Boskalis
Dredging & Marine Experts

PROJECT SHEET

URK DREDGING METHOD
DEALT WITH CONTAMINANTS WITH A HIGH DEBRIS CONTENT

GENERAL INFORMATION

Many port areas requiring dredging works have been forced to put projects on hold due to the absence of an environmentally safe solution for the disposal or processing of contaminated sediments. While this is a global problem, the availability of central, large-scale repositories in the Netherlands has transformed disposal economics at the national level. Nevertheless, the high level of debris encountered during the dredging of ports and harbors remains a major challenge to all contractors. The hydraulic transport of sediments with a high debris content is impossible.

Boskalis, however, has developed a hybrid dredging system combining precision dredging of contaminated soils with a robust, integrated system to sieve out debris. After sieving, sediments can be hydraulically transported, in the conventional way, to a processing plant or settlement lagoons. Sand separation then takes place, prior to disposal to repositories such as Ketelmeer, one of the country's largest "Confined Disposal Facilities" (CDFs).

URK DEEPENING

Urk is a small fishing port and industrial harbor on the IJsselmeer. It was once an island, but was incorporated within the boundaries of a new polder constructed just before the Second World War. Industrial activities have declined, but it remains a busy fishing port and is very popular with yachts and small craft.

The harbor was extended during the 1970s, but maintenance dredging was deferred due to high levels of contamination and the lack of an economically feasible option to dispose of the contaminated sediments. This situation changed three years ago, when the IJsseloog facility, located in the Ketelmeer, became operational. After engineering and the issue of permits, a tender procedure resulted in the award of a contract in October 2002 to a joint venture in which Boskalis was responsible for dredging and disposal. Work began at the end of that year and was completed in July 2003.

Urk involved the dredging of materials with both Class 3 and Class 4 contaminants (as designated under Dutch standards). These contaminants include oil, PCBs and heavy metals. Such dredged material must be received by an isolated landfill or repository. In the case of Urk, contaminated soils were dredged mechanically, transported by barge, sieved of debris and pumped to sedimentation basins, to remove most of the sand fraction from the dredged sediments. The sand content in the sediment was around 60 per cent by weight.

Contaminated sediments were then deposited at the Ketelmeer CDF, with a capacity of 20 million m^3. Typical costs for disposal of contaminated materials with a low sand content at Ketelmeer are now in the region of €10 per cubic meter. This is just ten per cent of the cost of disposal to a conventional, isolated landfill.

The volume of debris in contaminated material from harbors is often under-estimated. Urk is rather an extreme example, but the statistics are illuminating. The Urk material was known to contain a high concentration of debris, so an allowance of 1,000 tonnes was made for a projected dredged volume of 70,000 m^3. In the event, Boskalis' project team dredged 67,000 m^3 and recovered 8,100 tonnes of metal and other debris.

The remediation dredging concerned a number of basins in the commercial port, the marina and areas in the vicinity of three shipyards. Suction dredging was ruled out due to the high density of debris. Mechanical dredging was the preferred solution, the backhoes being equipped with specially designed

FEATURES

Client	Municipality of Urk, with engineering supervision provided by the Ministry of Transport, Public Works and Water Management.
Location	Urk, The Netherlands
Period	End 2002 – July 2003

A Location map

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buckets for remediation works. Class 4 sediments were dredged by the long-reach hydraulic excavator dredge Kreeft (Lobster). Kreeft was equipped with the Boskalis Horizontal Profiling Grab (HPG). This HPG had a 3.0 m^3 bucket with a 9 sq m footprint. It has horizontally closing twin lids, for effective removal to grade.

Kreeft was also equipped with the Boskalis developed Crane Monitoring System (CMS). This was linked to an RTK-DGPS system. This combination provided accurate positioning and real time profiling (+ 5 cm in vertical plane and + 20 cm in horizontal plane). Required and actual bottom levels are displayed. Bottom levels are updated automatically during the dredging process. This system paid dividends in many ways, including a problem-free return to work following moves off-location, to allow port traffic to proceed without disruption. Several moves in a day were commonplace but downtime was minimized thanks to the CMS system.

The HPG is designed for the excavation of thin layers with high accuracy and minimal spill and turbidity. The bucket produces a level cut, rather than the conventional clamshell bucket's semi-circular or arched cut. The maximum opening of 4.5 m is around 80 per cent longer than the normal hydraulic grab, allowing optimal fill to be reached even when operating in thin layers.

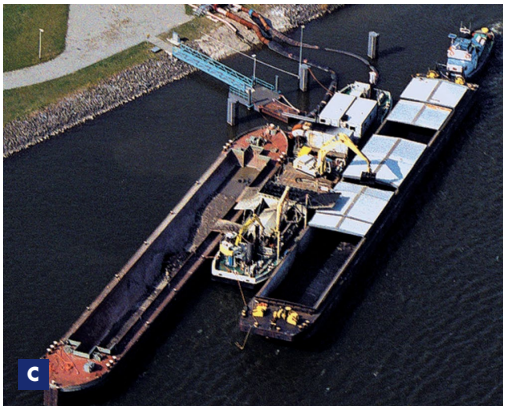
Class 3 sediments were dredged by the backhoe dredge Texel. It was equipped with a 2.5 m^3 bucket with a closing lid, to minimize turbidity. This dredge was also supported by a CMS for precision dredging.

The operational cycle consisted of several phases: dredging and loading the 750 m3 hopper barges; transport to Ketelmeer, some 18 km distant; unloading and debris sieving; hydraulic transport to settling basins, for sand separation; and placement in the CDF by means of a diffuser.

Barge unloading was tackled by the Boskalis DBV10, the in-house developed unloader barge for the handling of contaminated sediments containing debris. The system consists of an excavator equipped with a hydraulically closing watertight grab, to minimize leakage. Debris was removed by a 6 m by 2 m diameter rotating wash sieve drum. Sediments were washed out and pumped by pipeline transport to the sedimentation basins. The process water was recycled to minimize water content. Washed debris was discharged out of the drum, for onward transport to a landfill. With sand separated out in sedimentation basins, the contaminated material was disposed of to the CDF. The DBV 10 provided a platform for the unloading excavator, sieve drum, sediment slurry pump and jet pumps.

Urk repeated the high levels of accuracy achieved in remediation dredging at Ketelmeer's eastern sector during the 2000-03 period. Boskalis met project depth accuracy parameters specifying + 10 cm on survey recordings over a square meter and no higher than 25 mm and no deeper than 35 mm of desired profile over 5,000 sq m.

The execution of this project would have been impossible to achieve by conventional dredging methods. The availability of Ketelmeer had a profound effect on project economics. This factor, together with the new generation positioning and profiling systems, has greatly improved the outlook. Boskalis now offers highly accurate remediation dredging, with low turbidity and minimal disturbance of non-contaminated layers, followed by cost-effective disposal. The effective handling of debris was successfully demonstrated at Urk, by means of integrated separation and washing.



B Port of Urk with the excavator Kreeft at work
C Disposal at the IJsseloog by the DBV10 in-house developed barge for handling contaminants containing debris
D The long-reach hydraulic excavator Kreeft equipped with the Horizontal Profiling Grab and the Crane Monitoring System
E Aerial view of the confined disposal facility "IJsseloog" in the Ketelmeer

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