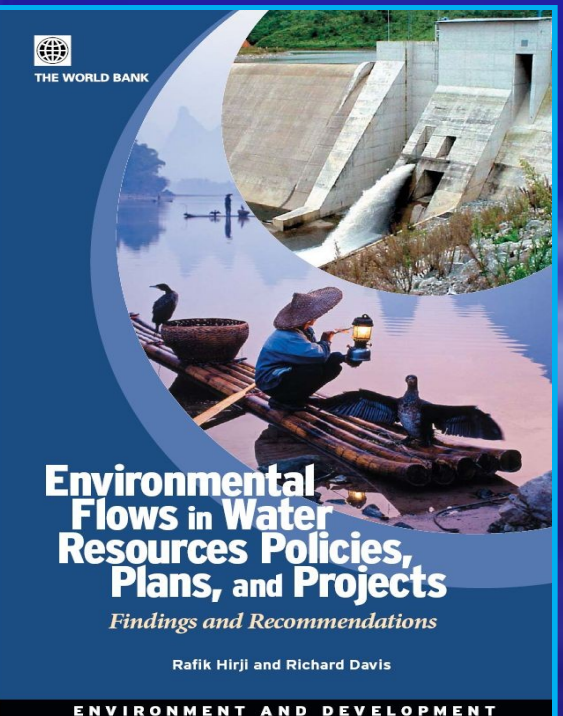
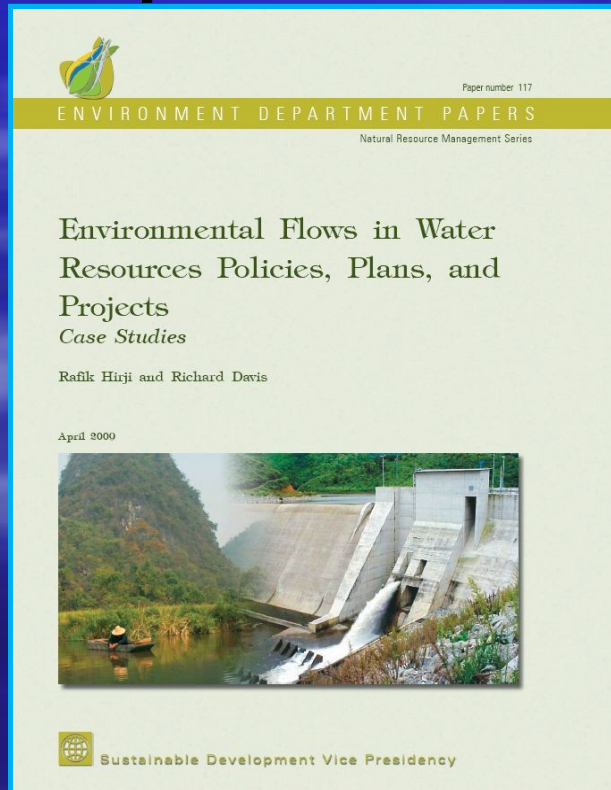
Environmental Flows in Water Resources Policies, Plans and Projects

International Association of Impact Assessment



World Bank
Washington, DC
November 15, 2010

Rafik Hirji
World Bank



Objective

To help advance the understanding and integration in operational terms of environmental water allocation into integrated water resources management

Presentation Outline

I. E Flow Science and Decision Making

II. E Flow Case Study Analysis

III. Framework for Action

I. E FLOW SCIENCE AND DECISION MAKING

- E Flow definitions and importance
- E Flows in IWRM
- E Flow Integration Mechanisms
- E Flow Assessment Methods

Environmental Flows Are...

- ***Not*** **minimum flows typically defined on ...basis of hydrological conditions alone...**
- **Flows for maintaining downstream river ecosystems in a "desired" ecological state …sewer, pristine or…?**
- **Deciding on e-flows is a social choice, not a technical decision – social input is essential but needs to be informed by science**
- **E Flows described in terms of:**
  1. dry-season low flows and wet-season pulses;
  2. the magnitude, timing and duration of flood events.

