WATER GLOBAL PRACTICE

Promoting Development in Shared River Basins

Case Studies from International Experience

Mehmet Altingoz, Antti Belinskij, Christian Brethaut, Afonso do Ó, Suren Gevinian, Glen Hearns, Marko Keskinen, Melissa McCracken, Vadim Ni, Niko Soininen, and Aaron T. Wolf

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Cover photo: Aldeadavila Dam on the Douro River on the border between Spain and Portugal. © Rusm/ iStock.
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Preface

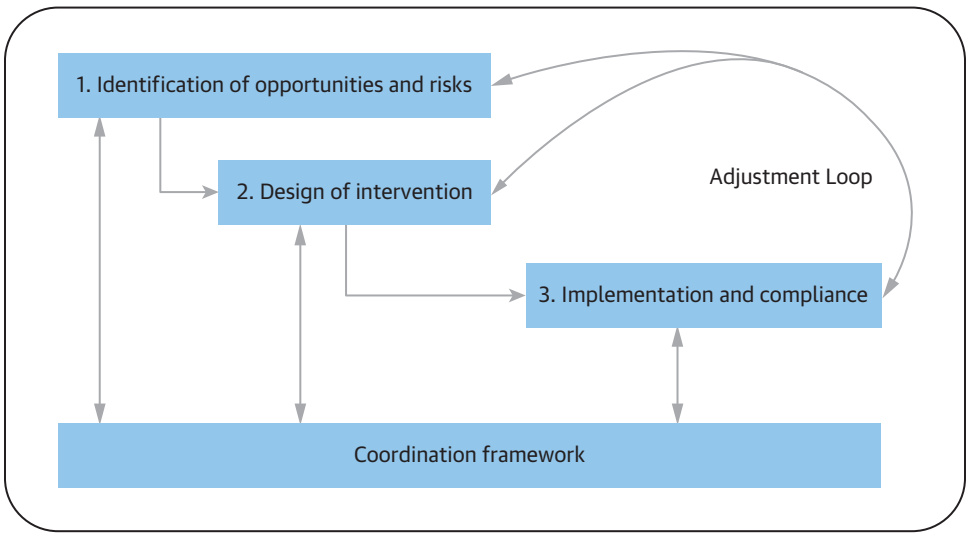
This report is Part III of "Promoting Development in Shared River Basins: Tools for Enhancing Transboundary Basin Management" (Leb et al. 2018). It presents six case studies of international experience on coordinated basin management in transboundary river basins: The case studies focus on specific operations in the broader context of basin development in the Kura-Araks Basin, the Columbia Basin, the Chu and Talas Basins, the Vuoksi Basin, the Douro Basin, and the Rhône Basin. Each case study begins with a summary section that explains the application of the three-stage process of coordinated basin development and the five dimensions of coordinated basin development, as well as the use of tools employed to identify, design and implement coordinated basin development activities.

The three-stage process framework, dimensions of coordinated basin development, and the wide range of tools available to countries and development partners are described in more detail in the companion report "Promoting Development in Shared River Basins: Tools for Enhancing Transboundary Basin Management" (Leb et al. 2018).

The three-stage process of coordinated basin development presents a framework to structure/think of basin development along three phases: (1) identification of opportunities and risks of basin development; (2) design of interventions; and (3) implementation and compliance with agreed actions (figure P.1). Action taken in each of these phases are underpinned and supported by coordination frameworks, such as joint basin management institutions, which provide platforms for countries to interact and identify new opportunities to deepen coordinated development in specific sectors or to expand cooperation to other sectors and beyond the basin.

The tools that can be employed for coordinated basin development can be distinguished into two categories: (1) tools that are available to countries directly (i.e., that do not require involvement of third parties) and (2) complementary tools that are typically provided by development partners or other third parties.

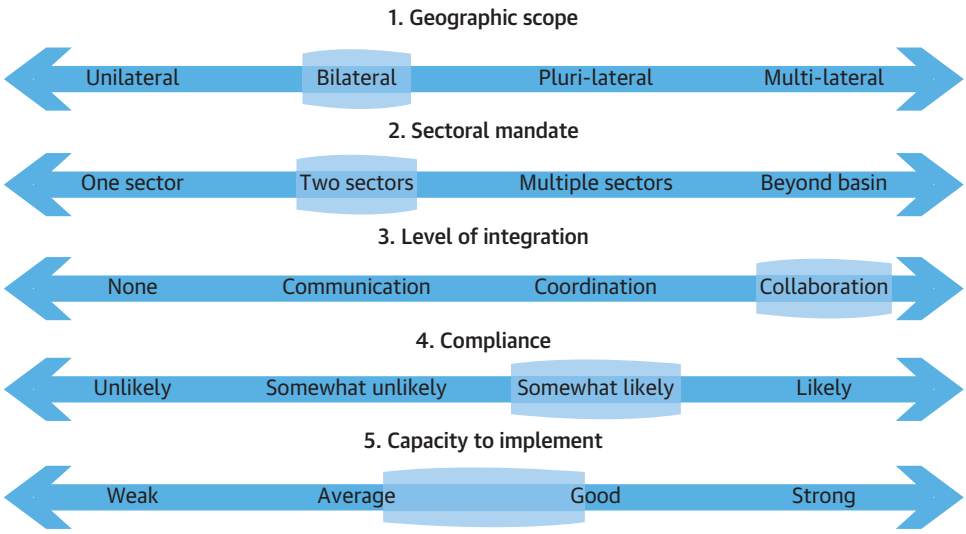
FIGURE P.1. Three-Stage Process of Coordinated Basin Development



When deciding on the appropriate tools to be used for each stage in the process, countries need to consider a series of dimensions that will inform the choice and content of the tools ultimately used. Each transboundary river basin context displays unique characteristics in terms of hydrology, geography, climate, socio-economic indicators, population, culture, history and politics. Five dimensions should be considered when defining the characteristics

and content of the tools chosen for a respective intervention: (1) geographic scope; (2) sectoral mandate; (3) level of integration; (4) likelihood of compliance; and (5) capacity to implement. Each dimension represents a spectrum of characteristics ranging from minimum to maximum scope. For graphical presentation purposes, these characteristics are depicted as four levels located along the spectrum (see figure P.2). It is important to keep in mind that there are grey zones and intermediary levels that sit between the four levels presented for each dimension.

FIGURE P.2. Dimensions of Coordinated Basin Development



The dimensions on geographic scope, sectoral mandate and the level of integration can guide in the decision on the scope of the engagement and thus on the content design of the tools that are being used. The dimensions relating to the likelihood of compliance and capacity to implement can guide in the choice of corresponding tools: in case countries are in doubt of compliance or there are high risks involved, countries may want to employ independent monitoring or guarantees to mitigate for the risk of non-compliance; and in case of strong capacity to implement, technical assistance from third parties may not be needed.

The five dimensions can also guide adjustments in coordination (see "Adjustment Loop" in figure P.1). Regular revision of these dimensions throughout the three stages of coordination will help with adaptation to changing circumstances or inform about changes that may be necessary because of new information.

Authorship is listed alphabetically for each case study and is as follows:

Kura-Araks Basin

Mehmet Altingoz, Suren Gevinian, Melissa McCracken, and Aaron T. Wolf

Columbia Basin

Glen Hearns

Chu and Talas Basins

Vadim Ni

Vuoksi Basin

Antti Belinskij, Marko Keskinen, and Niko Soininen

Douro Basin

Afonso do Ó

Rhône Basin

Christian Bréthaut

Abbreviations

AHRN	Administração da Região Hidrográfica do Norte (Management of the Northern Region's Water)
ANPC	Agência Nacional de Proteção Civil (National Agency of Civil Protection, Portugal)
AOP	Assured Operating Plan
APA	Agência Portuguesa do Ambiente (Portuguese Environment Agency)
ARH	Administração da Região Hidrográfica (Hydrographic Regional Administration)
ARHN	Administração da Região Hidrográfica do Norte (Administration of the Northern Hydrographic Region)
a.s.l.	above sea level
BC	British Columbia
BCH	British Columbia Hydro and Power Authority
BMO	Basin Management Organization
BPA	Bonneville Power Administration
BWT	Boundary Waters Treaty
CADC	Commission for the Application and Development of the Albufeira Convention
CAREC	Central Asia Regional Environmental Centre
cfs	cubic feet per second
CD	Comisión de Desembalse (Commission on Dam Water Releases)
CGA	Comissão de Gestão de Albufeiras (Reservoir Management Commission)
CHD	Confederación Hidrográfica del Duero (Spain's River Basin Board)
CNR	Compagnie Nationale du Rhône
CoP	Conference of the Parties
CROHMS	Columbia River Operational Hydromet System
CRT	Columbia River Treaty
CRTHMC	Columbia River Treaty Hydrometeorological Committee
CSPE	Columbia Storage Power Exchange
DAI	Department of Internal Affairs
DGA	Dirección General del Agua del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (Water General Directorate of the Agriculture, Fisheries, Food and Environment Ministry)
DGPCE	Dirección General de Protección Civil y Emergencias (General Directorate of Civil Protection and Emergencies)
DGPUSA	General Subdirectorate for Water Planning and Sustainable Use
DGSH	Direção de Gestão e Segurança Hídrica (Water Management and Safety Board)
DOP	detailed operating plan
DRH	Departamento de Recursos Hídricos (Water Resources Department)

DSI	General Directorate of the State Hydraulic Works of the Republic of Turkey
EDF	Électricité de France
EDP	Energias de Portugal (National Electric Company of Portugal)
EECCA	Eastern Europe, Caucasus, and Central Asia
EIA	(Convention on) Environmental Impact Assessment in a Transboundary Context (Espoo Convention)
ENVSEC	Environment and Security
EU	European Union
FCOP	flood control operating plan
GEF	Global Environment Facility
GSB	Gabinete de Segurança de Barragens (Dam Safety Office)
GWh	gigawatt hours
ICJ	International Court of Justice
ICREB	International Columbia River Engineering Board
IFAS	International Fund for Saving the Aral Sea
IJC	International Joint Commission
IWRM	integrated water resources management
JBWC	Joint Boundary Water Commission
KWh	kilowatt hour
MAA	Ministry of Environment and Agriculture
Maf	million acre feet
MASL	meters above sea level
MENRP	Ministry of Environment and Natural Resources Protection
MIBEL	Mercado Ibérico de Electricidade (Iberian Electricity Market)
MOU	Memorandum of Understanding
MNP	Ministry of Nature Protection
MW	megawatt
MWh	megawatt hour
NATO	North Atlantic Treaty Organization
NTS	non-treaty storage
NTSA	Non-Treaty Storage Agreement
OC	operating committee
O&M	operations and maintenance
OSCE	Organization for Security and Co-operation in Europe
PEB	Permanent Engineering Board
PWC	Permanent Water Commission
RBMP	river basin management plan
RBO	River Basin Organization
SAP	strategic action program
SDC	Swiss Agency for Development and Cooperation

SFMCP	Société des Forces Motrices de Chancy-Pougny
SGIT	General Subdirectorate for Infrastructures and Technology
SIDA	Swedish International Development Cooperation Agency
SIG	Industrial Services of Geneva
SOP	Special Operating Program
TACIS	Technical Assistance to the Commonwealth of Independent States
TDA	Transboundary Diagnostic Analysis
TFDD	Transboundary Freshwater Dispute Database
TOR	terms of reference
TSR	Treaty Storage Regulation
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
USACE	United States Army Corps of Engineers
USAID	United States Agency for International Development
USSR	Union of Soviet Socialist Republics
WFD	Water Framework Directive (EU)
WG	working group

Kura River. © photoaliona/iStock.

Chapter 1 Kura-Araks Basin

Water Quantity and Quality Management

By Mehmet Altingoz, Suren Gevinian, Melissa McCracken, and Aaron T. Wolf

Summary: Three-Stage Process of Coordinated Basin Development

This case study showcases the use of mechanisms that benefit from basin investments and promote coordination between the riparian states to reduce transboundary harm. The first part describes the tools used to construct and operate the Arpaçay/Akhuryan Dam between Armenia and Turkey. The second part discusses the tools that address the management of water quality in three of the riparian states: Armenia, Azerbaijan, and Georgia.

For reference, the three-stage process of coordinated basin development is presented in figure 1.1.

Part A: The Arpacay/Akhuryan Dam between Armenia and Turkey

Identification of Opportunities and Risks

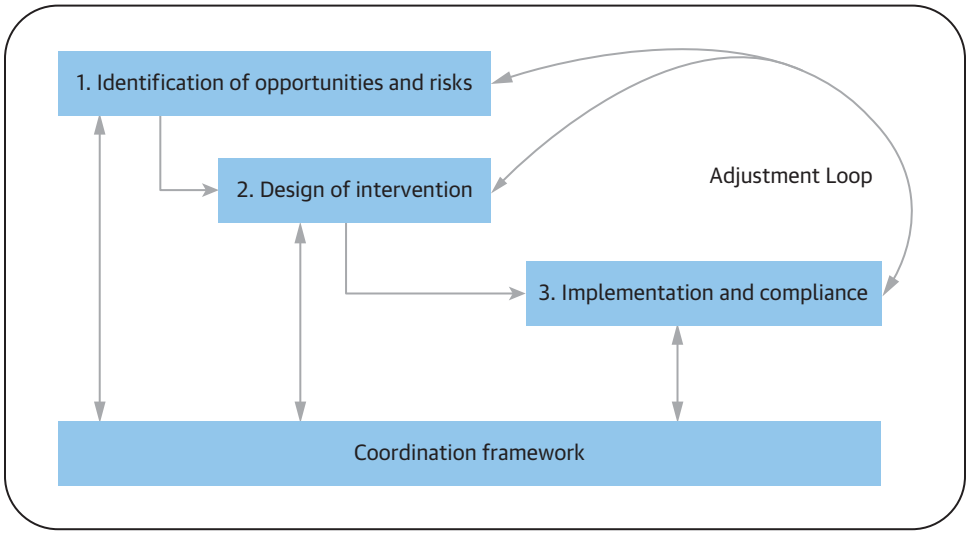
The Soviet Union and Turkey agreed to mutually beneficial management of the waters of the Kura-Araks River Basin. Based on this initial cooperation, the two countries later identified the opportunity to construct a dam and reservoir at the joint border to prevent water shortage during the dry months and provide interseasonal storage for irrigation purposes, fish production, and other uses.

