Delivering and Evaluating New Environmental Flows from Avon Dam

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Overview

• Background
  — SCA & Hawkesbury-Nepean River
  — Metropolitan Water Plan

• Delivery of environmental flows
  — Avon Dam

• Monitoring environmental flows
  — Approach
  — Implementation
• NSW Government agency

• Manages 16,000 km² of drinking water catchment

• Supplies raw water to customers including Sydney Water

• Approximately 60% of NSW population use water supplied by SCA
SCA Storages at the Headwaters of Hawkesbury-Nepean River

HAWKESBURY-NEPEAN RIVER SYSTEM
River Health Issue

• Deteriorating health of Hawkesbury Nepean River
  — Irrigation; High primary production; Urbanisation; Exotics

• NSW Government Response:
  — Water Management Licence (2001)
    ➢ Provisional environmental flow releases
  — Metropolitan Water Plan (MWP) (2004, 2006)
    ➢ Announced variable environmental releases from Avon Dam in 2006 & all Upper Nepean Dams in 2010
• Reach down stream of Avon Dam:
  — Subject to intense hydrological impacts
  — Vulnerable native fish species
  — Few confounding factors

Macquarie Perch

Avon River D/S of Avon Dam
Avon Dam: Monthly Inflow and Spill

Mega Litres

Inflow at Avon
Spill from Avon
Avon Dam

- Built in 1920s
- No releases since 1992 as supplies the Illawarra region
- Minor spill in 1998
New Works at Avon Dam

- Dam Wall
- Existing High Level Outlet
- New Low Flow Release Works
- Expanded Lower Level Outlet Works
- Multi Level Water Offtakes
- To River
New Works at Avon Dam

New low flow release works
New Works at Avon Dam

Lower level release works
New Works at Avon Dam

High level release outlet
Monitoring Program

- Integral part of any environmental flow regime
  - Assess impacts & inform management decisions
SCA Monitoring Objectives

• To meet goals specified in the NSW Government’s Metropolitan Water Plan

• To commence an environmental flows monitoring program focused on the reach below Avon Dam

• To evaluate the success of the variable environmental flows from Avon Dam
Framework for Setting Monitoring Program Objectives

- Australian guidelines for setting monitoring program objectives (Source: ANZECC/ARMCANZ 2000)

1. Define the issue
2. Define information requirements
3. Compile available information
4. Develop system understanding and conceptual process model
5. Set objectives
Conceptual Model

**Transparent low flow releases**
- More variable low flows <12 ML/day

**Translucent moderate to high flow releases**
- Reinstall small freshes 12 - 50 ML/day
- More high flow events 50 - 1000 ML/day

**First Order**
- Improved water quality below dam
- Increase wetted area
- Less pool stratification
- More riverbed scouring
- Increased flow over riffle-like habitats

**Second Order**
- Decrease in iron bacteria present below dam
- Increased availability of riffler-like and pool edge habitats
- Improved quality of benthic pool habitat
- More natural river biofilms
- Elimination of riparian vegetation and weeds from river channel
- Improved condition of spawning gravels
- Increased fish passage for potential spawning movements

**Third Order**
- Increased macroinvertebrate productivity and taxa richness
- Potential increase in native fish populations
Environmental flow hypotheses

• Conceptual model process led to more specific monitoring objectives & their framing as 12 hypotheses relating to:
  - hydrology
  - water quality
  - physical habitat change
  - expected ecological responses

• SCA utilised and refined the body of work conducted by the Independent Expert Panel
Experimental Design

• Study Design
  — Before
  — After
  — Reference
  — Impact

• Sites
  — 8 Impacted
  — 8 Reference
  — 2 Reference sites in regulated reaches
Sampling Program

- **Hydrological**
  - Gauging & release data
  - Calibration release

- **Physical Habitat**
  - Bathymetric & perimeter surveys
  - Wetted edge, velocity & water depth
  - Physical habitat attributes
Sampling Program

• Water Quality
  ― Water quality measurements
  ― Temperature & DO profiles

• Biological
  ― Iron bacteria
  ― Diatoms, Algae, Periphyton
  ― Macroinvertebrates
  ― Fish
  ― Riparian vegetation
Challenges

- Access issues
- Control sites
- Reference sites
- Hydrological monitoring
  - Upstream
  - Downstream
- Macroinvertebrate sampling
- Resources

Sandstone gorge country
Summary

• New works completed at Avon Dam in 2006

• Integrated sampling program initiated in 2007

• Environmental flow began on 4th March 2008

• Lessons learnt being applied to a broader SCA integrated environmental flow monitoring
Acknowledgements

• Co-authors:
  — Tim Berryman, Tony Paull, Penny Knights, Amanda Kotlash (Sydney Catchment Authority)
  — Tony Church (Sinclair Knight Merz)

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