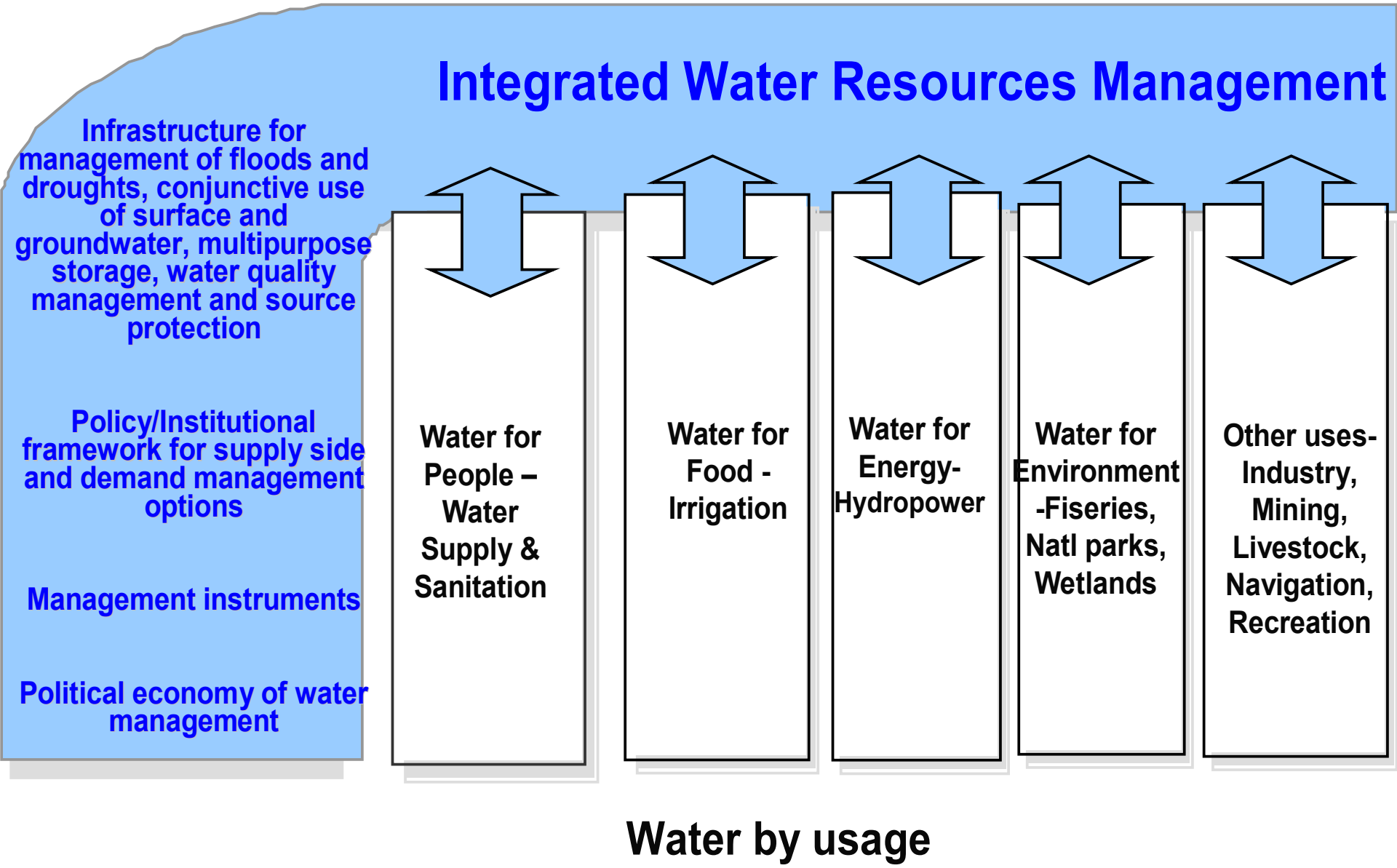
Flow regime is a multi-dimensional variable: quantity, timing, duration, frequency, quality….

