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FILTRATION BACK ON TRACK

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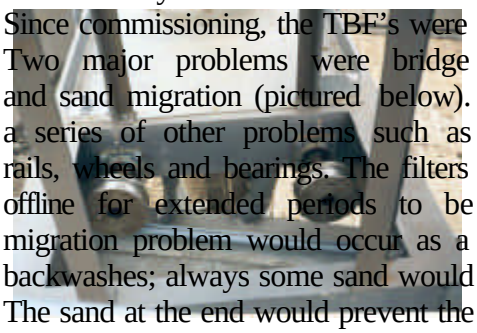
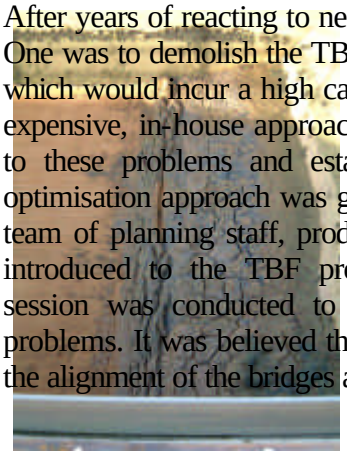
Quakers Hill Sewage Treatment Plant (STP) is Sydney Water's second largest inland STP, discharging an average of 32 megalitres per day of tertiary treated effluent into Breakfast Creek. The EPA regulates the effluent quality in order to protect the aquatic environment of the Hawkesbury/Nepean River System. Work has recently been completed to improve the reliability of four Travelling Bridge Filters, resulting in improvements in treatment performance and saving millions of dollars in deferred capital.

Filtration is an important process for the removal of phosphorous, suspended solids and faecal coliforms from wastewater. Quakers Hill STP's licence requires all flows up to 900L/s to be filtered. The aim is to produce an effluent with an average total phosphorous of 0.05mg/L (year to date performance is 0.03mg/L). Four dual media filters and four travelling bridge filters (TBF) comprise the filtration process. For over ten years the TBF have been very unreliable. The dual media filters alone are capable of producing high quality effluent during dry weather, however quality has traditionally been compromised during wet weather.

In 1989 four TBF's were built to supplement the four dual media filters. A TBF is a down-flow, single media, shallow bed filter that is broken up into many individual cells. The main advantage of the travelling bridge filter over a dual media filter is that filtration capacity is maintained during backwashing while still producing an effluent quality adequate for wastewater applications. The backwash system is mounted on a bridge, which travels slowly along the filter, backwashing each cell individually. The filter backwash operates by pumping filtered water through the sand bed into each individual cell. A wastewater pump takes the dirty backwash water out of the filter into a waste channel.



Since commissioning, the TBF's were plagued with problems. Two major problems were bridge derailment (pictured Left) and sand migration (pictured below). Bridge failure can lead to a series of other problems such as damage to limit switches, rails, wheels and bearings. The filters would need to be taken offline for extended periods to be repaired. The sand migration problem would occur as a result of numerous backwashes; always some sand would be dragged to one end. The sand at the end would prevent the bridge from reaching its limit switches and so cause damage to wheels and rails, as well as derailment. The two major problems were very much inter-related.



After years of reacting to near daily problems two options were considered. One was to demolish the TBF's and install four additional dual media filters, which would incur a high capital cost. The second option was to take a less expensive, in-house approach to discovering and addressing the root cause to these problems and establish reliability of the TBF's. The in-house optimisation approach was given priority over the rebuild approach. A small team of planning staff, production officers and maintenance workers were introduced to the TBF problems in December 2000. A brainstorming session was conducted to identify all possible causes for the inherent problems. It was believed that derailment could be avoided by investigating the alignment of the bridges and axles.

A maintenance crew was assigned to check and adjust the alignment of the drive system.

After the bridges were realigned, they ran for several weeks without misalignment. However, problems with sand build-up were still causing the wheels to climb the rails on some of the bridges. This was not

observed at other TBF installations. The wheel shape was compared to other Sydney Water STP installations and the cross sectional shape of the wheels was found to be different. It was believed that an H-shaped wheel would completely eliminate any derailing. A new wheel was manufactured and installed and the alignment was checked and rechecked. (The old wheel is the left picture; the new H-cross section is the right picture). This work was completed by June 2001. This work was successful since no further derailments have occurred. The elimination of the derailment problem was an important milestone for this project because it allowed for operational issues to be addressed without the threat of derailing.

The filters were now able to run for weeks without stopping. The only problem was that after a few weeks, sand would build up on the ends and prevent the bridge from reaching the limit switches, causing damage to the wheels and rails (pictured Left). It was unknown how this would be solved so the first thing was to check if the filter was operating according to the design. The waste water and backwash pumping capacity was designed to be 11L/s. The original pump size was 11L/s and the actual pumping rate was found to be 3.5L/s. It is believed that head losses in the system were incorrectly calculated resulting in undersized pumps. A filter was selected to trial a pump designed to pump 30L/s. Modifications to the filter were required to accommodate the larger pumps. After installation the pump flowrate was found to be a maximum of 13L/s, which can be turned down by the operator. The problem with sand migration was reduced when compared to the filter with the undersized pumps. As a result, all the backwash and wastewater pumps were replaced. This work was completed in March 2002.

Overall the work has been successful in improving filter reliability. As a result of TBF reliability improvements Quakers Hill STP is able to reliably achieve high quality effluent under all weather conditions. Full credit goes to the Production Officers at Quakers Hill STP for their operational support and problem solving skills, Sydney Water's Planning Team for providing technical support and finances and our maintenance staff for solving problems with wheels and alignment, and, for making the modifications required to install the new pumps.

As a result of this cooperation and determination, filtration at Quakers Hill STP is now BACK ON TRACK!