# Harnessing the COLLYWOBBLES

*Beneath the cover of water, deep deposits of silt have reduced the capacity of the Collywobbles dam.*

Sue Matthews

***Sue Matthews visited Collywobbles in the Eastern Cape and explores ways of mitigating its impact on the surrounding environment.***

The Mbhashe River rises in the mountains of the southern Drakensberg, and then snakes eastward across the coastal plateau, a gentle landscape of undulating grassland. Shortly after flowing beneath the N2, the river encounters the more rugged terrain of the Wild Coast, and – as if in shock or confusion – it suddenly flails into a series of violent contortions, before seemingly getting a grip on itself and continuing more sedately to the Indian Ocean.

This convoluted section of river course – viewed on Google Earth as a squiggle of loops and bends – is known as Collywobbles, and is the site of a hydroelectric power station of the same name. It was commissioned in 1985 by TESCOR, the former Transkei Electricity Corporation, and is now operated by Eskom. With three generating units of 14 MW each providing a total maximum output of 42 MW, it ranks as Eskom's third largest hydroelectric power station after the Gariep (360 MW) and Vanderkloof (240 MW) schemes on the Orange River. (This excludes the Drakensberg and Palmiet pumped storage schemes, where water is pumped during off-peak periods to generate electricity during peak demand.)

Like many conventional hydropower schemes, Collywobbles has a storage dam and a penstock to pipe water down to the turbines, which drive the generators. What's amazing about this scheme though is that the penstock tunnels straight through the mountain spine separating two bends of the river. This means the water takes a direct shortcut of a little over a kilometre to skip the 34 km 'by the river' meander between the dam wall and the power plant. As a result, this stretch of river barely flows unless water overtops the dam wall during the summer months, when the Mbhashe catchment gets most of its rainfall.

Of course, there's a higher demand for electricity in winter, so enough water must be stored to see the power station through the dry months. But the Collywobbles dam was only designed to provide an effective storage of 2,5 GWh – equivalent to 60 hours of operation with all three turbines generating at maximum capacity. Water is therefore diverted from the Ncora Dam on the Tsomo River in the neighbouring Greater Kei catchment, taking about two days to reach Collywobbles. This interbasin transfer of water has ranged between about 115 and 150 million $m^3$ annually over the last four years.

"In summer we generally have enough run-of-river yield, so most of the water is transferred in winter," explains Monique Klopper, Network Optimisation Analyst for Eskom's southern region, based in East London. "The valve at Ncora Dam is controlled by the Department of Water Affairs & Forestry (DWAF), so we monitor

the levels at Collywobbles and then put in requests to DWAF to release water to us. There's an agreement that the level of the Ncora Dam cannot drop below 50%, and the valve can only be opened 20-35%."

A complicating factor, however, is that the Collywobbles dam has silted up to such an extent that only about 10% of its original 9 million $m^3$ capacity remains. The soils in the Mbhashe catchment are naturally prone to erosion, but overgrazing exacerbates the problem, with the result that more than 60% siltation had already occurred. Clearly, somebody didn't do their homework properly in the planning stages of the scheme.

"At least once a year we'll open the scouring gates at the dam to try and scour out some of the silt, but it doesn't have much effect," says Klopper. "Since we've lost so much of the dam's holding capacity, we can't get the generation out of the station that we'd like." The upshot of this is that while the power station may run round-the-clock during summer, in winter only two of the three units run for a few hours per day over peak demand periods in the morning and evening.

"The operators at the power station check the level of the dam, and if it's overflowing they'll generate more, and stop if it drops too low. We monitor from East London as well to check what's going on," confirms Klopper. "Flow measurements taken by gauging weirs in the river are also fed back to us in East London so we can instantaneously see what the river level is, and generate depending on the rise and fall of the river."

Apart from reducing the dam's capacity, the silt load in the water causes increased wear and tear to the turbine parts. It is also silting up the Mbhashe River estuary, which separates the Dwesa and Cwebe Nature Reserves and forms part of the adjoining marine protected area.

"The amount of silt going down the river is a big concern for us, and we're always on the lookout for ways to mitigate the effects. That's why we can't scour as much as we'd like," says Klopper.

Yet the presence of the dam and the interbasin transfer of water in winter completely alters the flow regime of the river, which contributes to the siltation problem and also affects the system's ecological functioning. According to DWAF's Internal Strategic Perspective of the Mzimvubu to Mbhashe ISP Area (2005), the natural run-of-river yield determined using the Rapid Simulation Model is 67 million $m^3$ per year – about half the amount of water transferred from Ncora Dam.