Evaluation of Environmental Flow Requirements (EFRs)

Inadequate evaluation of EFR in water development projects has led to biased and sub-optimal allocation decisions resulting in:

- Inequitable allocations
- Exacerbated water use conflicts
- Threatened sustainability of downstream resources
- Undermined the productivity of the resource base
- Inflation of project economic rates of return and
- Costly restoration

It is cost effective to address downstream impacts early in the decision making process


Integrated Water Resources Management
Infrastructure for management of floods and droughts, conjunctive use of surface and groundwater, multipurpose storage, water quality management and source protection
Policy/Institutional framework for supply side and demand management options
Management instruments
Political economy of water management
Water for People – Water Supply & Sanitation
Water for Food - Irrigation
Water for Energy- Hydropower
Water for Environment -Fiseries, Natl parks, Wetlands
Other uses- Industry, Mining, Livestock, Navigation, Recreation
Water by usage

E Flow integration mechanisms

- **Water allocation** - Principles for allocating EF in water policies and laws and river basin plans
- **Safeguard practices** - Evaluation of downstream impacts in EA and EMP for new infrastructure
- **Restoration, rehabilitation and reoperation** - Enhance downstream sustainability and productivity objectives
- **Negotiations** - EFA for negotiations in international waters

Expanding Awareness in Dam Development

1940 Engineers

1950 + Economists

1960

1970 + Environment

1980

1990 + Sociologists

2000 + Displaced People

2010 + Downstream Impacts

Downstream Impacts

- ecosystem functions and productivity
- biodiversity loss
- fisheries
- saltwater intrusion
- dilution capacity
- groundwater recharge
- downstream water supply for other uses that support livelihoods (flood recession agriculture, livestock supply, fisheries…)

Methodologies for Defining EFRs

- **Hydrologic index** method (e.g., Tennant) uses historical flow records for making flow recommendations.
- **Hydraulic rating** method (e.g., Wetted Perimeter) uses the relationship between simple hydraulic variables, such as depth, velocity and discharge to recommend E flows.
- **Habitat simulation** methods (IFIM) link hydraulic-discharge relationship to simulation of the extent to which conditions over a range of flows meet the habitat requirements of selected river species.
- **Holistic** methodologies (BBM and DRIFT) are designed to address flow requirements for the entire riverine ecosystem, and may incorporate sub-routines derived from methodologies of the first three types.

Prescriptive and Interactive Methodologies

Prescriptive…(Tennant, Wetted Perimeter, BBM)

- Usually address a narrow, specific objective and result in recommendation for a single flow value or flow regime…
- Not conducive to exploring options.
- Suited for application where objectives are clear and the chances of conflict is small.

Interactive…(IFIM, DRIFT)

- Focuses on the relationship between changes in river flow and one or more aspects of the river...provides a range of EFRs; explains the consequences of flow manipulations.
- Conducive to exploring options and suited for application where eventual EFR is likely to result from negotiations.

II. E-FLOW CASE STUDY ANALYSIS

- Structured Methodology
- 5 Water policy case studies
- 4 River basin/catchment plans
- 8 Infrastructure projects

