

PROJECT SHEET

NORTH MANAMA CAUSEWAY PHASE 2 AND BUSAITEEN LINK, PACKAGES 1 AND 2, BUSAITEEN, KINGDOM OF BAHRAIN
GENERAL FILLING, RECLAMATION, DREDGING AND MARINE WORKS

BOSKALIS

Boskalis is a leading global marine contractor and services provider. With safety as our core value, we offer a wide variety of specialist activities to the oil & gas and renewables sectors. These activities include marine installation and decommissioning, seabed intervention, marine transport and services, subsea services and marine survey. In addition, Boskalis is a global dredging contractor, provides towage and terminal services across the globe and delivers marine salvage solutions.

By understanding what drives our clients we are able to provide the solutions that enable them to meet their specific business goals. For this reason we are constantly looking for new ways to broaden and optimize our offering and are committed to expanding our proposition, supported by our financial strength. With our committed professionals in engineering, project management and operations, 600 specialized vessels and an unprecedented breadth of activities in 90 countries across six continents we help our clients push boundaries and create new horizons.

INTRODUCTION

The Government of Bahrain as represented by the Ministry of Works, Municipalities Affairs and Urban Planning (MOWMAUP) intends to augment the existing road network by developing new road corridors to support the rapidly expanding economy of the Kingdom. The proposed corridors include (amongst others) the North Manama Causeway Phase-2 (NMC-2) and Busaiteen Link (that comprises of the 4th Crossing for Muharraq Governorate and

