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SONTEK-IQ SHALLOW FLOW METER REVOLUTIONIZES FLOW MEASUREMENT IN THE AUSTRALIAN BUSH

New South Wales, Australia

It's hard to picture just how flat Australia's Murray-Darling Basin is, but picture this - tens of thousands of square kilometers braided with slow-flowing rivers and streams with virtually no fall in their channels. Amid the tangle is Colombo Creek, a modest stream with a slope of just 31 meters in 60 kilometers (about 3 feet per mile). With such a flat profile, the backwater effect of confluences, fallen trees, slumped banks and even algal blooms can dramatically impact flow and affect accuracy of rating curves.

"Over the years, we have struggled to manage the hydrographic data for water users," says Danny Hannon, Hydrometric Coordinator for the South West Region for the New South Wales (NSW) Office of Water. "The challenges of providing accurate, repeatable data have been costly in both manpower and dollars."

Measuring flow in the Murray-Darling Basin is of national importance. Every litre is precious in the dusty Australian bush. Farmers in the basin generate 39 percent of Australia's agricultural income, producing more than half of the nation's grain, 95 percent of its oranges, and millions of head of livestock. The region is home to 2 million people, including the residents of the country's capital, and the system supplies water to 1.3 million more. Its wetlands are recognized as vital habitat, and the NSW Office of Water and other agencies are working under exacting public scrutiny to balance agricultural, municipal and environmental allocations in the drought-prone area.

The Colombo Creek Station

In October 2011, Danny and his team began testing a new SonTek-IQ shallow flow meter in Colombo Creek near the town of Morundah, New South Wales. For years, flow there has been gauged eight times per year - lately, with a SonTek RiverSurveyor M9 acoustic Doppler profiler. The hydrographers then plot the data onto a rating curve developed for the station.

"There has always been some variability in the results," Danny notes. "Gaugings were always scattered around the rating table. This has been attributed to a combination of downstream debris and large gum [eucalyptus] trees obstructing the watercourse, plus backwater effect from a downstream confluence that can provide variability in backwater and hydraulic effects."



Danny Hannon and Sophie Gatacre of the New South Wales Office of Water deploy a SonTek-IQ shallow water flow meter in Colombo Creek, part of the Murray-Darling river system.

Danny has high hopes for the IQ, which promises to provide a constant level reading and profile of flow - even in slow-moving water and shallow conditions. In turn, the data could shed light on water movement in the basin, improve the accuracy of monitoring data, and dramatically reduce labor and cost.

Right from the start, the results were exciting. The NSW team surveyed the bed and banks of Colombo Creek at the flow measurement site, "told" the IQ where it was located in the cross-section, and activated the unit's theoretical mode. During the SonTek-IQ's 15-to-20-minute self-learning phase,

Danny's team used their RiverSurveyor M9 to gauge the river's flow immediately upstream of the IQ.

"We measured 317 ML/d [1,300 cfs], and by the time we had finished the measurement, the IQ was saying that discharge was 321 ML/d," recalls Danny. "This was absolutely brilliant. In only a short space of time and with no physical input other than the cross-section, the IQ was measuring flows that agreed with our gauging with less than 1% difference."

Canals and Open Channels

The SonTek-IQ is also being adopted around Australia for measuring flow in irrigation canals in water as little as 8 cm (3 inches) deep, notes Steve Bird of YSI Australia in Newcastle, NSW. The unit employs five pulsed Doppler beams - one paired with a pressure sensor to provide level data, and four more to create a 3-D measurement of water velocity in the channel. SonTek's proprietary SmartPluse HD algorithm constantly adapts the acoustic pulse to depth, velocity and turbulence conditions, enhancing the IQ's accuracy in the low-velocity conditions that make the Murray-Darling Basin such a challenge. Onboard processing yields high-resolution volume and flow data.

With no need for earthworks, installing the instrument is simple. Using a pair of mounting bolts, Danny and his group anchored the SonTek-IQ onto a small, steel, sliding and angle-adjusting platform on an alloy H-beam and submerged it in the Colombo to keep constant track of the creek's flow. Readings are relayed hourly to the Office of Water database via modem. Data from the IQ are Modbus, SDI-12 and RS232 ready, providing flexibility for a wide range of transmission and management options.

Rigorous Test

With a power demand of just 0.5 watts and long battery life, maintenance visits can be infrequent and efficient, though Bird points out that Danny and his colleagues have visited the test site often to take extra gaugings with their RiverSurveyor that they compare with data from the IQ. That's because the Colombo Creek site provided NSW Office of Water - and SonTek - with an especially rigorous test of the IQ, he notes.

"At Colombo Creek, the IQ is not located in the most ideal location," Bird explains. "We are in a natural channel and on a slight bend, so we're testing the IQ to the max. Also, a large flood passed through the network in March, which may have affected the cross-section. But when the IQ was released, the Office of Water was keen to trial the unit as a solution for a metering device in an open channel application whereby flow can be calculated on the fly in order to assist with the heavy labour required to physically gauge the site with conventional technology."

The experiment has built confidence in the sensor, says Danny, who expects to deploy more SonTek-IQs around his portion of the



Like the vast network of braided creeks winding through the nearly flat Murray Darling Basin, Colombo Creek in rural New South Wales is highly subject to backwater effects from confluences, trees and other debris, and algal blooms. As a result, gaugings are typically scattered around the rating curve.



Hydrographers Sophie Gatacre and Simon Turner of the NSW Office of Water adjust the platform under a SonTek-IQ shallow water flow meter, preparing for accurate flow and level measurements in slow-flowing Colombo Creek.

Murray-Darling Basin. His department's hydrographers are stretched increasingly thin by an expanding metering network. Adding reliable, automatic flow measurement could save time, manpower and money, allowing the Office of Water to focus its resources on maintaining data quality control across the basin through regular verification gaugings.

"I can see the SonTek-IQ being the solution for many of these issues," Danny says.

"Overall, since installing the IQ, we have had very accurate, repeatable results that have made conventional ratings for this site redundant," he explains. "It is the single most exciting sensor to come out in years, and challenges the way we traditionally collect and measure height and flow. I have no doubt it will revolutionize the industry."



Right out of the box, with just a quick survey of the riverbed and banks input into its onboard software, this SonTek-IQ shallow water flow meter delivered extremely accurate level and flow data.



Hydrographer Sophie Gatacre of the NSW Office of Water readies a SonTek-IQ shallow water flow meter for long-term deployment in Colombo Creek. Readings are relayed hourly via modem to her office.

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