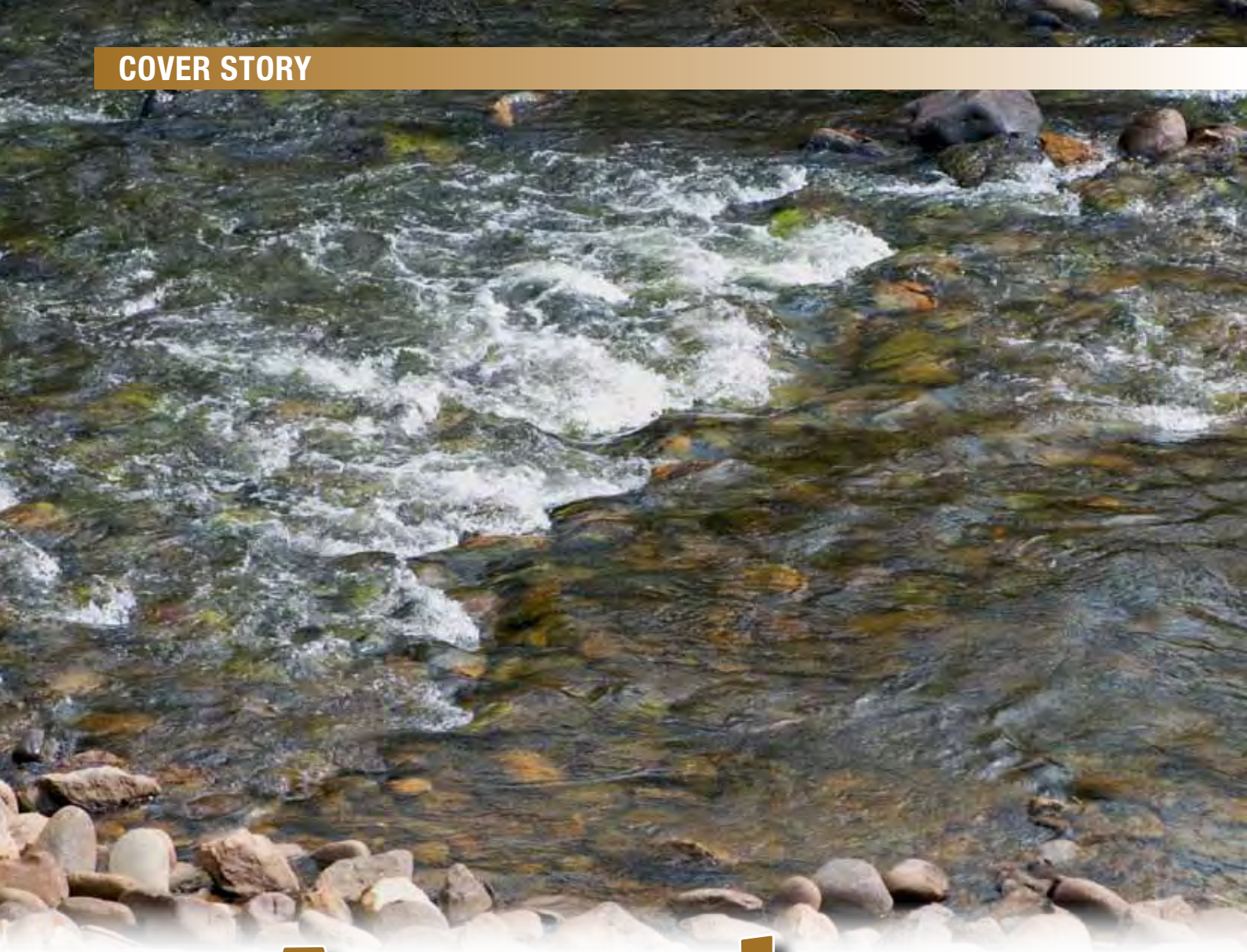

Assessing a dam's IMPACT

This story reports on the results from the first year of monitoring the environmental flows on the NSW's Shoalhaven River.

The Shoalhaven Environmental Flows Monitoring program is nearing the end of its first year. The program contributes to the monitoring and evaluation of new environmental flows in the NSW's Shoalhaven River.

Sydney Catchment Authority (SCA) is responsible, as a requirement of its water management licence, to release environmental flows from a number of its storages including Tallowa Dam.

The monitoring project assesses how this water has affected the water that is released from the Shoalhaven River downstream of the dam to the tidal limit at Burrier. The data collected will be analysed and used to improve downstream health.

The project is being carried out by Sinclair Knight Merz with Hydrometric Consulting Services assisting with fieldwork and Kangaroo Valley Safaris providing a field guide and equipment to navigate the river downstream of the Tallowa Dam. The three-year project is planned for completion in May 2011.

The data collected from the program will complement the information from the SCA's network of stream flow and lake level monitoring stations. This the baseline information about inflows to the dam and downstream releases.

Following scientific investigations and community consultation, the NSW government determined new environmental flow rules for the Shoalhaven River.

Under the new rules, more water is protected for the environment. Previously a maximum of up to 90ML/d of water was released for the environment.

