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FACTSHEET

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Fresh Water

# Environmental Flows: Orchestrating Healthy Waters



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**Sylvia Grinnell River, Nunavut. Environmental flows provide a range of economic, social, and environmental benefits.**

## What are environmental flows?

Environmental flows are central to healthy waters and sustainable water management.

Environmental flows are commonly described as ‘the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems’<sup>1</sup>. There are other definitions and terms to describe what is a simple, holistic concept: environmental flows are the water in river systems from their headwaters to the ocean that sustains aquatic ecosystems and the benefits they provide. Moving environmental flows from concept to application is the challenge and opportunity ahead.

## Flowing Waters, Healthy Waters

Multiple factors contribute to the structure and function of fresh waters and the ecosystems they support. The flow regime – the dynamic patterns of all water flows and levels – is widely considered the “master variable” or “maestro that orchestrates pattern and process” in rivers, and a critical influence in lakes, wetlands, and estuaries.<sup>2</sup>



**The South Nahanni River, Northwest Territories. The flow regime is the master variable of river health, and a critical influence in the health of lakes, wetlands, and estuaries.**

An ever-increasing body of knowledge suggests the natural flow regime is central to sustaining and restoring native biodiversity and ecosystem integrity. This regime is characterized in terms of:

- **Magnitude**, the amount of water moving in a river
- **Timing**, when flow events occur and how predictable they are
- **Duration**, the length of time of a particular flow event

- **Frequency**, how often flow events of a certain magnitude occur
- **Rate of change**, how rapidly flow changes from one condition to another<sup>3</sup>

The natural flow regime has shaped aquatic environments and habitats for thousands of years, and aquatic species evolved in response. This regime is now an increasingly adopted model for river conservation and restoration, and the scientific foundation of environmental flows.

## Water for People, Water for Nature

Environmental flows are about managing water for people and nature, part of a global shift in water governance that recognizes the full range of social, economic, and environmental values and benefits associated with water. These values and benefits include fisheries; water supply for hydroelectric power generation, agricultural, industrial, commercial and municipal purposes; recreation; and intrinsic and spiritual values.

Environmental flows are essential to better meeting the full range of often competing values for water. Implementing environmental flows makes a healthy and functioning ecosystem a core management objective.

While the natural flow regime is the scientific foundation of environmental flows, it is important to note that environmental flows are generally not natural flows. Environmental flows mimic the dynamic patterns of natural water flows and levels, but are compatible with and allow for some degree of water use. Environmental flows are about implementing limits on how much and when water can be used, or how much water is to remain in a river. They are based on the understanding that greater alteration to natural flows means greater risk to aquatic ecosystems, and also that human water uses typically alter flow patterns.

## Moving from Assessment to Implementation

Assessing and implementing environmental flows is far from simple. The assessment determines the water flow requirements of aquatic ecosystems. This is followed by implementation, integrating the water flow

requirements of these ecosystems into the way water is managed. The assessment and implementation of environmental flows involves inseparable scientific and social processes.

### Assessment

The science of environmental flows assessments can be considered in five components (hydrology, biology, water quality, geomorphology, and connectivity) and involves predicting and evaluating the ecological outcomes to a given change in the flow regime. Many methods and frameworks have been developed for environmental flows assessments: choosing the appropriate one depends on the local context, including the human and financial resources available, the physical setting, and the range of social, economic, and environmental interests for a given river.<sup>4</sup> Environmental flows assessments also involve legal, institutional and public

engagement. Ultimately, assessments are driven by what people want for and from their rivers.<sup>5</sup> Environmental flows science informs these decisions, but determining the acceptable risk levels is a social values judgment.

The process of making these decisions is critical and requires collaboration and often identifying and negotiating trade-offs. It should be transparent and include articulating core environmental, social and economic values as the base for decisions, determining desired outcomes, and describing the implications of water management alternatives.<sup>6</sup>

### Implementation

Moving environmental flows from assessment to implementation can be enabled or constrained by water policies and laws. Many existing water policies and laws were developed before the current understanding of environmental flows, so expanding and improving them is a critical step in advancing implementation. Leading jurisdictions such as Florida and South Africa have adapted and developed policies and laws to enable the implementation of environmental flows and others are following suit.<sup>7</sup>

Depending on the current status of a river, implementing environmental flows may either involve protecting or restoring water

to sustain aquatic ecosystems – protecting water where use and flow alteration is relatively minor, and restoring water where there is a high degree of water use. The proactive protection of environmental flows is generally far easier than their restoration. For both cases, policy and legal tools have been developed in leading jurisdictions across the globe and in Canada to support implementation.