Case Study Analysis Criteria

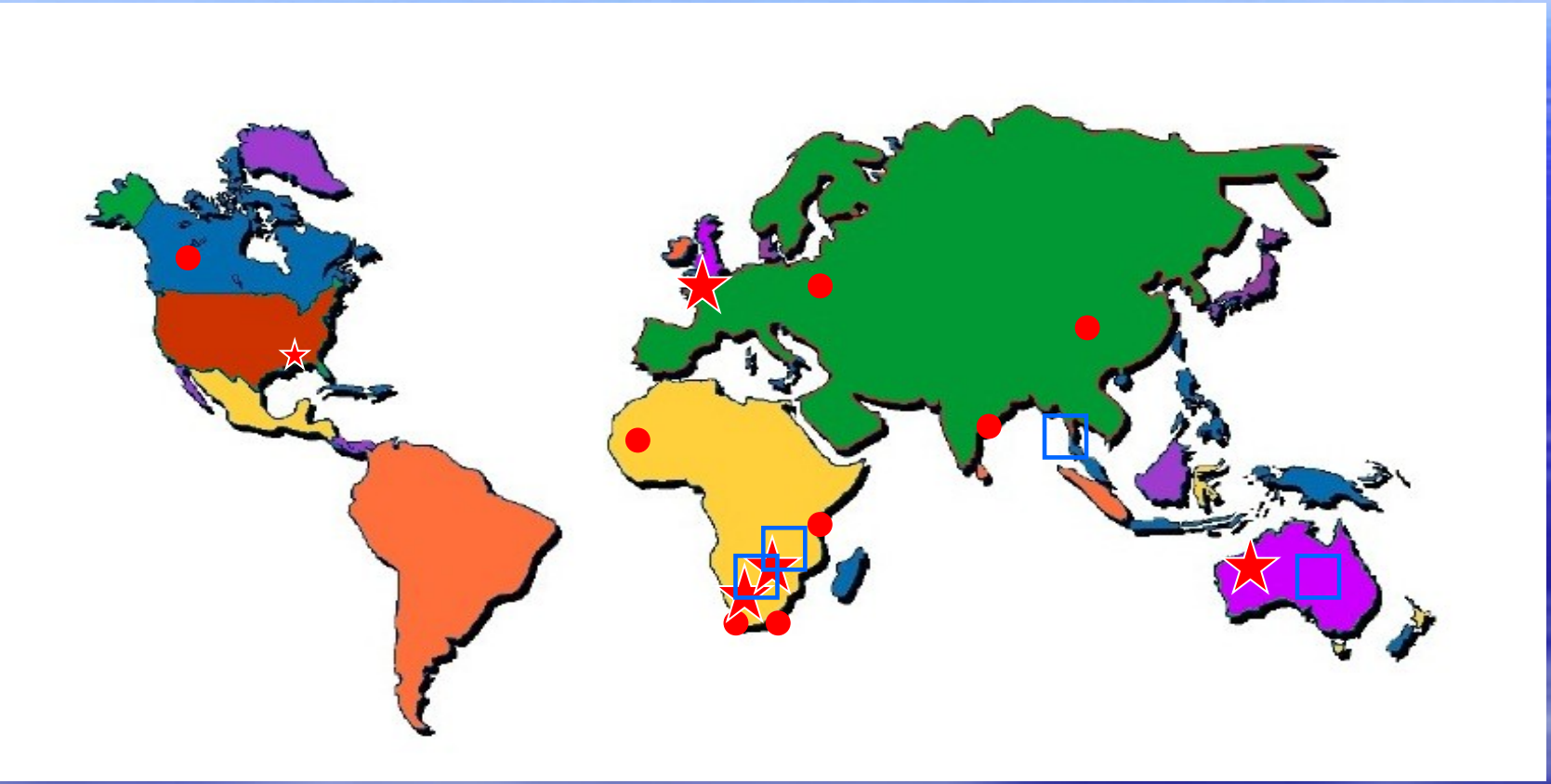
Good practice (modified IAIA criteria)

- Recognition
- Comprehensiveness
- Environmental water allocation
- Participation
- Assessment methods and data
- Reviewing, monitoring and enforcement
- Integration
- Cost effectiveness
- Beneficial influence

Institutional drivers (modified EIA criteria)

