Boskalis
Dredging & Marine Experts

PROJECT SHEET

PLUTO LNG PROJECT, AUSTRALIA
NORTHERN CARNARVON BASIN, WESTERN AUSTRALIA

INTRODUCTION

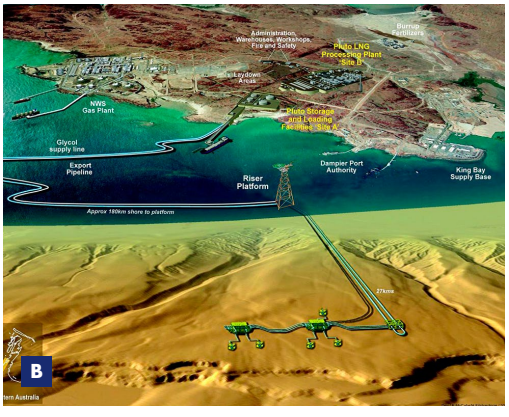
The Pluto LNG project is located about 190 km northwest of the coastal town Karratha, in the Northern Carnarvon Basin, Western Australia. The project is a joint venture between Woodside Burrup Pty. Ltd., the operator, with a 90% interest, and Tokyo Gas (5%) and Kansai Electric (5%). The A$12 bn project will process gas from the Pluto and neighboring Xena gasfields.

Pluto gas is said to be naturally low in carbon dioxide and the Pluto gasfield is exceptionally rich and estimated to contain a total dry gas recoverable reserve volume of 4.4 trillion cubic feet (tcf). To successfully exploit this gasfield, a new LNG terminal is being constructed adjacent to the existing terminal. In order to facilitate unrestricted access to this new LNG terminal, a channel, turning basin and berth pocket designed to allow access for 217,000 m^3 LNG tankers, unconstrained by tides, was required.

PROJECT SPECIFICATIONS

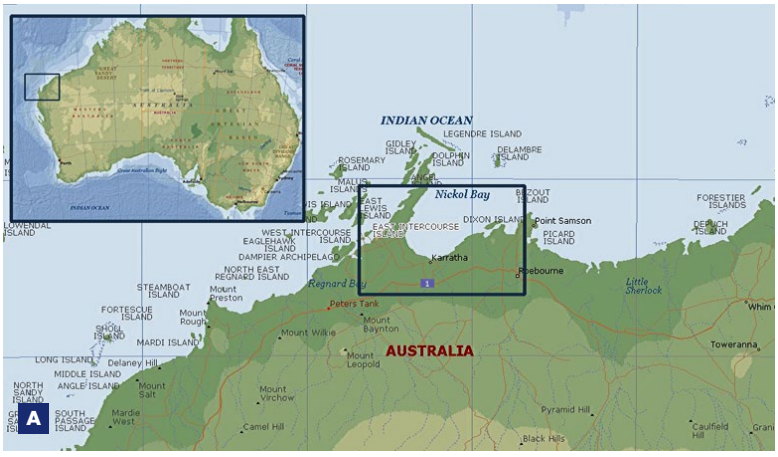
The project was executed in two phases: First the berth pocket, part of the turning basin and two trenches were excavated to allow the construction of the new LNG jetty; then part of the turning basin and two trenches, which traverse the existing NWSV LNG shipping channel, were dredged. Dredging the two trenches early in the program was required since shipping in the NWSV LNG channel was scheduled to increase in the near future, decreasing the time available for dredging. Work took place from late November 2007 through early May 2008 with the removal of 2,100,000 m^3 .

In the second phase, from September 1, 2009 through July 2010, the remainder of the turning basin and the shipping channel were dredged and 5,600,000 m^3 were removed.



FEATURES

Client	Woodside Burrup Pty. Ltd.
Location	Dampier, North West Australia
Period	September 2007 - July 2010
Contractor	Boskalis Australia Pty. Ltd



A Location map
B Artist's impression of the Pluto LNG project
C Aerial view of the project in progress

CHALLENGES FROM WEATHER AND DREDGED MATERIAL

Weather is a vital consideration in northwestern Australia. The area is prone to cyclones and since the dredging activities were year-round, precautions were put in place for the cyclone season from November through April. Luckily, the seasons were relatively calm; on only a few occasions did ships need to seek shelter for cyclone warnings, but no direct hits were encountered.

The trenches had to be dredged through the existing operational LNG channel, where ship movements are frequent. Work had to be scheduled around these ship movements, following strict communication protocols and

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verifying at all times that dredging operations did not compromise the draft. Both the TSHD Cornelis Zanen and the CSD Phoenix, had to work in the available windows between the passage of these LNG tankers. Prior to each vessel's movement, the channel had to be cleared and surveyed. The mega-TSHD Queen of the Netherlands was working in other shallow areas where tidal levels started at only –8 metre in some spots and ended with the final channel being –12.5 m.

Because of the size of the Queen, tidal restrictions were always considered and the tide was used to ensure optimal dredging. Three different types of dredged material demanded the use of three different excavation methods.

Soft overburden was removed by trailer. Harder underlying sediment was removed with specialized ripper dragheads. And at the lowest level, hard calcarenite was pre-treated by having it crushed by two very large cutter suction dredgers, one of which was the Phoenix. The crushed calcarenite was then relocated by trailer. In the first phase, TSHD Cornelis Zanen removed the overburden and transported crushed calcarenite. In the second phase, the Queen removed the overburden and both the Queen and Cornelis Zanen relocated the crushed materials.

ENVIRONMENT

Australian environmental regulations are among the strictest in the world. Therefore, all materials were disposed of responsibly in designated disposal grounds offshore. Given that the project is located close to a sensitive marine park, extra environmental precautions were mounted to ensure that all requirements would be met.
Furthermore, Woodside Burrup Pty. Ltd. is investing some A$100m in a program to offset reservoir emissions from the Pluto field. The program includes extensive marine monitoring to minimize the impact on marine life resulting from dredging activities. Boskalis played an active role in ensuring full compliance with environmental demands, which contributed to a very positive outcome.

SAFETY

During the first phase of the Pluto project, Boskalis was intensively evaluating the level of safety awareness during all its dredging projects. The collected research revealed that there was room for improvement. Recommendations from the research were immediately implemented during the second phase of the Pluto project. The underlying principle became: "Safety is not a set of rules to be enforced from the outside, but an intrinsic value individuals must feel from the inside".

The advantages of this heightened safety awareness were immediately obvious. Operations started with a 4-day safety workshop attended by all operational staff, during which expectations were made clear. The results: An excellent operational performance was combined with an impressive safety performance. As of October 2010, the job is completed and Pluto is set to become the world's fastest-developed LNG project to date, from the discovery of the field in 2005 to the production of first LNG expected in early 2011, contingent on a productive industrial relations environment.

D CSD Phoenix, one of the two CSD's that were deployed for crushing the hard calcarenite.
E Work had to be scheduled around the movements of vessels, following strict communication protocols and verifying at all times that dredging operations did not compromise the draft. CSD Phoenix at work
F TSHD's Cornelis Zanen and Queen of the Netherlands relocated the crushed materials.

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