While a large body of scientific and social knowledge exists, it continues to evolve. A precautionary approach, monitoring, and adaptive management should support environmental flows implementation.

**THE ASSESSMENT AND IMPLEMENTATION OF ENVIRONMENTAL FLOWS IS CRITICAL TO ENSURING THE HEALTH OF CANADA'S RIVERS.**

**THE ASSESSMENT AND IMPLEMENTATION OF ENVIRONMENTAL FLOWS IN WATER MANAGEMENT MAY TAKE MANY DIFFERENT FORMS. INTERNATIONALLY AND IN CANADA, A TWO-COMPONENT APPROACH THAT INVOLVES A LIMIT TO CUMULATIVE USE FROM NATURAL FLOW AND SUSPENDING HUMAN WATER USE DURING CRITICAL LOW FLOW PERIODS IS EMERGING AS A BEST PRACTICE.**



**Sockeye salmon (*Oncorhynchus nerka*) returning to spawn in the Adams River, British Columbia. Aquatic species have evolved life history strategies to adapt to natural flow regimes.**

## Securing Healthy Waters

Implementing environmental flows is just beginning in Canada and will need to accelerate as pressures on water bodies and water resources continue to mount. As a primary, but not exclusive, driver of healthy waters, environmental flows must be implemented alongside other

measures as part of a comprehensive, integrated approach to securing healthy freshwater ecosystems and the benefits that they provide. Protecting and restoring environmental flows is central to securing Canada's freshwater future.

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## WWF-Canada and Environmental Flows

WWF-Canada has been advancing knowledge and application of environmental flows in Canada since 2008. WWF has contributed to environmental flows assessments and implementation in water management planning at the river-basin scale, partnered with government agencies to guide the development

of environmental flows policy, and participated in scientific and technical advisory groups to develop environmental flows frameworks. Moving forward WWF will continue to support increasing the application of environmental flows in water management to help secure Canada's freshwater future.

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<sup>1</sup>Brisbane Declaration. 2007. 10th International River Symposium and International Environmental Flows Conference, held in Brisbane, Australia, September 3–6, 2007.

<sup>2</sup>Walker, K.F., Sheldon, F. and J.T. Puckridge. 1995. A perspective on dryland river ecosystems. *Regulated Rivers: Research and Management*, 11: 85–104.

<sup>3</sup>Poff N.L., Allan J.D., Bain M.B., Karr J.R., Prestegard K.L., Richter B.D., Sparks R.E. and J.C. Stromberg. 1997. The natural flow regime: a paradigm for river conservation and restoration. *Bioscience*, 47: 769–784.

<sup>4</sup>Linnansaari, T., Monk, W.A., Baird, D.J. and R.A. Curry. 2013. Review of approaches and methods to assess Environmental Flows across Canada and internationally. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/039. vii + 75 p.

<sup>4,5</sup>Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jöbbs, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth, and C. Stalnaker. 2004. *Instream Flows for Riverine Resource Stewardship*, Revised Edition. Cheyenne, WY: Instream Flow Council.

<sup>5</sup>Kendy, E., Apse, C., and K. Blann. 2012. *A Practical Guide to Environmental Flows for Policy and Planning with Nine Case Studies in the United States*. The Nature Conservancy.

<sup>6</sup>Richter, B.D. 2009. Re-thinking environmental flows: from allocations and reserves to sustainability boundaries. *River Research and Applications*, 25: 1–12.

<sup>7</sup>Le Quesne, T., Kendy, E., and D. Weston. 2010. *The Implementation Challenge: Taking stock of government policies to protect and restore environmental flows*. WWF and The Nature Conservancy.



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A great blue heron (*Ardea Herodias*) along the Mamquam River, British Columbia. Environmental flows are central to healthy waters.

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