- Judicial
- Procedural
- Evaluative
- Instrumental
- Professional
- Public

Geographic Diversity



★ Policy – Australia, EU, South Africa, Tanzania, Florida

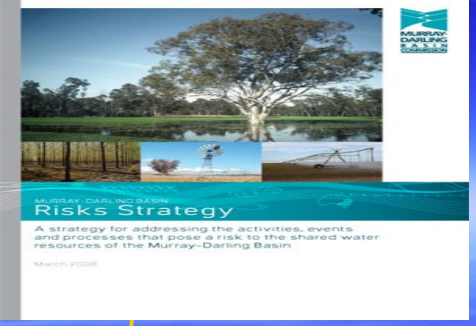
□ Plans – Kruger, Mekong, Pangani, Pioneer

● Projects – Aral Sea, Berg River, Bridge River, Chilika, Lesotho, Kihansi, Senegal River, Tarim

Lessons - Policy

- √ **Policy backing very important**
  - Gives legitimacy to e-flows in plans and projects
  - Establish priority for e-flow allocation
  - Specify procedures
  - Provides participation requirements

- √ **Include whole water cycle in policy, esp. groundwater**
- √ **Value-laden terms must be operationally defined**
- √ **Independent oversight authority valuable**



Lessons - Plans

- √ Equitable distribution for downstream users
- √ Benchmark for subsequent infrastructure development
- √ Environmental benefits must be demonstrable
- √ E-flow terminology must be clear
- √ Whole water cycle in plans
- √ Participation important, but tailor to capacity
- √ Range of EFA methods required
- √ Monitor environmental outcomes
- √ Procedural drivers important for water plans

Lessons – Projects

- √ Restoration projects often require both engineering and flow management
- √ Environmental outcomes need to be linked to socio-economic outcomes
- √ EFA is a small component of project costs
- √ Need understandable presentation of e-flow outcomes
- √ Economic studies can help the case for e-flows
- √ E-flows readily accepted when benefits obvious

International Achievements

- E-flows institutionalized in many developed and some developing countries (e.g. RSA)
- Applications broadened beyond infrastructure
- Applications extend to groundwater, estuaries, near-shore
- Science evolved considerably; numerous EFA methods now available
- International agencies and NGOs provide assistance

International Challenges

- Terminology and perceptions
- Integrating groundwater, estuaries, near-shore in EFAs
- Land use and land mgmt change impacts on flows
- Integrating climate change impacts
- Integrating EFA with EIA for project assessments

The World Bank and E-Flows

- **Bank both informed by and contributes to evolving global e-flow knowledge and practice. The Bank contribution through**
  - Lesotho Highland Water Project
  - Restoration of the Tarim River
  - Restoration of the Northern Aral Sea
  - Infrastructure in Lower Kihansi River
  - Infrastructure in the Senegal River basin
  - Technical documents and sector analysis
- **To date, successes from individual leadership rather than Bank processes**
- **Future will require more structured and institutionalized approaches**

III. FRAMEWORK FOR ACTION

1. Strengthen Bank Capacity

- Promote development of a common understanding across the water and environmental communities, including the need to incorporate EFAs into EIAs and SEAs; and
- Build capacity in EFA by broadening the pool of ecologists, social scientists, and environmental and water specialists.

2. Strengthen EFAs in Project Lending

- Guidance material and training for Bank and borrower staff;
- EA Sourcebook Update on the use of EFAs in EIA & SEA;
- Technical note on downstream social impacts of water resources infrastructure projects.

