Addressing assumptions of natural flow variability for environmental flow regimes

the Tasmanian Environmental Flows Project

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Water Assessment
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Environmental flow assessments in Tasmania

Required for Water Management Plans.

Previously based on the amount of water to maintain instream habitat for aquatic flora and fauna

• identifies minimum environmental flows
• used to develop cease-to-take provisions in WMPs.

Recent shift to assessing entire flow regime to determine requirements for entire ecosystem.
An holistic environmental flow framework for Tasmania

• Characterise freshwater-dependent values and develop environmental objectives

• Assess current impacts on hydrology

• Conduct field assessments.

• Identify and define flow events to meet objectives
  – where these are unknown, use the natural flow regime.
Framework assumptions

NATURAL FLOW VARIABILITY ➔ PHYSICAL HETEROGENEITY

⇒ Determine how fine-scale flow variability drives physical structure and biological function of river systems.
Project approach

Stage 1: scoping            Jul 06 - Feb 07

Stage 2: catchment studies  Feb 07 - Jan 09

Stage 3: developing tools and recommendations  Jan 09 - Jul 09
Rivers of low flow variability
Rivers of high flow variability
Stage 1: scoping

- Biophysical characterisation of each catchment
- Natural and current flow regimes characterised
- Development of conceptual models
- 2 sites selected per catchment
- Hydraulic model of each site constructed
Freshwater-dependent values

Conservation of Freshwater Ecosystem Values (CFEV) database.

GIS database of freshwater-dependent features: rivers, wetlands, lakes, estuaries, saltmarshes and karst.

Conservation Management Priority classification

- representativeness (biophysical class)
- distinctiveness (special values)
- naturalness (condition)
- land tenure security
Freshwater-dependent values - Ringarooma

**Upper catchment:**
- riparian vegetation
- fish assemblages
- threatened and priority flora and fauna

**Lower catchment:**
- fish assemblages
- threatened and priority flora and fauna
Stage 1: scoping

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• Natural and current flow regimes characterised

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• 2 sites selected per catchment

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# Catchment hydrology

## Natural flows

<table>
<thead>
<tr>
<th></th>
<th>Ringarooma (predictable)</th>
<th>Little Swanport (unpredictable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean annual runoff (m$^3$s$^{-1}$)</td>
<td>4,700</td>
<td>1,000</td>
</tr>
<tr>
<td>Mean daily flow (m$^3$s$^{-1}$)</td>
<td>12.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Mean annual 10% exceedance (m$^3$s$^{-1}$)</td>
<td>31.4</td>
<td>5.0</td>
</tr>
<tr>
<td>Mean annual 90% exceedance (m$^3$s$^{-1}$)</td>
<td>1.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Mean number zero flow days per year</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Mean annual $C_v$</td>
<td>1.26</td>
<td>3.72</td>
</tr>
</tbody>
</table>
Stage 1: scoping

- Biophysical characterisation of each catchment
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Conceptual models

Conceptual models developed to test hypotheses of flow regime variability on various ecosystem components:

- physical heterogeneity
- riparian and aquatic vegetation
- food webs
- ecosystem processes

LOW FLOW VARIABILITY

HIGH FLOW VARIABILITY
Stage 1: scoping

• Biophysical characterisation of each catchment
• Natural and current flow regimes characterised
• Development of conceptual models
• 2 sites selected per catchment
• Hydraulic model of each site constructed
Stage 1: scoping

- Biophysical characterisation of each catchment
- Natural and current flow regimes characterised
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Stage 2: catchment studies

Continuous monitoring of river level and water quality parameters

- DO, temp, conductivity, pH and turbidity
Stage 2: catchment studies

Seasonal (3 month) monitoring of a range of variables:

**Hydraulic**
- water level
- discharge

**Water Quality**
- DO, temp, conductivity, pH, turbidity, TN and TP

**Geomorphic**
- thalweg location
- sediment composition
- leaf litter and wood cover
- photomonitoring

**Flora**
- growth form structure of riparian and aquatic vegetation
- algal biomass and composition
- photomonitoring

**Fauna**
- macroinvertebrate assemblage structure
- fish assemblage structure
- food web structure (stable isotopes)

**Ecosystem processes**
- organic matter breakdown
- benthic metabolism
Stage 2: catchment studies

Flow manipulation experiment to look at rapid-response variables:

- fine particle movement
- benthic metabolism
- food web structure
Stage 3: developing tools and recommendations

- Develop a Decision Support System to explore flow scenarios in rivers of similar hydrology.
- Suite of potential flow-related indicators.
- Independent review by Scientific Panel.

A transparent means of recommending environmental flows and allocating water from the natural flow regime.
Acknowledgements

Water Resources (DPIW) technical assistance:

• John Gooderham, Shivaraj Gurung, Danielle Hardie, Scott Hardie, David Horner, Tom Krasnicki, David Spiers

Contributing consultancies:

• Freshwater Systems, Technical Advice on Water, Glen McPherson Consultancy

Scientific Review Panel:

• Angela Arthington, Margaret Brock, Peter M. Davies, Graham Harris, Sam Lake, Helen Locher, Paul Reich, Peter Scanes, John Whittington