Coordination Framework (Stage 1)

In order to take advantage of this opportunity, the Union of Soviet Socialist Republics (USSR) and Turkey entered into bilateral arrangements on the Araks and Arpaçay/Akhuryan Rivers. They used the following tools:

- ***International Treaties*** **(T44):** the two countries signed an agreement, the 1927 Protocol on the Beneficial Uses of Boundary Waters, initially to equally share the boundary waters of the Araks and Arpaçay/Akhuryan Rivers.

FIGURE 1.1. Three-Stage Process of Coordinated Basin Development



- ***Basin Coordinating Committees or Councils*** **(T58):** based on the Protocol, the countries established a Joint Boundary Water Commission (JBWC) with **advisory, executive, and regulatory powers** to manage the use of the waters **(T50-52)** and to settle disputes through **negotiations (T66**).

Design of Intervention

The countries distributed responsibilities for the design and construction of the dam and reservoir—the USSR preparing detailed design studies and ensuring construction of the dam, while Turkey oversaw the construction. They used the following tools:

- ***Equal cost sharing*** **(T14):** they agreed to jointly finance the dam.

Coordination Framework (Stage 2)

- ***Memoranda of Understanding*** **(T43)** and protocols: they established numerous protocols and memoranda of understanding between 1962 and 1964 for the establishment of a joint dam on the Arpaçay/Akhuryan River.
- ***International Treaties*** **(T44):** they signed bilateral agreements in 1964 and 1973 to construct the dam and reservoir and formally commit to equally share the water.
- ***Joint Technical Committee*** **(T55):** the Joint Water Committee—established on the basis of the1964 Protocol on the Joint Construction of the Arpaçay/Akhuryan Dam—managed the construction of the dam. It was also charged with preparing the annual operation schedule of the dam and overseeing its implementation; this responsibility was later delegated to the Permanent Water Commission (PWC).

Implementation and Compliance

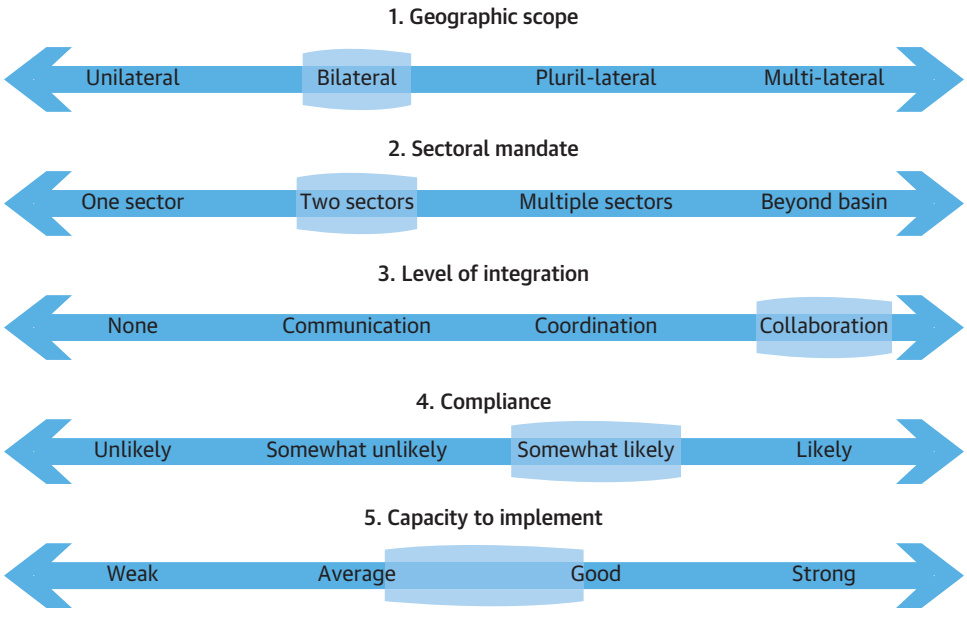
Once the dam had been built, they used the following tools to implement the agreements:

- ***Single Sector Operational or Implementation Plans* (T39)**: the PWC makes a monthly management plan that includes decisions on the operation of the dam and its facilities, a water usage schedule, cleanliness of the dam reservoir, and fish production in the dam lake.
- ***Periodic Reviews* (T48)**: today, both the Armenian and Turkish sides have technical subcommittees that periodically gauge the other country's water usage.
- ***Site Visits* (T33)**: a joint inspection commission inspects the dam every three to five years.
- ***Negotiations* (T66)**: the PWC is charged with negotiating disputes that arise between the two sides; if it cannot resolve the conflict in question, the governments of both countries are notified.

Coordination Framework (Stage 3)

- ***International Treaties* (T44)**: a bilateral agreement that specifies the rules for managing the dam and the dam lake was signed in 1973.
- ***River Basin Organizations, Authorities or Commission* (T59)**: the PWC, a joint entity to manage the rivers as well as dam operations, was established based on the 1973 agreement.
- ***Executive Functions* (T51)**: the PWC established a subcommission to carry out its decisions.
- ***Technical Entities* (T36)**: a joint inspection commission carries out regular **Site Visits (T33)** and subcommittees on both sides gauge the water usage of the other party.

FIGURE 1.2. Application of the Five Dimensions to the Arpacay/Akhuryan Dam Case



Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention—to the Arpacay/Akhuryan Dam case is depicted in figure 1.2 and detailed below.

1. Bilateral arrangement between USSR (later Armenia) and Turkey.
2. The sectoral mandates of these agreements cover water allocations as well as dam construction and management.
3. The countries collaborated on the construction and cofinancing of the dam/reservoir and establishment of joint institutions. Successful cooperation is due to low-profile management at the technical level.
4. Strong compliance mechanisms were adopted. However, it is difficult to gauge the level of compliance the two parties expected at the time the agreements were negotiated. These mechanisms have so far been successful.
5. The capacity to implement the tools, as well as design the coordination framework, was probably between average and good, as the two parties entrusted each other with technical tasks to implement the agreements.

Part B: Water Quality Management by Armenia, Azerbaijan, and Georgia

Identification of Opportunities and Risks

The second section focuses on the management of water quality in Armenia, Azerbaijan, and Georgia. Most of the tools discussed in this section involve third-party engagement.

The following tools were used to identify problems with water quality:

- ***Transboundary Diagnostic Analysis*** **(TDA) (T3):** an analysis completed as part of the United Nations Development Programme (UNDP)-Global Environment Facility (GEF) *Reducing Transboundary Degradation in the Kura-Araks River Basin*. The TDA included discussions with stakeholders and identified deterioration of water quality as one of the four main transboundary issues in the basin.
- ***Experts to Conduct Assessments and Studies*** **(T71):** water quality assessments were carried out through third-party assistance from the United Nations Economic Commission for Europe (UNECE), the United States Agency for International Development (USAID), the North Atlantic Treaty Organization (NATO), the European Union (EU), and the Organization for Security and Co-operation in Europe (OSCE).

Coordination Framework (Stage 1)

- ***Multisector Development Plans*** **(T12):** UNDP and GEF provided technical assistance in creating a Strategic Action Program (SAP) that aimed to facilitate a coordinated approach to transboundary river management and address the key issues identified by the updated TDA.

Design of Intervention

To mitigate the water quality problem, third parties assisted the countries through the use of the following tools:

- ***Multisector Development Plans*** **(T12)**: the countries signed the European Neighborhood Policy Action Plan, which obligates them to cooperate regionally on water issues and develop integrated river basin management plans.
- ***Assistance for Building Institutions*** **(T100)** and ***Preparing Rules and Procedures*** **(T101)**: the EU is acting as a third-party facilitator and assisting all three countries in designing national water policies.

Coordination Framework (Stage 2)

- ***International Treaties*** **(T44):** while the three countries do not have an international multilateral framework, bilateral agreements that govern water-quality issues are in place between Azerbaijan and Georgia, and Armenia and Georgia respectively.
- ***Memorandum of Understanding*** **(T43):** the 2007 Memorandum of Understanding (MOU) between Azerbaijan and Georgia stipulates that both states should establish groups to exchange monitoring information to protect and use the transboundary waters.

Implementation and Compliance

Efforts to mitigate water quality problems are mostly undertaken at the national level in the three countries.

- ***Convener*** **(T79)** and ***Broker*** **(T80)**: a number of third-party projects have aimed to increase transboundary cooperation through data exchanges and information sharing; however, these projects proved unsuccessful in the long term.

Coordination Framework (Stage 3)

- ***Multisector Development Plans*** **(T12)**: Armenia, Azerbaijan, and Georgia are committed to developing integrated river basin management plans and bringing their national water policies in line with the EU's Water Framework Directive, which could provide a basis for future cooperation.

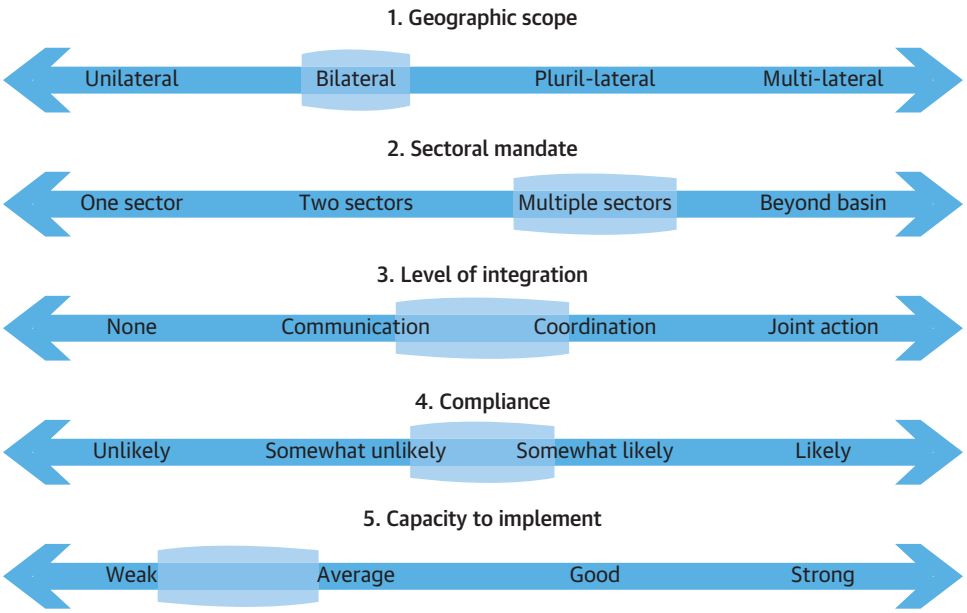
Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention—to the water quality management by Armenia, Azerbaijan, and Georgia case is depicted in figure 1.3 and detailed below.

1. Most of the tools related to geographic scope have been used bilaterally—between Armenia and Georgia, or Azerbaijan and Georgia—because of the lack of multilateral cooperation and limited communication between Armenia and Azerbaijan.

2. Third-party facilitation has focused on projects and agreements that cover multiple sectors.
3. Although third-party engagement has aimed to create communication channels between the riparians on monitoring water quality, the riparians have attempted to coordinate their efforts on monitoring through *bilateral* agreements.
4. It is difficult to gauge the level of compliance the riparians expect from each other because of the fragmented nature of the regulatory and institutional frameworks that deal with water quality issues.

FIGURE 1.3. Application of the Five Dimensions to the Kura-Araks Basin Water Quality Case



5. Although the capacity to implement the tools at the *national* level is average, the riparian states' weak implementation capacity at the *international* level has hampered the long-term success of many of these initiatives.

Case Study Description

Introduction

The Kura-Araks River Basin covers almost 190,000 km^2 across five riparian countries: Armenia, Azerbaijan, Georgia, the Islamic Republic of Iran, and Turkey (map 1.1). The basin is comprised of the Kura River and the Araks River, both of which originate in the mountains of northeast Turkey. From there, the Kura flows into Georgia and then to Azerbaijan. The Araks River follows a southerly path where it partially forms Armenia's borders with Turkey and the Islamic Republic of Iran respectively. Further south, the Araks partially forms the border between Azerbaijan and the Islamic Republic of Iran, and then merges with the Kura River in central Azerbaijan before discharging into the Caspian Sea.

The basin is an important transboundary water resource for the South Caucasus region. It supports much of the region's domestic, municipal, agricultural, and industrial needs. Population growth and regional economic development in the region are expected to further increase reliance on the rivers. This increase in water demand is compounded by the impacts of climate change, which is predicted to exacerbate water quantity, availability, and quality issues in the basin, particularly during low-flow months when assimilation capacity is at its lowest.

MAP 1.1. Kura-Araks River Basin

Source: TFDD 2017.

Given the challenges of increased demand and decreased availability, transboundary cooperation will be essential to addressing current and future water issues in the basin.

This case study focuses on two aspects of basin management: operation of the Arpaçay/Akhuryan Dam and water quality management. The Arpaçay/Akhuryan Dam is situated on a tributary of the Araks at the border between Armenia and Turkey, and is jointly managed by the two countries.