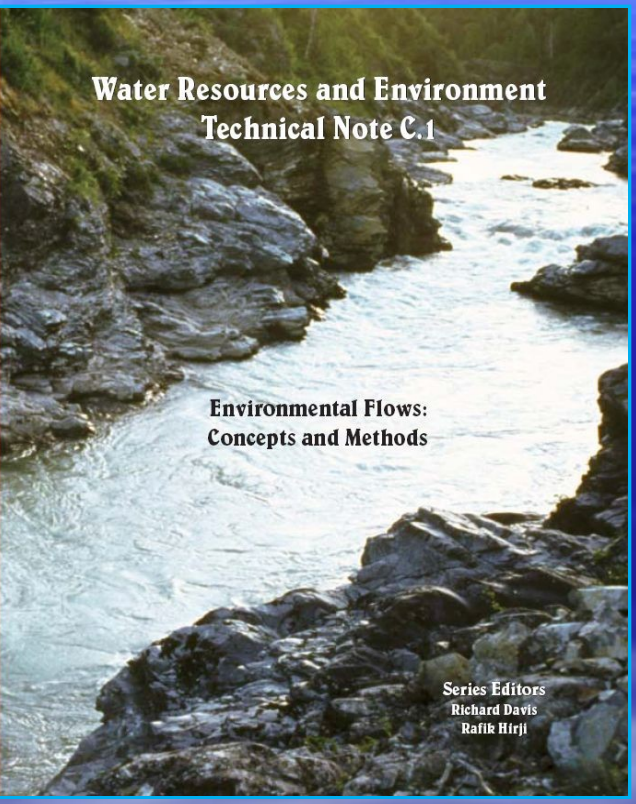
3. Integrate e-flows at policy & planning levels

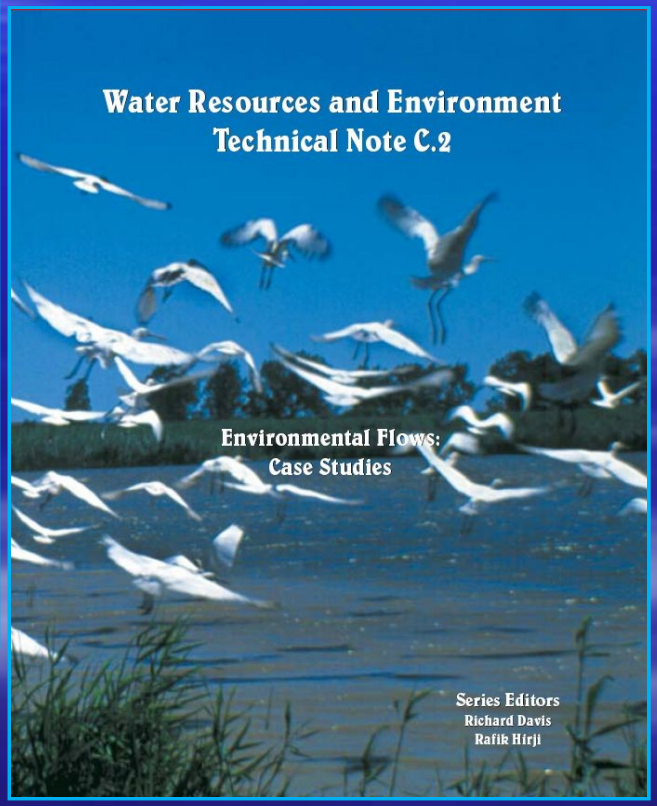
- Promote e-flows in
  - Water policy reforms
  - basin/catchment plans ;
- Develop support material on e-flows in basin planning and water resources policy and legislation reforms;
- Draw lessons from developed countries which have experience in E flows in catchment planning;
- Promote the harmonization of sectoral policies with environmental flows concepts.

