regulatory requirement to be approved before operations could commence. The DSDMP related to the management and monitoring for the nearshore trench dredging and offshore pre-sweeping program as well as to the disposal of the dredged material.

Site rehabilitation activities were undertaken post construction works at the shore approach area and centred around the successful reinstatement of cleared mangroves to revegetate the site with the same species that were present prior to construction. Approximately 12,000 seedlings of three different species were under nursery cultivation in preparation for planting out during the rehabilitation works.

HEALTH, SAFETY AND SECURITY

Mobilising an experienced team familiar with working in Australia enabled the project to create a positive safety culture. This served the project well during the complexities of working in a dynamic environment.

With effective planning and commitment to safe production Boskalis successfully achieved the following:

- INPEX awarded Boskalis with several 'Health and Safety Awards'
- More than 552,000 man hours were completed without a lost time injury
- Boskalis undertook more than 11,121 marine transfers of personnel and all of them were undertaken without incident



C BHD Baldur
D View from the pipe-pull winch
E TSHD Queen of the Netherlands

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