According to the Treaty of Moscow that established the border between Turkey and the Union of USSR, signed in 1921, the thalweg of the Araks and Arpaçay/Akhuryan Rivers form the geographic border between Turkey and Armenia. Water quality issues have been significant where the rivers reach the downstream countries of Armenia, Azerbaijan, and Georgia, and these three countries have undertaken joint efforts to manage water quality since gaining independence in 1991.

This case study is presented in two parts. Part A describes and analyzes the regulatory and institutional frameworks governing the Arpaçay/Akhuryan Dam between Armenia and Turkey. Part B discusses and reviews the regulatory and institutional frameworks that address the management of water quality in three of the five riparian states: Armenia, Azerbaijan, and Georgia. The conclusion summarizes the lessons learned from part A and part B.

Part A: The Arpaçay/Akhuryan Dam

Before its dissolution, the USSR shared rivers and transboundary water bodies with Turkey (along its border region) in the Southern Caucasus. The USSR and Turkey signed numerous agreements regarding the management of these water bodies. One of the most significant outcomes of these agreements was that the USSR (Armenia, since the dissolution of the USSR in 1991) and Turkey jointly constructed a dam on the boundary Arpaçay/Akhuryan River, which they have been managing through a joint committee since its construction was completed in 1983 (personal communication 2017). In addition, the USSR (now Armenia) and Turkey have been equally sharing the dam's water, which they primarily use for irrigation, fishing, and domestic purposes (personal communication 2017).

During the USSR administration, the day-to-day operations of the USSR-Turkish border were managed by the Armenian Soviet Socialist Republic. The border was heavily guarded, as the countries were members of two conflicting military blocs: NATO and the Warsaw Pact. Yet, the two countries jointly and cooperatively managed the Arpaçay/Akhuryan Dam.

Upon the dissolution of the USSR in 1991, many nations under its administration declared their independence. As a result, the boundary Araks River and the Arpaçay/Akhuryan Dam fell between Armenia and Turkey, two countries that have a history of tense relations. In fact, the border between Armenia and Turkey has been closed since 1993, and no formal relations exist between the two countries.

This part of the study reviews the way the Arpaçay/Akhuryan Dam is currently managed. First, it briefly discusses the regulatory and institutional frameworks that govern the management of the Arpaçay/Akhuryan Dam. Second, it analyzes how these frameworks work in practice and discusses the effectiveness of the joint management arrangement.

Regulatory Framework

The regulatory framework that lays the foundation for the joint management of the Arpaçay/Akhuryan Dam centers on treaties signed in 1927, 1964, 1973, 1990, and 2009. All the treaties were signed between the USSR and Turkey, except for the 2009 agreement, which was signed by Armenia and Turkey. The regulatory framework is summarized below.

Protocol on the Beneficial Uses of Boundary Waters (1927)

In 1927, the USSR and Turkey signed the Protocol on the Beneficial Uses of Boundary Waters. According to this protocol, the USSR and Turkey agreed to equally share the water from their boundary water resources—that is, the Araks and Arpaçay/Akhuryan Rivers. Per this agreement, the JBWC, composed of two members from each country, was established and given authority to manage the use of water from the Araks and Arpaçay/Akhuryan Rivers (Agreement 1927).

The 1927 Protocol gave both countries permission to build water infrastructure (e.g., pumps, mills, hydropower plants, and irrigation canals) on internal waters, as long as it would not harm the other country (Agreement 1927). In addition, the protocol stipulated that the governments would settle any conflict the JWBC failed to resolve. Furthermore, the parties were required to respond to a meeting request within 15 days, and the JWBC was to meet no later than three months after the request (Agreement 1927). The USSR and Turkey decided that the JWBC would meet at least twice a year to control the water level of the boundary rivers (Agreement 1927). This protocol established the legal regulatory framework for future boundary water agreements between the USSR and Turkey (personal communication 2017), and subsequent agreements adopted many of their provisions from the 1927 protocol (Agreements 1964, 1973).

Protocol on the Joint Construction of the Arpaçay Dam (1964)

The USSR and Turkey signed numerous protocols and MOUs between 1962 and 1964 for the joint building of a dam on the Arpaçay/Akhuryan River (Agreement 1964). Finally, in 1964, the USSR and Turkey signed the Protocol on the Joint Construction of the Arpaçay/Akhuryan Dam (Agreement 1964). Per the 1964 Protocol, the two countries agreed to jointly construct a dam on the Arpaçay/Akhuryan River, and established a joint water committee to manage it. They agreed that the latter would have equal representation from both sides and would be encharged with preparing the annual operation schedule of the dam and overseeing the implementation of this schedule (Agreement 1964). The USSR and Turkey also agreed that one party would build the dam while the other one would oversee the construction (Agreement 1964). This was formalized in a later agreement (Agreement 1973). The water-sharing policies laid down in the 1927 Agreement held between 1964 and 1973.

Cooperation Agreement on the Construction of a Dam on the Bordering Arpaçay River and the Constitution of a Dam Lake (1973)

In 1973, the USSR and Turkey signed the Cooperation Agreement on the Construction of a Dam on the Bordering Arpaçay River and the Constitution of a Dam Lake (Agreement 1973), which was ratified in 1975 (Kibaroglu, Kramer, and Scheumann 2011). The two countries agreed to construct a dam and a dam lake with a volume of 525 million m^3 on the shared Arpaçay/Akhuryan River and to equally share the water that would be allocated from the Arpaçay/Akhuryan Dam and Araks River.

Per the 1973 agreement, the USSR was put in charge of building the Arpaçay/Akhuryan Dam, while Turkey was given the responsibility of overseeing the construction. The parties agreed on equally contributing to the construction expenses (Agreement 1973). They also reached consensus on establishing the Permanent Water Commission (PWC)—composed of three members from each country—for managing the joint use of water and the operation of the dam. In addition, the parties agreed to establish a subcommission to execute the decisions of the PWC (Agreement 1973). The USSR and Turkey also agreed that, without violating the rights of the other party, both parties could use their internal water resources at any place, in the time and quantity that they found suitable (Agreement 1927, 1973).

Protocol Concerning Mainly Technical Cooperation, Riverbed Changes (1990)

In 1990, the USSR and Turkey signed the Protocol Concerning Mainly Technical Cooperation, Riverbed Changes, and Construction of Joint Hydrotechnical Facilities (Agreement 1990). Per the 1990 Protocol, the parties would start cooperating on the correction of existing changes and the prevention of possible changes in the beds of the Arpaçay/Akhuryan River, Çaksu Stream, Çoruh River, and Posof Stream, shared between the USSR and Turkey.

According to the 1990 Protocol, the two countries would take all necessary actions to prevent riverbed changes. The General Directorate of the State Hydraulic Works of the Republic

of Turkey (DSI) and the Ministry of Water Construction Works of the Union of Soviet Socialist Republics jointly produced the so-called Work Protocol, which specified the details of the works to be undertaken (Agreement 1990).

Protocol on the Establishment of Diplomatic Relations and the Protocol on the Development of Bilateral Relations (2009)

In 2009, Armenia and Turkey signed the Protocol on the Establishment of Diplomatic Relations and the Protocol on the Development of Bilateral Relations (Agreement 2009a, 2009b). These protocols were intended to open the border, which has been closed since 1993, but they have not been ratified as yet (Agreement 2009a, 2009b).

Institutional Frameworks

This section presents the main institutional arrangements that govern the management of the Arpaçay/Akhuryan Dam. In 1928, within the scope of the 1927 Protocol, the USSR and Turkey established the JWBC (Agreement 1927) to manage the use of the Araks and Arpaçay/Akhuryan Rivers.

Upon completion of the Arpaçay/Akhuryan Dam in 1983, the JWBC was replaced by the PWC (personal communication 2017). The PWC operates under the 1973 Agreement and manages both the Araks and Arpaçay/Akhuryan Rivers (personal communication 2017). To date, the PWC has also governed the management of the Arpaçay/Akhuryan Dam (personal communication 2017).

According to the 1973 Agreement, the PWC is comprised of three representatives from each country: a head engineer, an operations expert, and a hydraulic engineer. Per the 1973 Agreement, the parties decided that the PWC would meet once a month to make a monthly management plan. In addition, the parties agreed to establish a subcommission, formed by three employees from the operations staff of the two countries, to execute the decisions of the PWC (Agreement 1973). According to Armenian government decrees signed in 2005 and 2017, seven members are now appointed to the Armenian side of the PWC, including one translator (personal communication 2017). Even though the number of Turkish members of the PWC is uncertain, it is believed to be seven as well, since the agreements (Agreement 1964, 1973) require that the parties have equal representation in the PWC.

According to the 1973 Agreement, the primary duty of the PWC is to prepare the annual operating schedule of the Arpaçay/Akhuryan Dam and to oversee the implementation of this schedule. In addition, the 1973 Agreement specifies that the PWC decides on the following matters during the monthly meetings:

- The operation of the dam and its facilities
- Water use of the parties according to the water usage schedule
- Cleanliness of the dam reservoir

- Fish production in the dam lake
- Resolution of conflicts between the dam's operational staff of the two sides

At the end of every month and year, the PWC investigates whether the two countries exceeded their water usage limit as specified in the water usage schedule (Agreement 1973). Extraordinary meetings to discuss monthly allocations are held upon the request of one of the parties (Agreement 1973). According to the 1973 Agreement, the governments would settle any conflict that the PWC fails to resolve, but to date this mechanism has never been used (personal communication 2017). The PWC meets alternately in Turkey and Armenia (the USSR, prior to its dissolution in 1991) in the protocol rooms built on both sides of the dam (Agreement 1973; personal communication 2017).

According to the 1973 Agreement, the parties can allocate their water share at any location on the Araks River. However, the parties withdraw water from the dam via the specified allocation points—the Turkish Serdarabat and Armenian Talin regulators (Agreement 1973; personal communication 2017). Furthermore, the parties have the right to monitor each other's actual water withdrawal (Agreement 1973), as described in more detail further below.

According to the 1973 Agreement, even though the monthly allocation amounts can vary, the partiers must annually withdraw equal volumes of water. Unused water amounts cannot be used after the end of the allocation calendar, which is December 31st (Agreement 1973); on the first day of every allocation year, January 1st, the usage quotas are renewed (Agreement 1973). It is believed—but unconfirmed—that each country withdraws between 10 and 15 mm^3 per month (personal communication 2017).

The PWC makes the monthly management schedule of the Arpaçay/Akhuryan Dam (Agreement 1973). Each country is responsible for implementing the decisions in the schedule that directly concern its side as well as operating and maintaining the dam facilities within its borders (Agreement 1973). On the Turkish side, the Kars branch of the DSI is responsible for the management of the dam (personal communication 2017). On the Armenian side, the dam and reservoir are managed by a specialized company, which operates under the supervision of the regional (Akhuryan-Araks) branch of JRAR CJSC, the State Water Intake Company (personal communication 2017). In addition, the 1973 Agreement established a joint inspection commission of experts from both countries that is directed to thoroughly inspect the dam once every three to five years. The PWC subsequently has to implement the decisions made by the inspection commission (Agreement 1973).

Analysis and Implementation[1]

This section analyzes and discusses the actual level of implementation of the established regulatory and institutional frameworks.

According to the interviews, the agreements and arrangements are fully operational and the parties are following the 1973 Agreement and managing the dam accordingly (personal communication 2017). Despite tensions between the countries, they have

successfully honored the terms of the agreements through cooperation (personal communication 2017). To date, the two countries have been managing the basin cooperatively and peacefully and they have not experienced any notable conflict regarding the management of the dam (personal communication 2017). In addition, local farmers and administrators in the region also support this cooperation and do their share to help the parties preserve it (personal communication 2017). This factor significantly contributes to the effective cooperative management of the Arpaçay/Akhuryan Dam.

The water in the Araks River and the Arpaçay/Akhuryan Dam is equally shared (personal communication 2017). According to the 1973 Agreement, the parties can allocate their water share at any point on the Araks River. However, the parties have to withdraw water from the dam via the Serdarabat (Turkey) and Talin (Armenia) regulators, as specified in the 1973 Agreement (personal communication 2017). Water from the dam is used to irrigate the agricultural lands in the Ararat Valley of Armenia and the Igdir Plain in Turkey (Kibaroglu, Kramer, and Scheumann 2011). The dam has two automated spillways that release water into the Akhuryan River; the main spillway has a capacity of 380 m^3/s. From the river, Armenia diverts water into the 6.5 km tunnel to the irrigation schemes (personal communication 2017).

The PWC is in charge of the management of the dam (personal communication 2017). The PWC meets once a month from April to December, which is peak irrigation season (personal communication 2017). Instant communication also exists and happens informally via phone, email, text messages, etc. (personal communication 2017). PWC meetings are alternately hosted in Armenia and Turkey, and held in the protocol rooms built on both sides of the dam (personal communication 2017). While the PWC meetings are held at least once a month, at times the parties have met more frequently (personal communication 2017).

The Turkish committee representatives are from the Kars branch of the DSI, and the Armenian representatives are from various agencies—the State Water Committee, Committee Hydromet, the Akhuryan Basin Management Agency, the Ministry of Nature Protection (MNP), and the Water Withdrawal Agency in Armenia (personal communication 2017). While Turkish and Russian Federation soldiers are also present at the PWC meetings, the meetings are held in a very calm and friendly environment (personal communication 2017). The interviewees claimed soldiers are present at these meetings because the countries do not maintain formal international relations (personal communication 2017). The Turkish side brings along a Russian interpreter to the meetings, while the Armenian side brings a Turkish interpreter (personal communication 2017). The meetings are held in Turkish and Russian, and the interpreters simultaneously translate the discussions (personal communication 2017). The meetings go on until a final decision is reached by consensus, regardless of their duration (personal communication 2017). Thus far, the parties have not experienced any intractable issues at these meetings (personal communication 2017). If a conflict arises during a committee meeting, it is resolved by the head of the PWC. If a severe conflict were to occur that the PWC could not resolve, the governments would be notified. To date, this situation has not occurred.

