

# Pioneering Boskalis water quality adaptive monitoring in Southampton

Although Dutch company Boskalis Westminster has been working in the UK for around 80 years, its pioneering water quality Adaptive Monitoring technique had not been deployed until recently in British waters, when the company embarked on a project on behalf of Associated British Ports (ABP).

ABP, which operates 21 ports in the UK, awarded a contract to Boskalis for dredging parts of Southampton Water in a bid to significantly increase the draught for large containerhips visiting the DPWS Southampton Container Terminal. An important part of the tender procedure was that any contractor should be able to comply with ABP's water quality Adaptive Management Strategy (AMS), which was developed together with the Environment Agency (EA).

According to Dr Adrian Fewings, Environment Agency Fisheries' Technical Specialist, the adaptive monitoring strategy was needed to protect the population of Atlantic salmon to ensure compliance with the Shellfish Waters Directive and to ensure no deterioration of the water body under the Water Framework Directive (WFD).

Sue Simmonite, development and environment manager at ABP explains: "When ABP took the decision to proceed with the capital dredging project, it was vitally important that we implemented measures to protect water quality for a range of species, including the protected Atlantic Salmon migrating to and from the Rivers Test and Itchen, in line with the EA's requirements to maintain high quality water standards."

## In-house system

Simmonite explains: "We felt that the most effective way to ensure the water quality was to give the contractor the responsibility for monitoring it. Boskalis had its own in-house, proven system and this gave us

a lot of confidence that it had the ability to operate effectively and maintain the required quality levels. This system has been used by Boskalis before, so we knew the company was familiar with it and that was a major advantage."

Fewings says: "The scheme provides an open and transparent means to ensure the water quality in the potentially impacted zone is maintained to agreed standards. The monitoring buoys allowed us to access live data, which meant we were able to check whether thresholds were breached, and if so, ensure that the agreed actions were undertaken."

Boskalis has worked on similar projects in Germany, Melbourne, Australia and Khalifa in Abu Dhabi. In Southampton, Boskalis deployed nine specially-designed environmental buoys.

Gert Jan Peters, project manager Boskalis Westminster explains: "The contract was signed in mid-October 2013, the buoys were mobilised to Southampton in November and were operational by December 1."

Initially, the nine buoys – with one spare – were used for three months to measure the baseline values before the dredging campaign.

## Nine buoys

There is a frame fitted under each buoy, which is connected with a 40m umbilical cord. Three sensors are attached to the frame – one measuring dissolved oxygen levels, one turbidity, and one is a turbidity sensor capable of measuring a larger range – which acts as a backup turbidity sensor.

Boskalis can then 'communicate' with the buoy via a data connection and can make any necessary changes to the settings remotely. At the site office in Southampton, the chief surveyor has access to the AMS and electronic engineers monitor the network at head

office in the Netherlands. Additionally, they are assisted by an Environmental Engineer from Boskalis, who interprets the data. The engineer advises on whether a spike in the results could have been caused by dredging or another reason, and they analyse the information about turbidity levels/dissolved oxygen etc.

Peters comments: "During the initial monitoring period we could look at background levels, including the influence of the rivers Hamble, Itchen and Test, as well as the effects of passing vessels. For example, we could see the impact of the large container vessels. This showed a temporary spike in turbidity on the buoys' sensors. We compared the time and location of this 'turbidity spike' with the vessel's Automatic Identification System (AIS) data and could see the impact of larger vessels passing the buoys/sensors, which was well below the identified thresholds."

There is in fact a large variation in the background values due to the tide and natural events (e.g. storms, rainfall) and anthropogenic effects on turbidity such as the movements of passing ships. But this three-month period, combined with background monitoring that ABP had executed, gave a good indication of the natural variations that could be expected.

## Real time

Crucially for ABP, the system is in real time, stresses Simmonite. "If turbidity increases, the Environment Agency receives an email and I receive an SMS message via my mobile directly from the monitoring system. If there is an alarm we can immediately implement mitigating measures, and either call a halt to the dredging or move the vessels to another area."

Boskalis has had six dredgers working on the ABP project so far: the smallest, the Causeway, with a 4,500m<sup>3</sup>-capacity

through to the largest, the 15,961m<sup>3</sup> Prins der Nederlanden. A backhoe dredger is filling split barges and a hopper suction dredger goes from Southampton port to the dredging disposal area.

The works, to date, with both the backhoe dredger Manu Pekka and the hoppers, have not resulted in any exceeded turbidity levels.

Using this system, we are able to manage the dredging process, Peters stresses. "For example, we limit where we overflow and using the falling rather than the rising tides we limit turbidity within the inner part of Southampton Water, which is the most sensitive area for fish migration. The dredge areas are a +/-20km-long area, so we can choose the location where we dredge very carefully. If we encounter an elevated turbidity reading we have the ability to vary the dredge location or limit the amount of dredging in each work area."

### Careful dredging plan

Peters comments that this real-time system means that if the project team sees that an alarm may be triggered, it adjusts the dredging plan straight away and leaves the dredge area until the levels restore themselves. "And most importantly, ABP, our client has never had reasons for concern."

Fewings adds: "Boskalis has carried out the project in an efficient and professional manner. As expected with complex technical projects in the marine environment, there have been unexpected technical challenges. These challenges have been largely overcome by Boskalis although some important lessons have been learned for future projects."

From our point of view, Simmonite says, this technique means that the project is not seasonally restricted. "We can dredge 24/7, 365 days a year, and we have reassurance that the protected species are not being adversely affected."

Ironically, says Simmonite, there have been occasions when the dredgers have not been on site, but there have been several alarms. This is likely to be down to algal blooms and recently, the culprit setting off the sensors was identified as a particularly determined crab.

The weather is the only other thing that has been a factor. Peters explains saying the buoys largely run on solar panels but the exceptionally wet and dark winter meant there was a lack of sunlight, so it was sometimes a struggle to maintain the power supply for the buoys. Boskalis then used batteries and even put wind turbines on the top of some of the buoys. Additionally, when maintenance teams



Top: Lifting of the frame from the seabed for (monthly) maintenance - cleaning;  
Top insert: Cornelis Zanen and Manu Pekka working in Southampton waters, near berth SCT5;  
Bottom insert: Cleaning the frame which supports the measurement sensors.

visited the buoys every week they were often facing significant wave heights, which meant work had to stop on some occasions.

But this has not resulted in delays to the schedule and Boskalis is confident that it will finish on time. Fewings emphasises: "The water-quality standards agreed have been maintained throughout the dredging activities, so it is unlikely that impacts have been caused by dredging on the WFD water body, designated shellfish waters or to our populations of salmon."

### About the organisation

Royal Boskalis Westminster is a leading global services provider operating in the dredging, maritime infrastructure and maritime services sectors. The company provides creative and innovative all-round solutions to infrastructural challenges in the maritime, coastal and delta regions of the world with the construction and

maintenance of ports and waterways, land reclamation, coastal defence and riverbank protection. Boskalis also offers a wide variety of marine services and contracting for the offshore energy sector, including subsea, heavy transport, lifting and installation (through Boskalis Offshore and Dockwise) and towage and salvage (through SMIT). It also has a strategic partnership in terminal services (Smit Lamnalco). With a versatile fleet of 1,100 units Boskalis operates in around 75 countries across six continents. Including its share in partnerships, Boskalis has 11,000 employees.

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