The relationship between freshwater flows and the state of the estuary, as well as the consequences for its habitats and biota, will be examined in a desktop assessment that form part of a project to develop an estuary management plan for the Mbhashe River.

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*The machine floor at Collywobbles hydroelectric power station, showing the three 14 MW generating units.*

The Eastern Cape Parks Board has commissioned the study, under the auspices of the CAPE (Cape Action Plan for People and the Environment) Estuaries Management Programme. Options for rehabilitation of the estuary are to be identified, and perhaps some operating rules for the Collywobbles scheme can be suggested to reduce its impact. Because despite all its problems, Eskom is not likely to give up on the scheme in the near future – especially in the current era of countrywide power shortages and the looming threat of rolling black-outs.

"Collywobbles is important in terms of electricity supply, but more so in terms of the stability of the network, as it can keep the network running during high demand periods or temporary shortages," explains Klopper. "The return we get on it is enormous, plus it's a clean source of energy."

Electricity generated at Collywobbles is distributed remotely from East London, with most directed to Mthatha (formerly Umtata) and other towns and villages in Transkei – some quite close to the point of origin. The Mbhashe River flows through one of the poorest and most undeveloped areas of the country, where 77% of the inhabitants earn less than R800 per month. Census 2001 revealed that there were 253 372 people (53 199 households) living in the Mbhashe municipal area, which includes the towns of Dutywa, Gatyana (Willowvale) and Xhora (Elliotdale), but 95% of residents live in rural settlements on tribal land. In the gaily painted bungalows scattered throughout the countryside, people burn paraffin, candles, wood and gas – or even cow dung and maize cobs – for cooking, light and warmth, but more than 25% of villages have electric power. Indeed, according to the Mbhashe Municipality's draft Integrated Development Plan for 2008-2009, about 60% of all households now have access to electricity, and Eskom is extending its reach little by little.

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*Plant operator Lucas Ngqata (seated), electrical officer Fundile Mgulugulu (left) and mechanical officer Lungile Madlolo (right) in the Collywobbles control room.*

Water services are the more pressing problem, since only 0,63% of households have access to water inside the home, while 67% rely on streams and rivers for their water requirements. DWAF's ISP report indicates that rural people in the upper catchments must deal with annual water deficits during the dry season, limiting their domestic uses and stock watering. The situation is exacerbated by the 24 600 ha (246 $km^2$) of forestry plantation here, which reduces annual runoff by an estimated 19 million $m^3$. Any expansion of this land use – as promoted through the government's afforestation plans for 100 000 ha in the Eastern Cape – will put the system and its dependent communities under severe pressure.

With all the water being transferred from Ncora Dam, however, there's a substantial surplus of water downstream of Collywobbles. The ISP report suggests that consideration is given to making this water available for other uses that could create economic opportunities. It points out, though, that the potential for crop irrigation is limited due to the area's poor soils and steep terrain.

A bit further north, however, the twin benefits of irrigation and hydroelectricity are being touted as the main motivation to dam the Mzimvubu River, which flows into the sea at Port St Johns. This is South Africa's largest remaining undeveloped river, but the massively ambitious Mzimvubu Basin Development Project is set to change this. The numbers being bandied about are that some 897 000 jobs would be created through forestry and agricultural expansion, and as much as 2 000 MW of hydroelectricity generated for the national grid through a network of large dams. Eskom has reportedly identified nine possible hydropower sites on the Mzimvubu River and its main tributaries.

Apart from Collywobbles, Eskom inherited three other small hydropower stations from TESCOR. The smallest is Ncora (2 MW), situated alongside the dam of the same name. Some of the water transferred to Collywobbles is routed via the Ncora plant, so it effectively generates electricity twice. First Falls (6 MW) and Second Falls (11 MW) lie below the Mthatha Dam, but they too can only operate over peak periods in winter to ensure that the city of Mthatha's water supply is not compromised.

Hopefully, before the mighty Mzimvubu is shackled by a chain of dams, the true costs and benefits of hydropower schemes will be carefully considered, and lessons learned from past mistakes.

## WHAT'S IN A NAME

Collywobbles was named after Sir George Pomeroy Colley, who served as Special Magistrate in the Dutywa District for two years from 1858. The story goes that on first seeing the river's maze of canyons, he exclaimed: "My, it wobbles!"
"Yes, sir," responded a quick-witted aid.
"Collywobbles!"
Colley was later promoted to the rank of Major-General, and was killed during the First Boer War's Battle of Majuba in 1881.