At the PWC meetings, both parties state how much water they wish to use in the following month (personal communication 2017). The water is allocated based on available water and the demand of the parties (personal communication 2017). Sometimes the monthly allocations for each party are not the same (personal communication 2017); this is acceptable as long as the annual allocation amounts are equal (Agreement 1973).

Both the Armenian and Turkish sides have technical subcommittees (personal communication 2017). According to Armenian government decrees signed in 2005 and 2017, the Armenian technical subcommittee consists of 11 individuals, including one translator (personal communication 2017). These subcommittees periodically gauge the other country's water use (personal communication 2017). They also hold small "work protocols" at water intake locations (up to eight times a month) (personal communication 2017). This mechanism is believed to play a vital role in the continued cooperative management of the dam (personal communication 2017).

The Turkish side's water gauges are located on the Armenian side, and the Armenian side's water gauges are located on the Turkish side (personal communication 2017). In this way, the parties can constantly monitor each other's consumption (personal communication 2017). The subcommittees from both sides gauge water usage together, which establishes trust, ensures access to reliable information, and ultimately prevents conflicts (personal communication 2017).

The PWC has successfully managed the dam even during droughts (personal communication 2017). For instance, during a severe drought in 2014, the PWC decided that the parties would alternately withdraw water (personal communication 2017). In any given week, one side would withdraw water while the other side would reduce its water withdrawal; the next week the arrangement would be reversed (personal communication 2017). In addition, the parties took domestic drought measures to reduce overall consumption (personal communication 2017). For instance, when it was Turkey's turn to withdraw water during the 2014 drought, the Turkish irrigation districts that were allocated water from the dam also alternated using the water (personal communication 2017). Additionally, to reduce evaporation, night-time irrigation was practiced (personal communication 2017). The scenario was similar on the Armenian side; the water institutions and local stakeholders from both sides were understanding and cooperative (personal communication 2017).

One local problem is lack of access to the Armenian side of the dam reservoir (personal communication 2017). On the Armenian bank, barbed wire fences remain from the Cold War period, which restrict local access to the dam reservoir (personal communication 2017). However, it is rumored that the border guards occasionally grant the local population informal access to the reservoir (personal communication 2017).

While the Arpaçay/Akhuryan Dam is fully functional, there is no dam on the mainstem of the Araks River. According to the interviewees (2017), the parties face water scarcity in these regions during summer. The limited water availability has had an impact on the types of vegetation and crop that can be grown in the region (personal communication 2017).

The interviewees (2017) discussed the need to build another dam in the face of increased water demand, and both countries actually wish to increase the number of dams (personal communication 2017). The idea of jointly constructing a new dam is being discussed informally (personal communication 2017), but no concrete actions have been taken thus far.

One of the most substantial weaknesses of the 1927 and 1973 Agreements is that both countries are allowed to build water infrastructure in their internal waters, provided it does not harm the other party. However, the agreements do not establish an operational definition of "harm." In addition, the agreements do not address the fact that internal water projects could decrease the water available in shared water bodies by reducing the water level of the streams feeding them.

A further limitation of the frameworks governing the Arpaçay/Akhuryan Dam is that there is no transboundary cooperative framework for water quality standards and protection. This has become an issue because water quality behind the dam is poor (Adelphi 2017). Heavy metal and toxic materials have been found, in addition to the domestic waste that is released into the reservoir. Further, agricultural production has led to an increase in chemical pesticides and fertilizers, creating salinity issues in the reservoir and river. None of the current cooperative measures discuss transboundary water quality issues in the Arpaçay/Akhuryan reservoir (Adelphi 2017).

In 2009, Armenia and Turkey signed two protocols that would open the common border that has been closed since 1993 (personal communication 2017), but these protocols have not yet been ratified. It is not clear if these protocols would improve the management of the dam. It appears that Armenia and Turkey have been able to successfully cooperate on managing the Arpaçay/Akhuryan Dam mainly because they keep the cooperation low-key, free of high politics, and directed at the technical level. In addition, the operations and management of the dam are kept out of the public and media eye, and third-party involvement is avoided (personal communication 2017).

Despite the fact that Armenia and Turkey maintain no diplomatic relations, cross-border communities and employees from both sides seem to understand, empathize with, and assist each other in challenging water circumstances. To date, Armenia and Turkey have fulfilled the agreements and managed the basin cooperatively, efficiently, and peacefully (personal communication 2017).

Key Points

- Comprehensive, clear, and sustainable regulatory and institutional framework
- Low-profile, free of high politics, and directed at the technical level of management
- Instant informal communication
- Frequent subcommittee meetings
- The parties' water gauges are located in each other's regions, and the subcommittees gauge water together. In this way, both mutual trust and reliable access to information have been secured.

- Long-standing management experience and cooperation
- Support of the local farmers and administrators

Part B: Basin Water Quality

While the Kura-Araks River Basin includes five riparians, this section focuses on the management of water quality involving three of the riparian states—Armenia, Azerbaijan, and Georgia—which together comprise 65 percent of the basin area (Campana et al. 2008; Leummens and Matthews 2013). International donor projects, including this case study, tend to focus on these three riparians. Water quantity and annual variability in flows are important transboundary issues that have been identified in the basin. Concerns regarding water availability are more prevalent in the lower basin, where both Armenia and Azerbaijan are considered water-stressed—Azerbaijan has an annual deficit of 4-5 km^3 (Leummens and Matthews 2013). Water quantity issues are caused by an increase in demand on the Kura-Araks, predominately for agriculture, the increase in irrigation and lack of irrigation efficiency being a key factor. Climate change has and will continue to exacerbate water quantity issues because a decline in precipitation has been predicted for areas in the basin that are already under water stress (Leummens and Matthews 2013). The regional stakeholders have also identified water quality deterioration as a major transboundary issue in the basin through the TDA, the UNECE Water Quality Assessments, and other international projects (Abu Elseoud 2013; Leummens and Matthews 2013; Matthews 2014). Pollution in the basin is generally dealt with by dilution; however, the assimilation capacity is *spatially* variable (throughout the basin) and *temporally* variable as well. Water pollution is generally attributed to land-based sources, such as agriculture, industry, and mining, but another major contributing factor is the lack of operational or adequate wastewater treatment plants (Abu Elseoud 2013). While progress has definitely been made toward managing and addressing water quality issues in the basin, many challenges remain.

While this part of the study focuses on water *quality* management and the associated frameworks, water *quantity* management faces similar challenges. No multilateral agreements, treaties, or international bodies exist that manage transboundary water between Armenia, Azerbaijan, and Georgia, and no allocations have been established between the states. Many of the frameworks described below also oversee water quantity monitoring and management nationally. Other regulatory and national institutions for managing water quantity exist besides these frameworks. Overall, these frameworks place a greater emphasis on water *quantity* issues rather than water *quality* (personal communication 2017).

This section of the study briefly describes the regulatory and institutional frameworks that manage water in the basin, with a focus on the frameworks affecting transboundary water quality issues. The next section discusses and analyzes the implementation and effectiveness of the frameworks for managing water quality.

Regulatory Frameworks

International Conventions

Armenia, Azerbaijan, and Georgia are not signatories of the 1997 Convention on the Law of the Non-Navigational Uses of International Watercourses. However, some of the riparians have expressed interest in the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes, with Azerbaijan acceding to the Convention in 2000. Georgia has expressed interest in ratifying the 1992 Convention and has been supported by UNECE and OSCE projects, but is reluctant to sign the Convention because of the additional obligations and financial costs it would entail (Strosser, De Paoli, and Efimova 2017). The 1992 Convention has elements that are being included in transboundary cooperative arrangements and institutions in the region (Campana, Vener, and Lee 2012; UNECE 2017; United Nations 2011).

Regional Policies

Armenia, Azerbaijan, and Georgia have all signed the European Neighborhood Policy Action Plan with the EU in 2006. This policy does not directly relate to transboundary management of water quality in the Kura-Araks but, under the Action Plan, the involved countries agree to enhance regional cooperation, "in particular in regard to water issues" (Leummens and Matthews 2013). This also commits the countries to adopting legislation and policy that fits with the European Union Water Framework Directive (EU WFD) and the development of integrated management plans for river basins (Leummens and Matthews 2013; United Nations 2011). In addition, Georgia signed an EU Association Agreement, in 2014, to prioritize its sustainable development policies in line with EU environmental directives (United Nations Development Programme Global Environment Facility [UNDP-GEF] 2014). The President of Azerbaijan issued a decree that prioritized managing water quantity and quality so as to align with the EU environmental directives as well (UNDP-GEF 2014). Similarly, Armenia has enacted a State Reform Program that established national policies to harmonize with European standards (Taslakyan 2010).

Treaties and Other International Agreements

Currently, no multilateral agreement exists that governs water quality, water quantity, or water rights between the three riparians; this absence is probably related to the political conflict between Armenia and Azerbaijan (Campana et al. 2008). However, countries have been coordinating *bilaterally*, based on the principle of "parallel bilateralism"—a process by which Georgia-Armenia and Georgia-Azerbaijan collaborate in parallel (Newton 2007). The following agreements at least partially address water quality:

- The 1927 Agreement between the USSR and Turkey on the Utilization of Trans-boundary Streams, which includes several provisions on water quality protection (Taslakyan 2010, 2014). (Beyond this source, no other reference to this treaty was found, as it is not the same as the 1927 Agreement discussed in the previous section.)

- The 1974 Agreement between the Soviet Socialist Republic of Armenia and the Soviet Socialist Republic of Azerbaijan on the Joint Utilization of the Waters of the River Vorotan
- The 1997 Agreement between the Governments of Georgia and of the Republic of Armenia on Cooperation in Environmental Protection
- The 1997 Agreement between the Government of Georgia and the Government of Azerbaijan on Cooperation in Environmental Protection
- The 1997 Memorandum of Understanding between the Ministry of Environment of Georgia and the State Committee of Ecology and Nature Management of the Republic of Azerbaijan on Cooperation in the Development and Implementation of Pilot Projects for Monitoring and Assessment of the Status of the Kura River Basin
- The 2007 Memorandum of Understanding between the Ministry of Ecology and Natural Resources of Azerbaijan and the Ministry of Environment Protection and Natural Resources of Georgia
- The 2010 Environmental Agreement between Georgia and Armenia (as mentioned by an interviewee, no record of the agreement was found).
- An agreement is currently being negotiated between Azerbaijan and Georgia on Cooperation in the Field of Protection and Sustainable Use of the Water Resources of the Kura River Basin. This treaty is in line with the 1992 UNECE Water Convention principles, and negotiations have been supported by UNECE and the OSCE.

National Policies and Plans

Governance and management of water quality predominately takes place at the national level. The three countries have national policies or plans in place that include mechanisms for water quality. In 2002, Armenia enacted its Water Code and National Water Policy. This code includes provisions on the Regulation of the Use of Transboundary Water Resources (art 63-65). An important provision is that interstate agreements and/or treaties should be established, and permanent interstate committees should be created for the joint use and protection of transboundary waters (Taslakyan 2010).

As a component of the first UNDP-GEF Project—Reducing Transboundary Degradation in the Kura-Ara(k)s Basin—both Azerbaijan and Georgia developed a National Integrated Water Resources Management Plan. These plans support national-level policies and provide actions that link national priorities to transboundary issues. They represent the national component of the larger SAP agreed to and formally supported in 2014 by both Azerbaijan and Georgia. The SAP aims to facilitate a coordinated approach to transboundary river management and address the key issues identified by the Updated TDA. The deterioration of water quality is one of the four key transboundary issues identified through the project.

Institutional Frameworks

The institutional framework that governs water quality management in the three riparians is largely national and includes limited transboundary institutions. International donors and projects have had significant influence in the basin. This section presents the main institutions that govern and manage water quality resources in the basin.

International Institutions

Prior to the dissolution of the USSR, Armenia, Azerbaijan, and Georgia's national hydrometeorological agency monitored water resources (both their quantity and quality), and data were shared and stored centrally. In the post-Soviet era, the national hydrometeorological agencies and departments continue to monitor water resources, but the data exchange has stopped. International organizations and projects have attempted to resurrect the exchange of data between the states. For example, in 2003, a national-level data exchange was held, where data were shared bilaterally between Armenia-Georgia and Azerbaijan-Georgia (Development Alternative, Inc. 2002). This exchange did not continue and is discussed in more detail below.

Currently no joint commission—neither bilateral nor multilateral—exists in the basin. In parallel with negotiations for a bilateral agreement, Azerbaijan and Georgia are discussing the creation of a Joint Commission on Sustainable Use and Protection of the Kura River Basin. This commission would help coordinate transboundary cooperation between two of the riparians in the basin (Strosser, De Paoli, and Efimova 2017).