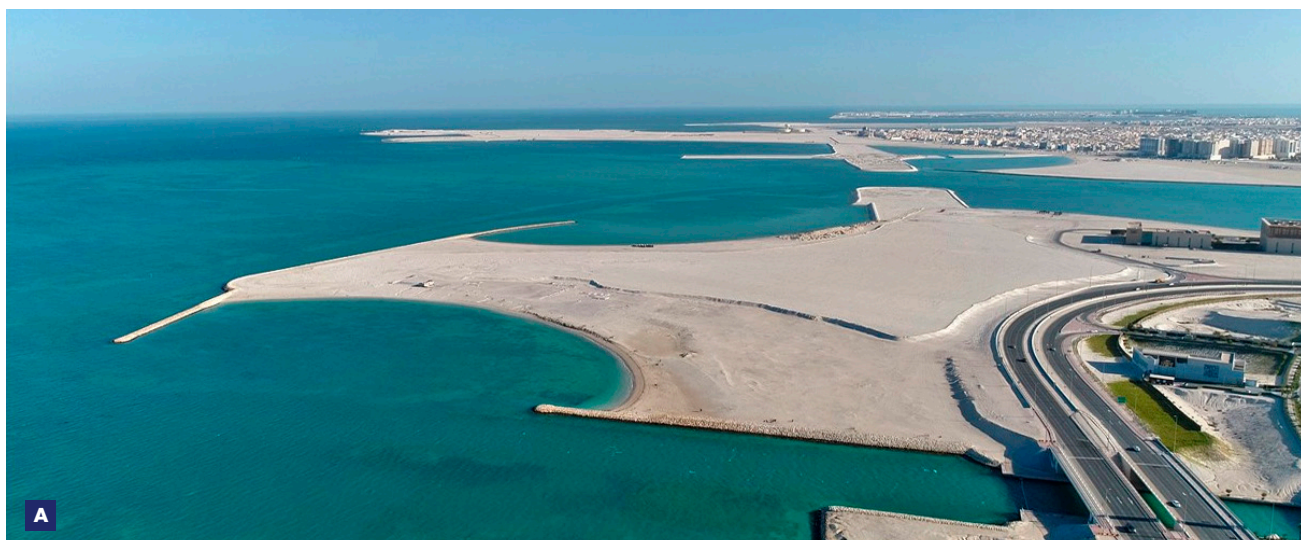
FEATURES

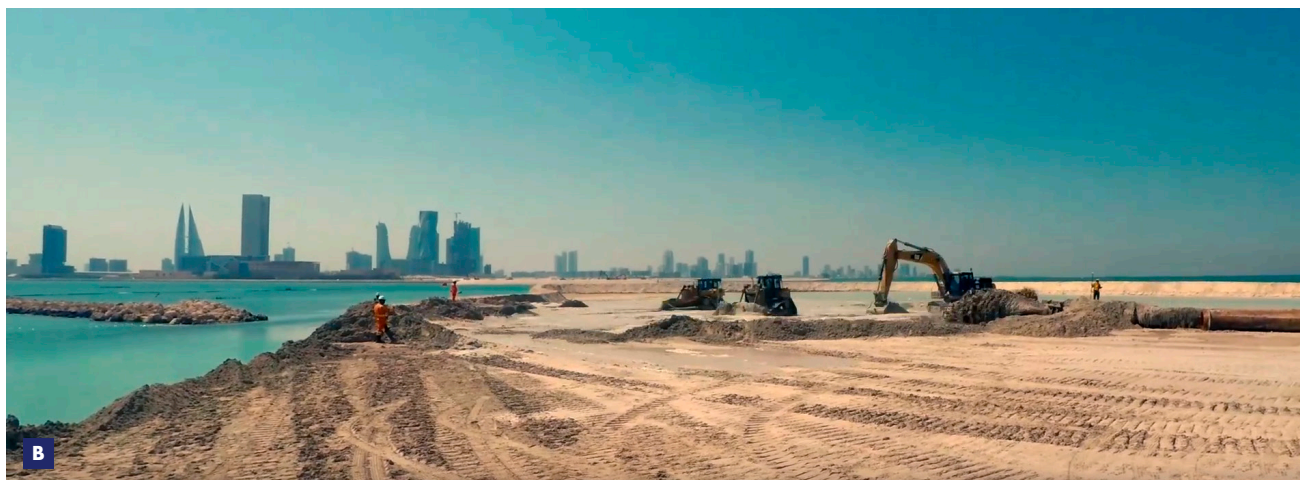
Client	Ministry of Works, Municipalities Affairs and Urban Planning
Location	Busaiteen and Al Saya District, Kingdom of Bahrain
Period	December 2018 - March 2021
Contractor	Boskalis Westminster Al-Rushaid Boskalis Westminster Contracting JV
Type of contract	Lumpsum contract

Muharraq Ring Road Phase-2) The project is planned as part of the national plan 'Bahrain 2030' and is labelled by the client as one of its 'Strategic Projects'. The Scope of Work for Package 1 and 2 entailed the filling, reclamation, rock revetment edge protection works and diversion of existing outfalls for a section of Muharraq Ring Road Phase-2, the Busaiteen Link Road and Associated Roads from Muharraq North Shore to Bahrain Bay.

MAIN ELEMENTS OF THE PROJECT

- Mobilization of the Trailer Suction Hopper Dredgers (TSHD) Coastway and Causeway
- Dredging and reclamation works (pumping ashore) with the TSHD's
- Removal of material classified as unsuitable within the projected road corridor
- Supply and installation of rock revetment protection works
- Installation of a pipeline bridge across highway 'Road 3469'





MAIN PROJECT QUANTITIES

	Package 1	Package 2
Dredging	1.8 million m ³	8 million m ³
Rock revetment	41k m ³	235k m ³
Geotextile	54k m ²	165k m ²

DREDGING

Based on extensive local knowledge of previous projects in the area and the available sand resources, Boskalis was able to define an optimized reclamation solution in terms of time and cost for Package 1 by direct hydraulic filling of the areas thus avoiding stockpiling, rehandling and re-allocation of material by dry earth movement equipment. This solution was only possible by using its knowledge of the characteristics of the sand in the borrow areas in combination with the selected dredging TSHD Coastway which is equipped with extra pumping power. A similar approach was used for Package 2 works whereby an extra TSHD was mobilized to guarantee an acceptable duration for the project towards the Client. The challenging hydraulic solution with large pumping distances (over 4,300 m) for this phase was properly engineered by a strong project team in order to overcome the distance and guarantee a good quality of the reclaimed land.

ROCK REVETMENT

The engineering of the revetment works was performed in-house and installation was supervised by our rock specialist. The supply and installation of the rock revetment was subcontracted to a renowned local contractor with a long track record of rock installation. The required rock for the project was obtained from the National Quarry of Askar. Due to its nearly depleted status only ministerial related projects are allowed to source material from Askar; for all other projects in the Kingdom of Bahrain rock material outside of the Kingdom needs to be sourced.

SAFETY, HEALTH, ENVIRONMENT AND QUALITY

Safety, Health, Environment and Quality is paramount for Boskalis. During the execution of both packages (combined) a major safety accomplishment was achieved: 1,000,000 manhours without a LTI (Lost Time Injury). This significant accomplishment could only be reached by promoting a 'free to speak' atmosphere on the project whereby safety matters were addressed and all parties were involved and participated (client, main contractor and subcontractors). To stimulate this, an incentive program was launched during which on monthly basis the best idea, initiative or exceptional behavior was being awarded with a price.