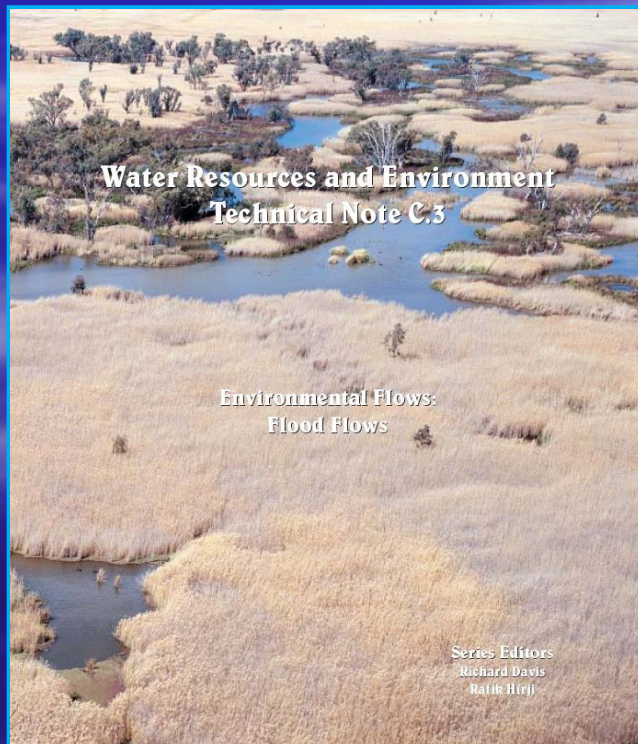
4. Expand Collaborative Relationships

- Expand collaboration with NGOs and international organizations to take advantage of their experience in developing countries;
- Strengthen collaborative relationships with industry associations.