National Institutions

National institutions are the main stakeholders and decision makers on water quality issues in the Kura-Araks Basin. Armenia's MNP oversees the sustainable use and management of natural resources, including water. Under the MNP, the Water Policy Division oversees the National Water Policy. The Water Resources Management Agency implements national policies for water management and protection. The organization oversees the six Basin Management Organizations (BMOs) within Armenia—the Northern, Akhuryan, Ararat, Sevan, Hrazdan, and Southern BMO—that are part of a process to decentralize management and are responsible for implementing integrated water resources management (IWRM) in the respective basin areas (Leummens and Matthews 2013). Surface water quality monitoring as well as air and soil pollution are monitored by the Environmental Impact Monitoring Center; the Center expanded its monitoring activities in 2007, through its efforts to bring some monitoring in line with the EU WFD. Outside of the MNP, the National Water Council is an advisory body that is chaired by the Prime Minister and provides guidance on the National Water Policy and Program. Armenia has made significant changes to its regulatory and institutional framework, particularly as it moves toward a decentralized, integrated system that aims to comply with the requirements of the EU WFD (Leummens and Matthews 2013).

Azerbaijan's Ministry of Ecology and Natural Resources is the main authority on implementing policy for environmental protection, which includes the monitoring of water quality—both surface and groundwater. The Ministry is the main implementer of the state's water policy, which is aimed at the sustainable use of water resources. Within this Ministry, the Ecology and Nature Protection Policy Division directly oversees policies for the protection of water resources from pollution. The National Environmental Monitoring Department monitors water quality in the state. Within the Ministry of Emergency Situations, the State Agency on Water Resources was given new obligations in 2011 to protect national water reservoirs; oversee the monitoring of water resources; and monitor entities and facilities that use state water resources. This Agency and the Ministry of Emergency Situations are secondary to the Ministry of Ecology and Natural Resources, which takes priority for water quality management (Leummens and Matthews 2013).

The institutions in Georgia that oversee water resources are fragmented and centralized. Several ministries oversee different aspects of water management, including the Ministry of Agriculture, the Ministry of Regional Development, and most relevant to water quality, the Ministry of Environment and Natural Resources Protection (MENRP). The MENRP is responsible for the implementation of state policy regarding environmental protection, including water resources. Under the MENRP, the Service of Water Resources Management sets the policy related to surface water management, including the harmonization of national water plans with the EU WFD. It also coordinates river basin management plans and implements international agreements relating to surface water management. In addition to state-level institutions, local self-governance institutions supervise the use and protection of water within their municipality or territory (Leummens and Matthews 2013).

International Projects and Agencies

There has been a substantial amount of international support for transboundary cooperation and management over the Kura-Araks River Basin. Given the long-standing role they have played in the region, a select list of projects and agencies has been included as part of the institutional framework in the Kura-Araks River Basin that influences water quality management (UNDP-GEF 2014):

- Water Management in the South Caucasus (USAID 2000-04) helped to establish bilateral data sharing on water quality
- Science for Peace Program: South Caucasus River Monitoring Project (NATO, 2002-08) established database for data sharing that is no longer operational
- South Caucasus Water Program (USAID, 2005-08)
- EU Water Governance in the Western Eastern Europe, Caucasus and Central Asia (EECCA) Countries, Technical Assistance to the Commonwealth of Independent States (TACIS) (2008-10)

- Multi-Phase Project on Reducing Transboundary Degradation in the Kura-Araks River Basin (UNDP, Swedish International Development Cooperation Agency [SIDA], GEF, 2003-05, 2004-07, 2011-14)
- Implementation of the UNECE Water Convention and development of an agreement on the management of transboundary watercourses shared by Georgia and Azerbaijan (UNECE/OSCE/EU, 2009-10)
- Kura II and III—Transboundary River Management Phase III for the Kura River Basin (EU, 2008-13)
- Support for the management of transboundary watercourses shared by Georgia and Azerbaijan (Environment and Security [ENVSEC]/OSCE, 2010-14)
- Kura II: Advancing IWRM across the Kura river basin through implementation of the agreed transboundary actions and national plans (UNDP, GEF, 2014 to present)

Analysis and Implementation

The Water Quality Problem

The Kura-Araks Rivers are a key resource to the region, but they suffer from water quality issues. After the collapse of the USSR, the rivers and their tributaries became transboundary not only between Turkey and the Islamic Republic of Iran, but also between three newly independent states: Armenia, Azerbaijan, and Georgia. The agreements signed between the USSR and Turkey, and the USSR and the Islamic Republic of Iran are still mostly being implemented, despite the political changes. However, these agreements do not apply to the new transboundary portions between these three riparians. The legal framework for transboundary management between the three countries has not been adequately developed. However, with support from international donor projects, progress has been made toward the development of water quality monitoring standards and practices.

The TDA, completed as part of the UNDP-GEF Reducing Transboundary Degradation in the Kura-Araks River Basin Project, involved discussions with stakeholders and identified four main transboundary issues: (1) reduction and change in hydrological flow, (2) deterioration of water quality, (3) ecosystem degradation, and (4) flooding. Many stakeholders ranked water quality as their top concern for the basin, particularly in the downstream portion (Matthews 2014). The river is contaminated with chemical, industrial, biological, and agricultural pollutants. The lack of operational and adequate wastewater treatment plants is a major factor in the high degree of pollution; less water is being treated now than was treated 25-30 years ago, as most of the existing plants were constructed during the Soviet era and are either technologically outdated or no longer operational. Concentrations of contaminants exceed local and international monitoring standards. All three riparians rely on the assimilation capacity of the rivers to dilute the pollutants; during the annual

high-flow periods, pollutant levels are manageable, as the river has a decent ability to self-clean (personal communication 2017). However, during low-flow periods, the rivers' ability to assimilate the pollutant load is low (Abu Elseoud 2013). Azerbaijan, being the downstream riparian and relying heavily on the Kura-Araks for domestic, industrial, and agricultural uses (particularly for agriculture, where its extraction greatly exceeds that of its neighboring states), usually registers the worst levels of pollution (Leummens and Matthews 2013; Matthews 2014).

Political relations between Armenia and Azerbaijan compound the issue of lack of transboundary cooperation between the three riparians. Tensions over the Nagorno-Karabakh region have existed since the late 1980s, with violent conflict from 1991 until a ceasefire was negotiated in 1994. The conflict had been considered "frozen" but, in recent years, low-level conflict has been increasing in frequency and intensity with renewed heavy violence erupting in April 2016 (Economist 2016; Mirovalev 2016). Nearly three decades after the conflict first erupted, the issue has not been resolved, creating tensions between two of the three riparians with respect to diplomatic issues. Therefore, it has been difficult for the three riparians to come together to discuss transboundary management of the Kura-Araks River Basin.

Implementation of Regulatory and Institutional Frameworks

The above description of the regulatory and institutional frameworks that govern approximately 65 percent of the basin in Armenia, Azerbaijan, and Georgia shows that these frameworks are complex, fragmented, and multi-scalar. Given their complexity, it is difficult to determine their degree of implementation and differentiate between the on-paper and in-practice activities and actions. Most of the frameworks have been implemented at the national level, and to some degree within each country. In Armenia, the institutions and policies that govern water resources—not specifically address water quality issues—are working to establish IWRM and create a decentralized system that complies with the requirements of the EU WFD. However, to fully implement IWRM, coordination needs to be strengthened at the national and basin level (Leummens and Matthews 2013). Armenia has recently significantly improved its policy on monitoring water quality—monitoring now covers 105 parameters at 140 monitoring stations where transboundary sites are checked monthly (Abu Elseoud 2013). However, monitoring both quantity and quality at these sites and beyond is still hindered by the lack of financial and human resources (Leummens and Matthews 2013). In Azerbaijan, the institutions managing water have been evolving, as illustrated by the new obligations given to the State Agency on Water Resources within the Ministry of Emergency Situations, discussed above. Ultimately, the national frameworks are marked by limited information sharing between national institutions, and overlaps and gaps in institutional mandates that inhibit efficient management.

Further, water quantity and quality monitoring has only been partially implemented. Monitoring does not inform decisions aimed at actually improving the management of water resources (Leummens and Matthews 2013). Azerbaijan's monitoring program calls for the measurement of 25 parameters (of transboundary waters) at 44 monitoring stations, to be done *every 10 days* (Abu Elseoud 2013). Georgia's monitoring program similarly calls for 36 parameters to be checked at 43 monitoring stations, where both national and transboundary sites are sampled *monthly* (Abu Elseoud 2013). Furthermore, the parameters and standards have not been updated in either country and are consistent with monitoring practices in the USSR, which are not appropriate for the basin. The high turnover rates of staff and lack of adequate funds to fully implement quality-control procedures make it difficult to assess the reliability of the collected data and the degree of consistency with which they are collected according to the monitoring programs (Abu Elseoud 2013).

Georgia's national frameworks are highly centralized and fragmented; for example, no mechanisms whatsoever manage water at the local scale. However, a new Law on Water is being developed in Georgia that would call for basin-scale management. Given that management has been siloed into different state agencies, there is limited exchange of information and communication between the agencies involved in water quality management (Leummens and Matthews 2013).

No international multilateral framework exists in the basin between Armenia, Azerbaijan, and Georgia, aside from several UN Conventions (annex 1A). The regional policy that seems to hold the most potential for promoting change and cooperation is the signing of the European Neighborhood Policy and the intention to adopt policies that are in compliance with the EU WFD. As stated above, Armenia has made the most progress in updating water quality monitoring standards and procedures to fit with the EU WFD. However, both Azerbaijan and Georgia have formally indicated their intention to change their national water policies to align them with these standards as well. As these countries adapt their policies, this may provide a platform for future cooperation, despite the separate nature of each state's actions, given that it will make their national policies and monitoring standards more uniform.

Of the bilateral international agreements that are in place in the Kura-Araks Basin, most are broadly related to environmental protection and not specifically to water resources, even less so water quality. Of the agreements signed, only a few that are specific to these three riparians have entered into force—namely, the 1997 Agreement on Environmental Protection between Azerbaijan and Georgia, and the 2007 MOU between Azerbaijan and Georgia. These two agreements only cursorily mention transboundary waters. The 1997 Agreement relates to the protection of the Kura River and the Jandar Lake by noting the importance of the water resources for the countries (UNECE and OSCE 2009). The 2007 MOU stipulates that the states should establish groups entrusted with exchanging monitoring information to jointly protect and use the transboundary waters

(UNECE and OSCE 2009). While the parallel 1997 Agreement between Armenia and Georgia on Environmental Protection has been signed, it has not yet entered into force (United Nations 2011). If signed and implemented, the proposed agreement between Azerbaijan and Georgia on transboundary cooperation in the Kura Basin would represent substantial progress toward IWRM and basin-scale cooperative management. According to UNECE, the agreement will be available for signature in 2017 (UNECE 2017). However, it is possible the agreement will not to be signed, given that Georgia has held off on ratifying the 1992 UNECE Water Convention because of the additional obligations and financial costs it would incur (Strosser, De Paoli, and Efimova 2017). These same reservations could also apply to the agreement itself, because the treaty provisions are probably in line with the components of the 1992 Water Convention (since UNECE and the OSCE supported the negotiation of the agreement).

Since international donors and initiatives play a significant role in supporting national and transboundary water management, including protecting water quality, it is important to consider the level of implementation and sustainability of the projects in question. The USAID Water Management in the South Caucasus Project, and the NATO Science for Peace, South Caucasus River Monitoring Project are two examples of donor projects that have failed to sustainably support cooperation and transboundary management in the basin. The USAID project had established two councils to advise on water management for the Alazani and Khrami Rivers; these councils were never formally recognized by the governments and ceased functioning once the project had been completed (UNECE and OSCE 2009). In addition, this USAID project had developed a bilateral and national-level data exchange between Azerbaijan and Georgia, and Armenia and Georgia in 2003; however, this bilateral data exchange did not continue (Development Alternative, Inc. 2002). The South Caucasus River Monitoring Project had established a group with representatives of all three countries to meet annually to present and share the results of monitoring in the basin, and the data had been centrally hosted on a website for all to access. The project formally ended in December 2009. The website is no longer operational, and monitoring under the project's guidelines was discontinued, except perhaps in Azerbaijan, thanks to the country's greater interest as the downstream riparian (Campana, Vener, and Lee 2012).

One of the more long-lasting projects in the basin is the UNDP-GEF Reducing Transboundary Degradation in the Kura-Araks River Basin Project. The initial formation of the project involved all three riparians and conducted a TDA that culminated in producing a SAP that provides foundational support to the national and transboundary efforts to manage the basin (UNDP-GEF 2014). However, the current iteration of the project only involves the Kura Basin within Azerbaijan and Georgia; both countries have signed letters of endorsement for the SAP (UNDP-GEF 2014). Sources say there was potential for a separate but simultaneous project on the Kura-Araks in Armenia, but it was never approved or implemented because of lack of funding (personal communication 2017).

Progress and Challenges

The description above illustrates how complex and extensive, yet incomplete, the regulatory and institutional frameworks are that govern water quality management in the Kura-Araks River Basin in Armenia, Azerbaijan, and Georgia. The discussion allows four key points and lessons learned to be identified. First, the existing transboundary frameworks in the basin are mainly based on the principle of parallel bilateralism. For example, given the political conflict between Armenia and Azerbaijan, cooperative agreements on the environment have only been signed bilaterally between Georgia and Azerbaijan, and between Georgia and Armenia. Despite this encouraging example of cooperation in a region that is in conflict, the prolonged dispute could undermine the sustainability of cooperation and the effectiveness of attempts to develop transboundary cooperation. In short, projects developed and supported by international donors may not last, given the complex political situation.

Second, communication within national entities and between international agencies needs to be strengthened, and monitoring harmonized. There is a lack of uniform monitoring standards and uniform implementation of these water-quality standards among the riparians. Azerbaijan and Georgia still base their quality parameters on old Soviet standards that did not consider the local hydrology and background concentrations that may exist. On the other hand, Armenia has updated its monitoring standards to account for the background concentrations in the Kura-Araks River Basin (Abu Elseoud 2013). Even if the water-quality data that are currently being collected were to be exchanged between the riparians, they would not be comparable due to the lack of data uniformity.