The new rules specify:

- 100% of low flows less than or equal to the 80th percentile monthly inflow are released to improve the health of the Shoalhaven River. The amount of water released varies depending on the actual inflows into Tallowa Dam, to better mimic the natural flow variability in the river and are known as transparent flows
- 20% of flows above the 80th monthly inflow percentile are also released as translucent flows in addition to transparent flows

Special purpose environmental flow releases could be made to address specific downstream river health issues. Importantly water will continue to spill over the dam wall when Tallowa Dam is full.

Monitoring and results

In examining changes induced by the environmental flows, the SCA's monitoring and evaluation program obtained results in these areas:

Thermal pollution

Thermal pollution is cold water pollution, where discharges from a dam may be significantly cooler than receiving waters. Where the temperature difference between discharge waters and receiving waters is greater than 2°C, the downstream aquatic environment may be receiving cold water pollution.

The downstream environment may be affected as cold water can threaten the survival of native fish and aquatic plants. The monitoring of thermal pollution involves placing surface thermistors downstream of the dam and monitoring inflows and storage temperatures to determine the temperature difference between inflows and receiving waters.

Data has been collected between March and June. Preliminary analysis of this data indicates that cold water pollution was not observed during this period. Furthermore, release works recently commissioned at the dam now mean environmental releases occur from the surface layers of the lake instead of the colder lower layers.

Pool stratification

Pool stratification includes thermal and oxygen stratification which tends to occur during the summer months. Stratification is a naturally occurring process whereby a thermal or oxygen gradient (thermocline or oxycline) results from limited mixing of a water column. It affects water quality, with the occurrence of stratification increasing in pools downstream of dams. This is because of a lack of natural flow which affects the mixing.

The environmental flow regime for the Shoalhaven River is intended to reduce the frequency and duration of stratification in pools downstream of the dam.

Stratification is being monitored with thermistor chains which include data loggers that measure temperature at various intervals within pools downstream of the dam. The thermistor chains include the surface loggers used to monitor thermal pollution.

The data collected suggests pools downstream of the dam thermally stratify, and this stratification is related to the depth and size of the pool, climatic conditions and water discharge. Further monitoring is required to examine both the temporal and spatial patterns of stratification.

General water quality

Water quality downstream of the dam is affected by the quality of the water released to the river from the storage. In the past, water was released from 21m below full storage level, but the quality of water from deep within the storage has elevated nutrient levels which encourage the growth of algae.

The data collected from monitoring the Shoalhaven River (shown here) will be added to baseline information held by the Sydney Catchment Authority.

Artificial destratification of the lake since 2005 and the more recent construction of high level release works for the environmental flows aim to improve the quality of water discharged from the storage. Current water quality monitoring involves depth profiles of physicochemical parameters in situ during maintenance field trips undertaken to check thermistor chains.

Iron bacteria cover

Iron bacteria mats or flocs are generally associated with the release of reduced hypolimentic water (water below the thermocline) from deep within the storage. Where discharges have high concentrations of soluble iron and other metal ions, including manganese and aluminium, dissolved iron can be oxidised to form biofilms. These biofilms generally occur in shallow waters and can smother the riverbed substrate and affect water quality (reduce dissolved oxygen) and, in turn, affect aquatic biota.

Iron bacteria transect will be established at four sites within 1km of the dam wall to assess the percentage cover of iron bacteria.

Periphyton

Periphyton comprises a mixed community of algae, fungi and bacteria that grow on stable substrates in streams and rivers. They are an important indicator of the health of a river system as they can influence water quality and are an important part of the food chain. As periphyton has an important role in biological processes of river systems and is highly responsive to degradation in water quality, they can form an important component of ecological monitoring and are therefore monitored in the Shoalhaven River as part of the environmental flows monitoring program. Periphyton is collected and analysed using three different approaches including ash free dry mass (AFDM), chlorophyll-a concentrations and an autotrophic index (AI). AFDM and chlorophyll-a are common methods used to estimate the bio-mass of a periphyton community, while AI is used to measure the degree of organic enrichment.

Samples collected and analysed to date indicate that there is no organic enrichment of waters downstream of the dam.

Macroinvertebrates

Lastly, macroinvertebrates are useful indicators of the ecological condition of a river. They are examined using the Australian Rivers Assessment Scheme (Ausrivas), which is a standardised sampling methodology and modelling program used to assess the ecological condition of macroinvertebrate populations.

The program generates an observed to expected ratio (O/E score) which provides an indication of the health of a waterway. The O/E score is based upon the number of macroinvertebrates observed compared against those that are expected to occur if the site was in its reference or natural condition.

As the aquatic environment downstream of the dam has been affected by unnatural flows, an examination of macroinvertebrate communities can provide an indication of potential impacts and responses to changes in the flow regime associated with the introduction of environmental flows.

The macroinvertebrate Ausrivas O/E scores from sampling undertaken earlier in the year suggest that sites downstream of Tallowa Dam are impaired. The new environmental flows are expected to improve these scores. ●

This article was prepared with the assistance of Sinclair Knight Merz and the Sydney Catchment Authority.