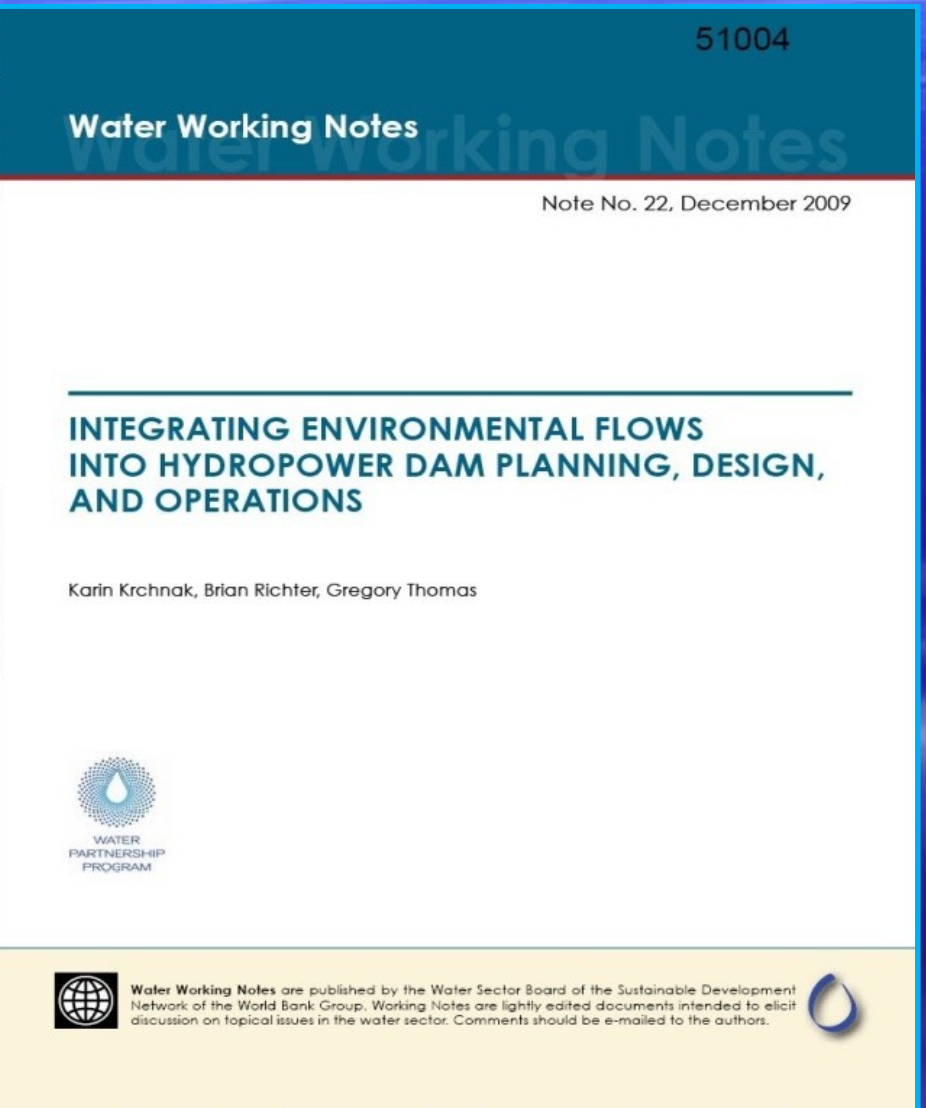
E Flow Technical Notes

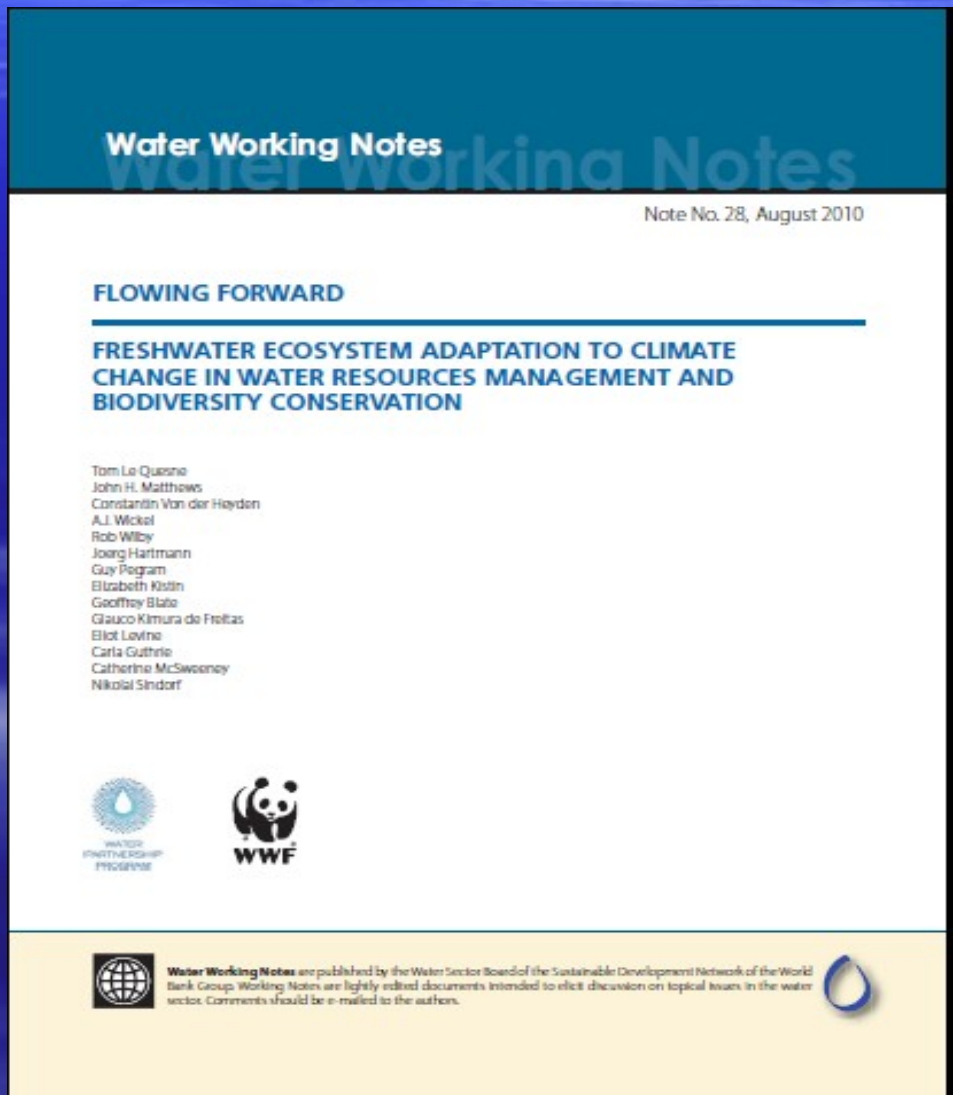






Related Knowledge Products





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