Third, adequate funding and government support will be necessary for future transboundary cooperation. For example, the lack of funding for monitoring water quality in the riparian states will limit the positive impact and benefits of future transboundary cooperation. Nearly all transboundary cooperation on water quality is and has been donor-driven and supported by donor project activities. Thus, without support from international donors, there will be no formal or informal cooperation on transboundary water-quality issues (personal communication 2017). For transboundary water quality to improve, efforts to monitor and manage quality need funding and support from national, regional, and local governments.

Fourth, to truly move toward IWRM and manage the rivers at a basin scale, Turkey and the Islamic Republic of Iran should be included in future efforts to manage the basin cooperatively. As upstream riparians, the activities undertaken in both these countries are a major determinant of water quality. For example, the Arpaçay/Akhuryan reservoir has been found to be polluted by domestic waste, heavy metals, and toxic materials (Adelphi 2017).

The ultimate goal of regulatory and institutional frameworks that address water quality is to improve water quality and resolve pollution issues. Therefore, the question whether

the frameworks have been implemented is ultimately immaterial if the frameworks are not effective at improving water quality and addressing pollution. According to interview sources, the focus is mainly on water *quantity* issues, while water *quality* is only partially addressed (personal communication 2017). Therefore, water quality has overall shown very little improvement in the Kura-Araks River Basin. Much work remains to be done toward reaching transboundary cooperation between the riparians and improving the overall water quality of the basin.

Conclusions

The two cases studies presented here—management of the Arpaçay/Akhuryan Dam and water quality of the basin shared by Armenia, Azerbaijan, and Georgia—yield some lessons for similar issues in other basins, including the following:

- Collaborative frameworks, once firmly established, tend to be tremendously resilient, even if the governance setting and/or the parties change over time. Collaboration on the Arpaçay/Akhuryan Dam and water allocation, for example, was established between Turkey and the USSR, and survived not only the dissolution of the latter, but was continued and enhanced by Armenia and Turkey—two countries with a history of grievances and tensions.
- Establishing new, collaborative frameworks between tense co-riparians, however, is extremely difficult, given the inertia of existing political situations that has to be overcome. Despite the history of collaboration between Turkey and Armenia over the Arpaçay/Akhuryan Dam, for example, cooperation has not extended to new projects or the inclusion of water-quality issues in joint management. Similarly, despite extensive interest and funding from regional authorities, and counter to occasional breakthroughs, explicit collaboration between Armenia and Azerbaijan on joint management of water quality has not taken hold because of the existing tensions.
- Not all cooperation needs to be explicit. Due to political sensitivities, some components of collaboration are better left unwritten or not made public. Each of our interviewees on the Arpaçay/Akhuryan dam, for example, was reluctant to admit being well aware of their countries' collaboration, despite being justifiably proud of its smooth running. Similarly, the parties are not interested in third-party participation. Regarding water quality, neither Armenia, nor Azerbaijan, nor Georgia, have explicitly and effectively implemented cooperative frameworks without the involvement of an international donor to guide the project or activity. Cooperation, in this case, is secured almost entirely through the actions and funding of third parties.
- Quite a lot can be accomplished even in the absence of explicit cooperation. The best regional example of this what is possible based on the principle of "parallel bilateralism"—allowing projects between Armenia and Georgia, and Azerbaijan and Georgia to be

developed simultaneously in parallel. For example, the drafting and signing of the two 1997 Agreements on Environmental Protection; thus, explicit cooperation between Armenia and Azerbaijan was not necessary.

- Depending on the specific context, the legal language used should be either very precise or creatively ambiguous. Both approaches are useful, depending on the situation. "Harm," for example, is not clearly defined in the 1927 and 1973 Arpaçay/Akhuryan Agreements (nor is it likely to be intentionally ambiguous); this imprecision leaves the possibility of unilateral development taking place unabated on tributaries. By contrast, water management during droughts is not defined either, which allows for local, creative solutions to be developed when necessary. This creative ambiguity, while perhaps unintentional, has a positive impact on the management of water resources.
- Regardless of how agreements are written, trust and generosity in interpretation goes a long way. As discussed in part A, droughts along the Arpaçay/Akhuryan River were handled with compassion and creativity on both sides—combining an alternating water supply with the sharing of benefits of water-saving practices.
- For cooperation to occur, either explicitly or implicitly, there needs to be adequate communication between the parties. The lack of communication with the national agencies that monitor and regulate water pollution and quality issues further undermines communication between the riparians and compounds the tense political situation. This contrasts with the operation of the Arpaçay/Akhuryan Dam, where managers from the two countries regularly communicate, despite tense relations at the national level.
- Mutual trust and easily accessible information are also important for sustaining cooperation. In the Arpaçay/Akhuryan Dam case, the parties trust each other and have access to reliable information. Trust has gradually been built by having technicians from both countries literally work together to monitor the two countries' water gauges—verifying the data collected and compliance with the monthly water withdrawal schedule. This long-standing management experience, coupled with the delegation of authority to the committee and collegial decision making, have led to cooperation and trust, which has reportedly prevented serious conflicts.
- Similarly, focusing cooperation at the technical level seems to be effective. Decision making and problem solving may best be left to technical experts, escalating issues on the political echelon only when absolutely necessary.

Annexes

ANNEX 1A

Sub-Annex

TABLE 1A.1. Accession, Acceptance, Approval, or Ratification of International Water Conventions

Country	1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes[a]	1997 Convention on the Law of the Non-Navigational Uses of International Watercourses
Armenia	—	—
Azerbaijan	Accession: Aug 3, 2000	—
Georgia	—	—
Iran, Islamic Rep.	—	—
Turkey	—	—

Source: UNECE 2016.

Note: — = has not acceded, accepted, approved, or ratified.

a. The 1992 UNECE Water Convention was amended in 2013 to open the convention to all UN Member States. As of March 2016, all United Nations Member States outside the UNECE region are allowed to accede to it.

TABLE 1A.2. Accession (a), Acceptance (A), Approval (AA), or Ratification (R) of Select International Conventions

International convention	Armenia	Azerbaijan	Georgia	Iran, Islamic Rep.	Turkey
Convention on Wetlands of International Importance, Especially as Waterfowl Habitat	July 6, 1993 a	May 21, 2001 A	Feb 7, 1997 a	June 23, 1975 R	July 13, 1994 a
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Oct 1, 1999 a	Jun 1, 2001 a	May 20,1999 a	Jan 5, 1993 a	June 22, 1994 R
Espoo Convention on Environmental Impact Assessment in a Transboundary Context	Feb 21, 1997 a	Mar 25, 1999 a	—	—	—
Kyoto Protocol to the United Nations Framework Convention on Climate Change	Apr 25, 2003 a	Sept 28, 2000 a	June 16, 1999 a	Aug 22, 2005 a	May 28, 2009 a
Paris Agreement	Mar 23, 2017 R	Jan 9, 2017 R	Signed	Signed	Signed
Stockholm Convention on Persistent Organic Pollutants	Nov 26, 2003 R	Jan 13, 2004 a	Oct 4, 2006 R	Feb 6, 2006 R	Oct 14, 2009 R

Note: — = has not acceded, accepted, approved, or ratified.

Institutional Organization Charts

The following three pages present the national structure overseeing water resources management in Armenia, Azerbaijan, and Georgia. Figures 1A.1, 1A.2, and 1A.3 are from Leummens, H. J. L., and Mary Matthews. 2013. "Updated Transboundary Diagnostic Analysis for the Kura Ara(k)s River Basin." Reducing Transboundary Degradation in the Kura Ara(k)s River Basin. UNDP-GEF, Tbilisi, Baku, Yerevan. http://www.kura-aras.org/Digital Library files/TDA%202013%20-%2015Oct13%20FINAL%20-%20ENG.pdf.

FIGURE 1A.1. Institutional Framework on Water Management in Armenia

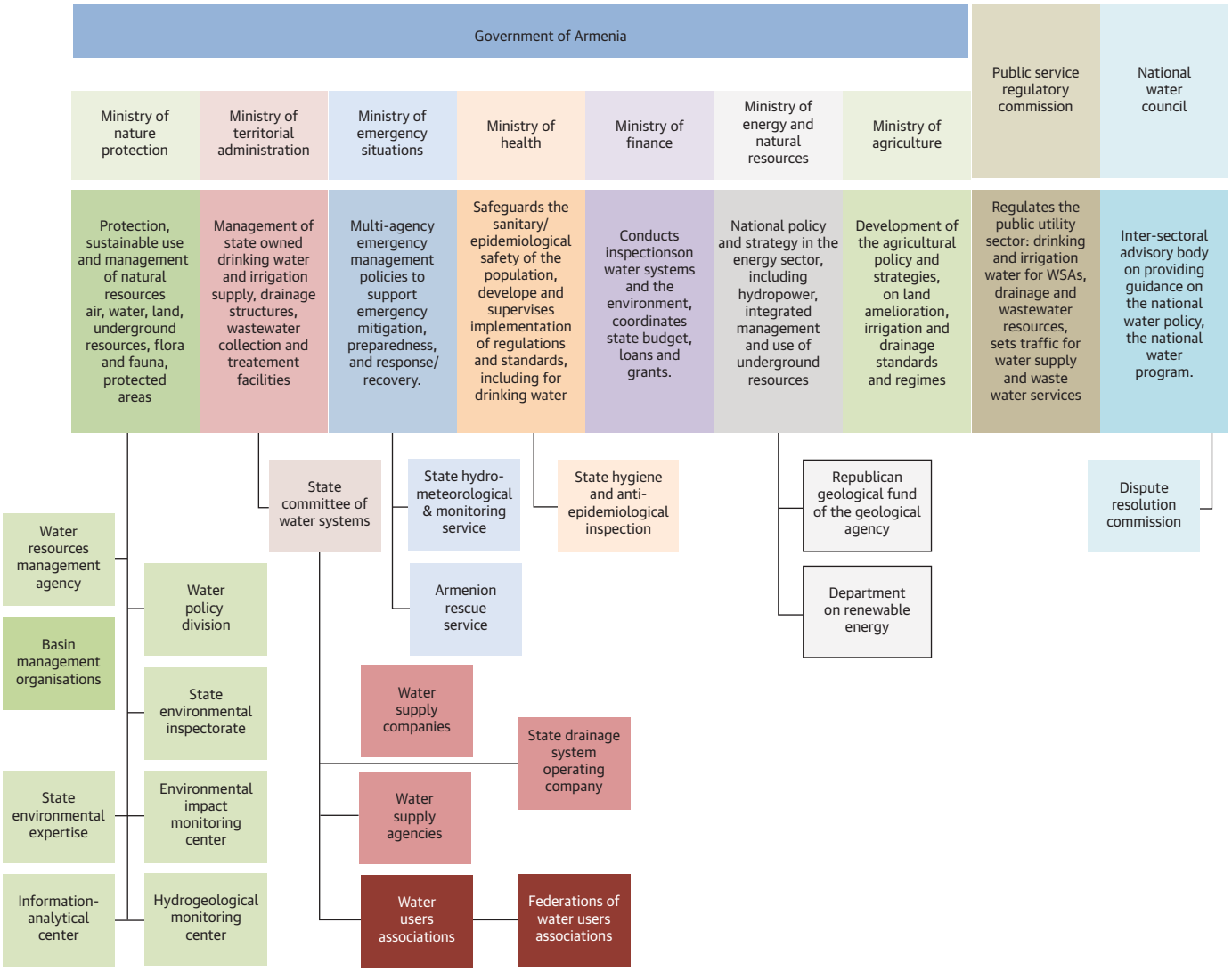
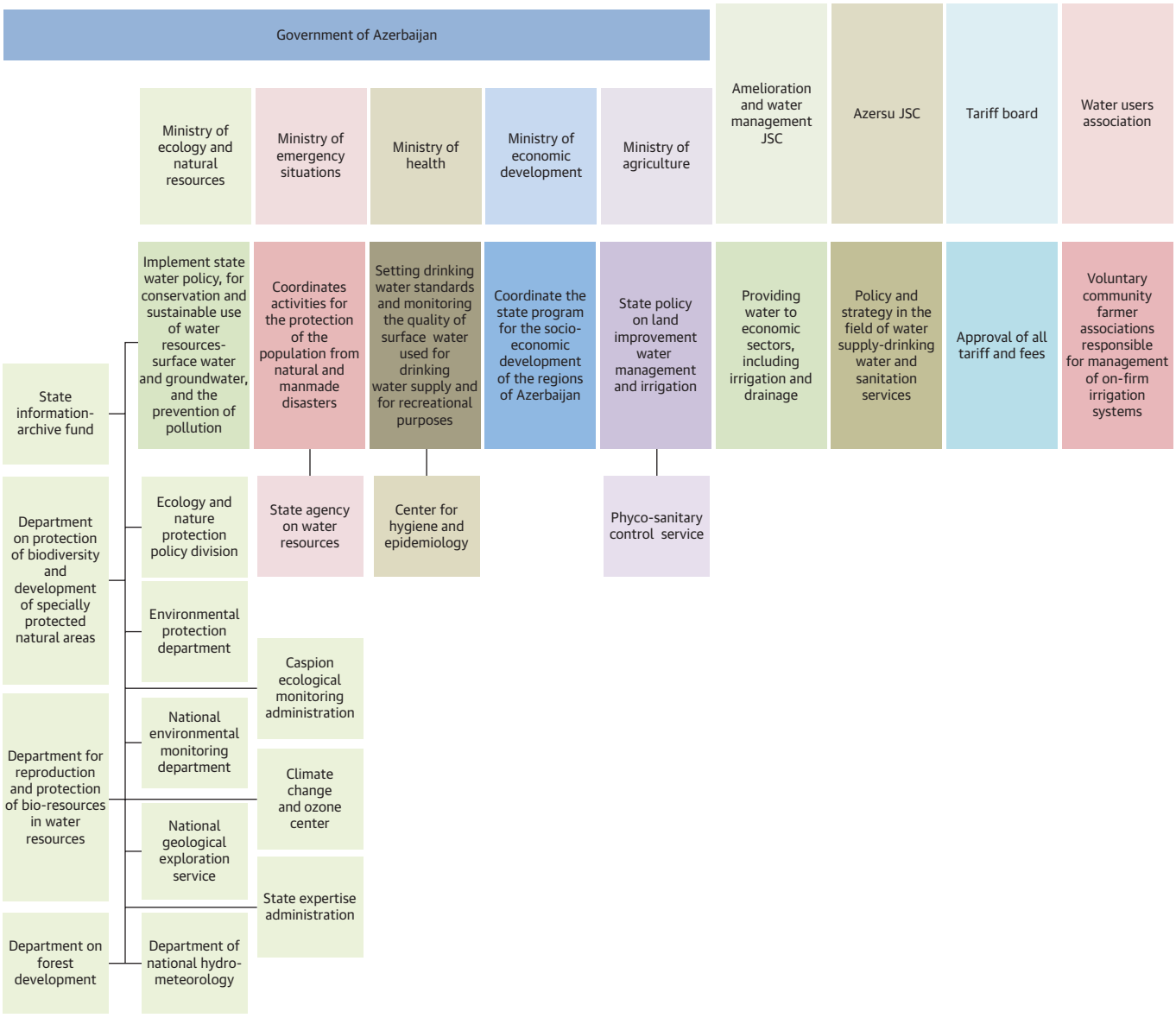