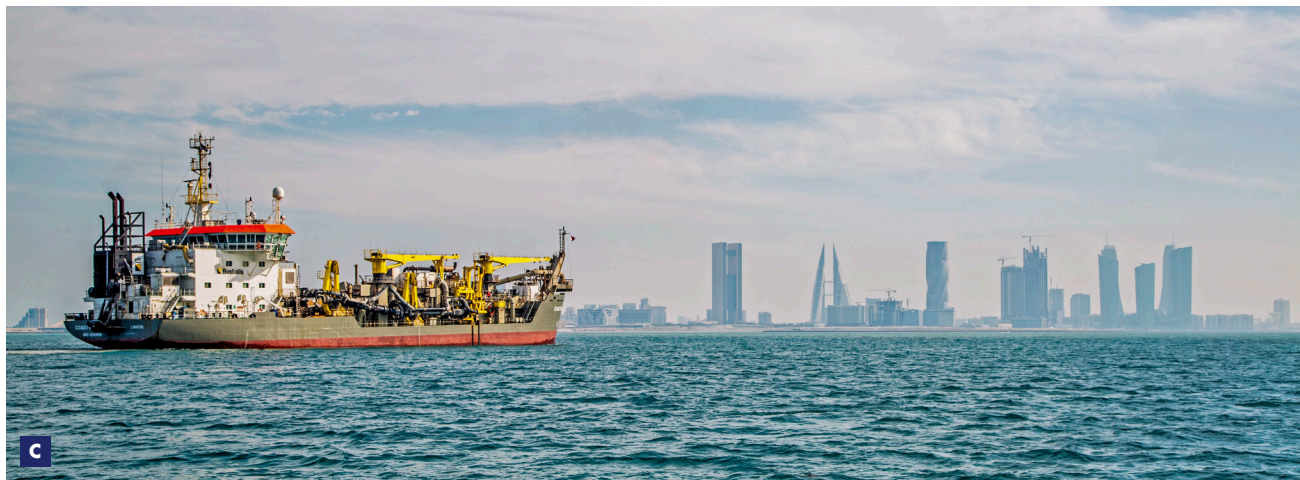
One important factor contributing to the overall safety performance on the project was the proper implementation of Lessons Learned from Package 1. We learned that standard 'tipper' trucks on unstable soil could lead to incidents and decided to replace those, with the help of our subcontractor, by heavy Articulated Dump Trucks which were temporarily mobilized from outside the Kingdom.

Proper attention was given to the 'Heat' challenge during the summer months. During these months, no exposed physical working activities between 12.00 and 16:00 hours were performed. Boskalis' 'Beat the Heat' program was successfully rolled out during the execution of both packages.

ENVIRONMENTAL PROTECTION MEASURES

In consultation with the Bahrain authorities, various precautions to prevent turbidity, including the use of silt screens and the construction of temporary perimeter bunds to safeguard the quality of the water during the reclamation work, were implemented. An extensive turbidity monitoring protocol (both in the borrow area as well the reclamation) is an important condition to obtain the required environmental approval prior to start of the works. The monitoring is overseen by an independent environmental consultant who reports to the authority in case of a significant exceedance.

- A Aerial view of the project
- B Overview of the reclamation area



**COMMUNITY SUPPORT AND
STAKEHOLDER MANAGEMENT**

During the execution of Package 1 and 2, the project organization embraced and supported the goals of a local organization that uses the proceeds from collected plastic waste to purchase special customized wheelchairs for the local community with disabilities by collecting all plastic waste on the project.

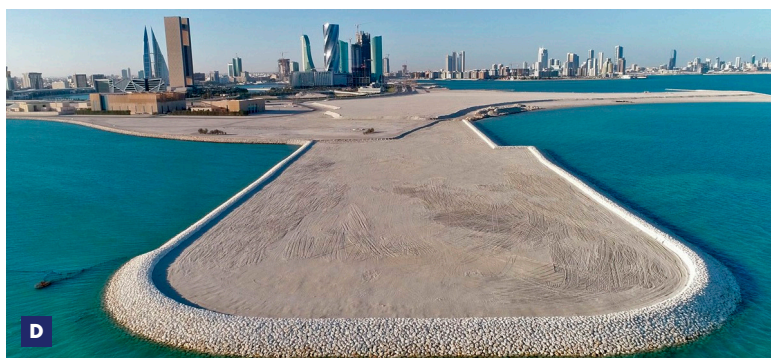
Another notable initiative was the realization of a public garden at Al Dair village as a gesture to the people living in the vicinity of our project. The actual construction work was awarded to a local landscaping company. His Excellency, the Minister of Works presided at a ceremony to launch the project.

In a third initiative, the project organization assisted local fishermen with new anchorages for their boats. The building work on the project overlapped with the area where the fishermen launched their boats and some of them had to move when the work was being done. The fishermen were moved to new anchorages and were provided with anchor blocks to moor their boats.

EQUIPMENT DEPLOYED ON THE PROJECT

Trailing suction hopper dredgers Coastway and Causeway.

Due to the challenging local circumstances in the Kingdom (shallow borrow area, local presence of caprock layers and large pumping distances to the reclamation), the utilization of both the Coastway and the Causeway on the project proved to be a sound strategic decision.



C TSHD Coastway
D Rock Revetment