FIGURE 1A.2. Institutional Framework on Water Management in Azerbaijan



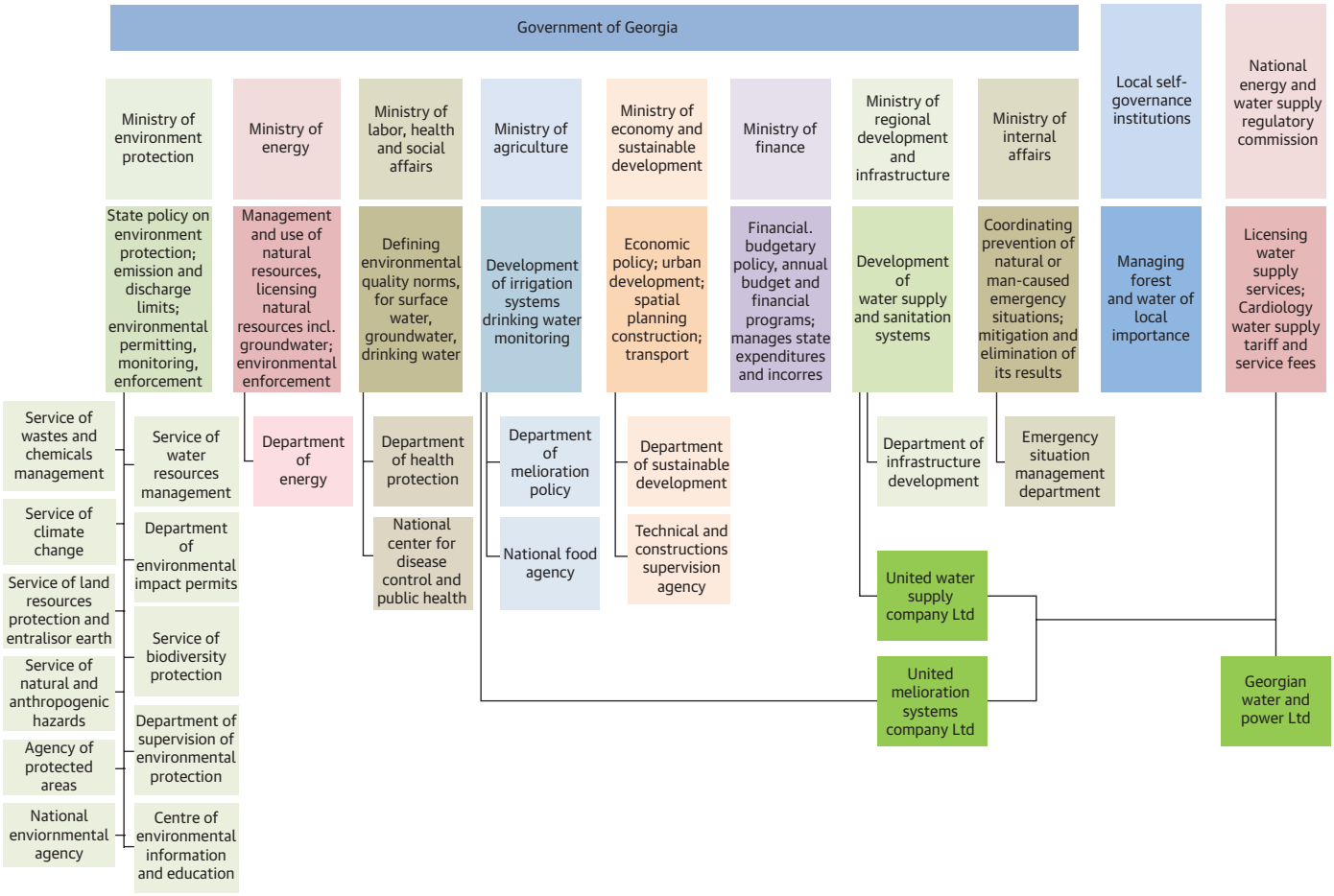
ANNEX 2A

Treaty and Agreement Text or Text Reference

Below are references and locations for treaties and agreements. Many international agreement texts were not available. The complete text of the 1927 USSR and Turkey Agreement is included below.

The following can be accessed in an English translation in the annex to Aysegul Kibaroglu, Annika Kramer, and Waltina Scheumann, eds. 2011. *Turkey's Water Policy*. Berlin, Heidelberg: Springer Berlin Heidelberg. http://link.springer.com/10.1007/978-3-642-19636-2.

FIGURE 1A.3. Institutional Framework on Water Management in Georgia



- Protocol on the Joint Construction of the Arpaçay Dam (1964)
- Cooperation Agreement on the Construction of a Dam on the Bordering Arpaçay River and the Constitution of a Dam Lake (1973)
- Protocol Concerning Mainly Technical Cooperation, Riverbed Changes (1990)

The SAP can be accessed in the annex to UNDP-GEF. 2014. "Project Document: Kura II: Advancing IWRM across the Kura River Basin through Implementation of the Transboundary Agreed Actions and National Plans (2014-2017)." UNDP-GEF 2014. https://www.thegef.org/sites/default/files/project_documents/5-18-16_Project_doc_0.pdf.

The Updated TDA can be accessed at Leummens, H.J.L., and Mary Matthews. 2013. "Updated Transboundary Diagnostic Analysis for the Kura Ara(k)s River Basin." Reducing Transboundary Degradation in the Kura Ara(k)s River Basin. UNDP-GEF, Tbilisi, Baku, Yerevan, http://www.kura-aras.org/Digital_Library_files/TDA%202013%20-%2015Oct13%20FINAL%20-%20ENG.pdf.

The next pages contain unofficial English translations of the following two agreements:

- The 1927 Protocol on the Beneficial Uses of Boundary Waters (1927), which was located at Международные соглашения по охране природы, Издательство "Юридическая литература," Москва, 1966 г. [International Agreements on Nature Protection, Publisher: Juridical Literature, Moscow 1966].
- The 1973 Cooperation Agreement on the Construction of a Dam on the Bordering Arpaçay River and the Constitution of a Dam Lake (1973).

Only available in the Russian language (copy with the authors):

- The Agreement between Russia and the Republic of Armenia on the Status of Border Troops of Russia Located in the Territory of the Republic of Armenia and Operational Procedures; signed September 30, 1992, in Yerevan. Open sources in Russia: Договор между Российской Федерацией и Республикой Армения о статусе Пограничных войск Российской Федерации, находящихся на территории Республики Армения, и условиях их функционирования (Ереван, 30 сентября 1992).

Convention Concerning Use of Water from Border Rivers and Streams between the Union of Soviet Socialist Republics and the Turkish Republic

Unofficial Translation

(Refer additionally to Protocol 792_081 to the Convention dated January 8, 1927.)

The Central Executive Committee of the Union of Soviet Socialist Republics, on the one part, and the Turkish Republic, on the other part, aspiring to continue hearty relationships and sincere friendship between them based on mutual interests, resolved to conclude, in the interests of both parties, this Convention Concerning Use of Water from Border Rivers and Streams, and to this end, appointed their Plenipotentiaries, who, after having exchanged their confirmations of authority which were found to be proper and lawful, agreed as follows:

Article 1

Both Contracting Parties shall use equally water from rivers and streams coinciding with the border between the Union of Soviet Socialist Republics and the Turkish Republic.

Article 2

Each Contracting Party reserves the right to keep all water use facilities existing as at the effective date of this Convention. The structure of such facilities may be improved or rehabilitated and the Contracting Parties shall maintain or rehabilitate their respective facilities in accordance with technical water use requirements.

Article 3

To apportion water and study river flows, both Contracting Parties shall install stream gauges (to determine cross sections, as well as water horizons and speed).

Both Parties shall have the right to measure river cross sections where water quantities need to be determined.

The place for locating stream gauges shall be selected by a Joint Commission comprising an equal number of representatives of both Contracting Parties.

Article 4

To measure water flow in rivers, both Contracting Parties shall form a Joint Commission on a parity basis, which shall determine twice a year, from 15 June to 1 July and from 1 September to 15 September, water flow at stream gauges located on the rivers determined by this Convention and prepare joint reports on water quantity.

The Joint Commission shall comprise two representatives of each of the Contracting Parties.

If river flow decreases and one of the Contracting Parties declares the need to determine river flow at respective stream gauges beyond the above timeframes, the other Party shall send its representatives within 15 days after the respective Government is notified about the intention to make measurements. If representatives of one of the Parties do not arrive on time, the other Party may determine river flow on its own, but shall provide the results of measurements to the other Party.

If the other Party obtains different results as a result of measuring the same flow, it shall have the right to require re-measurement. Both Contracting Parties shall bear common costs associated with the measurement of river flow by the Joint Commission in equal proportion.

Article 5

If water level needs to be raised in rivers, or artificial reservoirs need to be built in order to construct irrigation canals, each of the Contracting Parties shall have the right to build barrages.

a. If a Party builds a barrage it shall ensure that the quantity of water the other Party has the right to flows through the respective barrage or reservoir without hindrance and that fish can pass freely.

b. During barrage construction both Contracting Parties shall have the right to use both river banks for preparatory work and to arrange temporary water flow during construction, as well as build all possible kinds of water facilities, temporary tunnels, or protective structures (without limitation). Such facilities shall not divert water by more than 250 meters from the construction site.

c. The Party building a barrage shall use all endeavors to hold the other Contracting Party harmless against damages that may be caused by barrage construction and, upon

completion of the work, shall indemnify the other Contracting Party for any damages so caused despite the measures taken.

Barrages that may be used as bridges shall be built under a special agreement to be entered into in each case by both Governments.

Article 6

To protect the banks of the rivers that form the border against caving, each of the Parties reserves the right to build dams, provided that the other Party shall be protected against harmful effects of such construction.

Article 7

Neither of the Contracting Parties may change artificially the thalweg of a river. If border rivers deviate from their beds, both Parties shall have the right to regulate and correct both banks of the above rivers, provided that the other Contracting Party is given a timely notice.

Article 8

Both Parties shall reserve the right to build hydropower plants and mills, provided that water discharge points at such plants and installations are located close to each other so as to prevent damages to the other Contracting Party and that the river section (idle section) used by the respective hydropower plant or mill does not have water withdrawal facilities of the existing irrigation canals or those proposed for construction, or other facilities of the Contracting Parties covered by this Convention.

Article 9

Each Party shall have the right to build pumping stations provided that it uses only the portion of water it has the right to use.

Article 10

The final selection of the location and types of facilities indicated in Articles 3, 5, 6, 7, 8, and 9 of this Convention shall be done and recorded by the Joint Commission mentioned in the preceding articles.

The time for the convocation of the Joint Commission shall be set within not more than three months from the date of the respective notice given by any of the Parties. The Party that undertakes to convoke the Joint Commission shall send to the Government of the other Party, along with the convocation notice, the schematic layout of the designed facility.

If the Joint Commission has different opinions, all disputed issues shall be referred for final resolution to the Governments of both Parties.

Article 11

Citizens of both Contracting parties may use water from the flows forming the border between the Union of Soviet Socialist Republics and the Turkish Republic in equal proportions and on the following terms:

1. Citizens of both Contracting Parties shall use rivers and streams coinciding with the border and used to install mills, for irrigation, as watering places for animals or for fishing, during daytime without special permission.

   Approaching a river bank in the night if this is necessary for household needs is only permitted at places mutually agreed by border authorities of both states.
2. Animals brought for watering shall not pass onto the territory of the other Party.

   If animals cross the border, the shepherd is permitted to cross the border by not more than 50 meters so as to bring the animals back as soon as possible.

   Watering points shall be installed and agreed upon by border authorities of both Parties.
3. Each Party may fish from its bank. Fishing in the night shall be prohibited.
4. This Article shall not extend to the rivers of Aras, Arpa-Chai, Poskhov-Chai, Kura, and Çoruh.

Article 12

This Convention shall be ratified within two months of signing.

It shall take effect from the date of exchange of the instruments of ratification.*

The exchange of the instruments of ratifications shall take place in Angora as soon as possible.

This Convention shall be effective for five years. If neither Party takes action to repeal or amend this Convention before its expiry, the Convention shall remain in effect for another year and shall be effective until action is taken to repeal or amend it.

In witness whereof the above Plenipotentiaries signed this Convention and attached their seals to it.

Made in two counterparts in French, in Kars, on the eighth of January nineteen twenty-seven.

[Signatures of the Plenipotentiaries]

* Effective from June 26, 1928.

"Международные соглашения по охране природы," Издательство "Юридическая литература," Москва, 1966 г. (International Environment Protection Agreements, Legal Literature, Moscow, 1966).

Agreement between the Government of the Union of Soviet Socialist Republics and the Turkish Republic on Cooperation in the Construction of a Dam and a Water Reservoir on the Akhurian (Arpa-Chai) Border River

Unofficial Translation (Ankara, October 26, 1973)

The Government of the Union of Soviet Socialist Republics and the Government of the Turkish Republic,

- proceeding from the existing good neighborly relations between the countries;
- taking into consideration the terms and conditions of the Agreement on the Use of Border Water signed by the Soviet Union and Turkey in Kars on January 8, 1927;
- aspiring for further development of mutually beneficial economic and technical cooperation between the Soviet Union and the Turkish Republic; made this Agreement as follows.

Article 1

The Government of the Union of Soviet Socialist Republics and the Government of the Turkish Republic decided to cooperate in the construction of a dam and a water reservoir with a storage capacity of 525 million cubic meters on the Akhurian (Arpa-Chai) border river between the USSR and Turkey.

Article 2

To effect cooperation as set forth by Article 1 hereof, Soviet organizations shall prepare detailed engineering drawings and ensure the construction of a dam and a water reservoir with a storage capacity of 525 million cubic meters on the Akhurian (Arpa-Chai) border river, as envisioned by the engineering design approved by authorized organizations of the Parties, including the supply of equipment and materials necessary for construction.

Article 3

To effect cooperation as set forth by Article 1 hereof, the respective Turkish organizations shall take part as equal partners, to the full extent, in technical supervision over dam construction.

Article 4

The Parties shall finance the expenses associated with dam construction, the cost of which totals, according to the engineering design prepared by Soviet organizations, 16.6 million rubles, in equal proportions, which means that each of the Parties shall pay 50 percent of the above amount.

Article 5

Since irrigation facilities in the Turkish territory will not be built in a timely manner, to compensate losses to the Turkish Party, which has the equal right to use water and the dam, during the initial period of operation, the Soviet Party shall pay 4.4 million rubles from Turkey's share in the cost of the dam. This provision shall not contradict the principle of parity between the Soviet and Turkish Parties in incurring expenditure for the construction of the dam and in using water.

Article 6

The Turkish Party, in consideration of its share in the equal financing of dam and water reservoir construction, decreased by 4.4 million rubles as set forth by Article 5 hereof,

shall perform, predominantly in its own territory, a part of the construction work agreed by the Parties. The list of the construction work to be performed by the Turkish Party is provided in annex 1A hereto and forms an integral part hereof.

Article 7

Soviet specialists involved in construction shall be provided, in accordance with the Turkish law, with all preferences for the period of construction relating to their entry to, exit from, and presence at the construction site, which shall be arranged on the Turkish side and surrounded by a wire fence. Turkish specialists involved in construction and technical supervision shall have the same rights. The Soviet and Turkish personnel engaged in dam operation shall have the right to pass without hindrance to the Turkish and Soviet sides of the dam, which shall be determined jointly.

The procedure for the performance of the above provisions is provided in annexes 2 and 3 hereto.

Article 8

Equipment and materials to be delivered to the construction site hereunder shall be exempt from customs duties and other taxes.

Equipment and materials remaining after dam and water reservoir construction shall be removed by Soviet and Turkish organizations on the terms and conditions provided above.

Article 9

Based on a mutual understanding, the Parties may maintain and overhaul the dam and the water reservoir jointly, by providing mutual services on a parity basis.

Article 10

The operation of the dam and the water reservoir on the Akhurian (Arpa-Chai) River shall be in accordance with the Guidelines provided in annex 3 hereto.

Article 11

Soviet and Turkish organizations shall, within three months of signing this Agreement, prepare contracts (documents) containing detailed conditions of cooperation in the construction of the dam and the water reservoir on the border river of Akhurian (Arpa-Chai) as envisioned by this Agreement. Such contracts (documents) shall be signed by the respective organizations after this Agreement takes effect.

Article 12

Irrespective of the outline and size of the water reservoir, which shall form as a result of dam construction on the Akhurian (Arpa-Chai) River, the current border between the two states shall not change. When the water reservoir is filled, the current border shall be marked on the water surface with buoys anchored to the bed of the reservoir.

Article 13

This Agreement shall take effect on the day the Parties exchange notices about having complied with necessary formalities as required by the internal laws of each of the Parties.

Article 14

This Agreement is made in Ankara on October 26, 1973, in two counterparts in Russian, Turkish and French each. In the event of different interpretations of the texts in Russian and Turkish, the Parties shall be governed by the text in French.

[Signatures]

Information about compliance with the internal procedures:

- Turkey—August 8, 1975;
- The USSR—Decree 2660-IX of the Presidium of the Supreme Council of the USSR dated December 15, 1975.

The instruments of ratification were exchanged in Moscow on December 24, 1975.
Annex 1 to the Soviet-Turkish Agreement dated October 26, 1973.

Rules of Simplified Mutual Crossing of the Soviet-Turkish Border and Temporary Stay of Soviet and Turkish Citizens Involved in and Supervising Dam Construction on the Akhurian (Arpa-Chai) River

Simplified Procedure for Crossing the Soviet-Turkish Border on the Border Section of the Akhurian (Arpa-Chai) River

Unofficial Translation

1. The simplified procedure for border-crossing shall be in effect in accordance with this Agreement for Soviet and Turkish specialists and workers involved in the construction of the dam and related facilities on the Akhurian River, as well as for vehicles, machinery, equipment, materials, food, medicines and other goods transported from the construction site.

TABLE 1A.3. List of Dam Facilities on the Akhurian (Arpa-Chai) River to Be Built by Turkish Organizations in Accordance with Article 6 of this Agreement

No.	Facility
1	Watertight facilities
2	Upstream and downstream cofferdams
3	Operation buildings
4	Communication buildings
5	Road to the irrigation water discharge facility (left bank)
6	Right-bank road
7	Dam site landscaping

2. To cross the Soviet-Turkish border, a person shall have a standard identity card with his or her photograph, in Russian and Turkish, signed by and bearing the stamps of Soviet and Turkish border officers (the templates of the identity cards are attached).[2]

3. Identity cards shall be issued to Soviet and Turkish specialists and workers involved directly in dam construction.

   An identity card permits: (a) to cross the Soviet-Turkish border at any time of day at one of the permanent checkpoints located on the construction site to pass to the construction site on the other side of the border; and (b) move by vehicle or on foot to construction and residential locations. Identity cards shall be valid for the period indicated therein.

4. Identity cards shall be issued to Soviet and Turkish specialists and workers after they are finally processed by border officers of the Parties. Each border officer shall issue identity cards for the citizens of their respective country and provide them for further processing to the border officer of the other Party. The respective border officer shall return the processed or non-processed identity cards within 72 hours of their receipt.

5. The passage through the Soviet-Turkish border on the Akhurian River simplified in accordance with these Rules shall be ensured by border authorities of the USSR and the Turkish Republic.

   The location of checkpoints shall be determined and marked on the site by border officers of the Parties with a respective statement to be issued in Russian and Turkish in two counterparts each. The selection and marking of checkpoints shall be completed within one month from the effective date of these Rules.

6. If there is no more need in one of the permanent checkpoints, the abandonment or non-use of such checkpoint shall be ensured in accordance with an agreement between border officers of both Parties. The abandonment of such checkpoints shall be recorded in a statement in two counterparts, in Russian and Turkish each.

7. Soviet and Turkish border authorities shall arrange control posts in their respective territories at the locations of permanent checkpoints.

   Control posts shall have the right to check that all Soviet and Turkish citizens have documents authorizing their simplified passage.

8. Each control post shall have the lists and photographs of the Soviet and Turkish citizens holding the identity cards authorizing their passage through the Soviet-Turkish border at such post. The lists in two original counterparts, in Russian and Turkish each, shall be prepared by the respective border officer and shall include the specialists and workers of the respective Party, with one counterpart bearing a signature and a stamp to be provided to the border officer of the other Party.

   The lists shall include the order number, the surname, name and patronymic, the sex (male or female), the profession, the identity card number and its period of validity.

If Soviet or Turkish citizens lose their identity cards (documents authorizing them to cross the Soviet-Turkish border), the respective border officer shall notify the border officer of the other Party to that effect immediately.

9. Official correspondence for the construction organizations shall be passed in envelopes under a register issued for the delivering person (the form of the register is attached).[3]

   The Parties shall have the right to control such envelopes.

10. The following materials and things shall be passed with preliminary authorization for sending and delivery:

    a. intra-institutional printed materials relating to dam construction, either published or copied;

    b. technical and official documents, drawings, layouts, sketches and maps for dam construction and equipment sent separately from such equipment.

11. The following materials and personal belongings shall be passed without preliminary authorization for sending and delivery:

    a. scientific and technical literature relating to surveying and dam construction;

    b. documents confirming education, qualification and profession;

    c. birth certificates;

    d. clothes, hygienic items and other personal belongings, as well as food items (in insignificant quantities).

12. The items prohibited from bringing in or from the country by its respective laws shall not be permitted to pass the state border.

Dam Construction Site and Related Regulations

13. A construction site covering land in the Soviet and Turkish territories shall be arranged for the period of the construction of the Akhurian (Arpa-Chai) dam on the Soviet-Turkish border. The total area of the construction site shall not exceed 9 square kilometers.

14. The delineation of the construction site at the place of construction shall be arranged by border officers of the Parties with the participation of representatives of interested organizations.

    The construction site shall be delineated within one month from the ratification of this Agreement on the joint construction of a dam and water reservoir on the Akhurian (Arpa-Chai) River.

15. With increases in construction volumes, the boundaries of the construction site may be expanded or narrowed. A decision to change the boundaries of the construction site shall be made by the respective border officers with the participation of representatives from interested organizations.

16. The construction site shall include water and other facilities, auxiliary buildings, administrative premises, warehouses, medical aid stations and other buildings necessary for construction. Electric lighting shall be arranged on the construction site.

    In exceptional circumstances, with the agreement of border officers, construction material pits located beyond the dam construction site may be used.

17. The dam construction site shall be surrounded by a wire fence. The construction administration shall arrange safeguarding of constructed facilitates, buildings, machinery and equipment at the construction site.

18. Four passages, two in the Soviet territory and two in the Turkish territory, shall be arranged to ensure the passing to the dam construction site of Soviet and Turkish specialists, workers and vehicles. Each passage shall have a number. The numbers of the passages in the Soviet territory shall be 1 and 3, and in the Turkish territory 2 and 4. The respective passage number shall be indicated in the identity cards, authorizing their holders to pass through the respective passage only.

19. The passage to the dam construction site shall be ensured by the border representatives of the Soviet Union and the Turkish Republic 24 hours a day through permanent checkpoints. Each Party shall arrange control posts at the checkpoints vested with the rights set forth in Article 7 of these Rules.

    Such control posts shall have copies of the lists of persons holding identity cards to pass through the respective passages at the construction site.

20. The Parties shall authorize Soviet and Turkish specialists and workers to move and perform construction work within the dam construction site. Vehicles and their drivers going through the passages at the construction site to the territory of the other Party through permanent checkpoints shall be issued documents in the form provided in annexes 1^4 and 2. The documents shall indicate the numbers of the passages through which they may pass.

    The respective list shall be provided to control border posts.

21. Telephone communications may be arranged between constructed facilities at the construction site.

22. Soviet and Turkish specialists and workers authorized to be present at the construction site shall be prohibited from:

    a. entering or exiting not through the passages they are authorized to pass through;

    b. contacting strangers and giving to, or receiving from, them various items through the fence around the construction site;

    c. being present at the construction site during non-working hours.

23. The Soviet and Turkish specialists and workers who are in violation of these Rules in the border areas beyond the construction site shall be held liable in accordance with the laws of the Party, in the territory of which they are present.

24. If during the dam construction period an action is committed in the temporarily fenced territory that contradicts the law, order and general provisions, the investigation and prosecution of the guilty persons shall be in accordance with the laws of the Party, in the territory of which the offence was committed.

25. If, during surveys or dam construction on the Akhurian (Arpa-Chai) River, any of the Soviet or Turkish specialists or workers is injured or killed, damages to the affected person or his or her family shall be paid by the country, at its own expense, of which the affected person was a citizen, in accordance with the current national regulations of such country. The Party, of which the affected person is a citizen, reserves the right to sue the Party that was the cause of the accident. In such an event the courts of the country, in which the accident had place, shall have the right to deal with the matter and pass judgments in accordance with its law.

    No pension settlements shall be made between the Parties.

26. The permanent border officers shall settle any issues envisioned by these Rules and related to surveys and construction on the Akhurian (Arpa-Chai) River, the issue of documents for the simplified crossing of the Soviet-Turkish border for people and freight, and ensuring compliance by the construction administration, the Soviet and Turkish specialists and workers with these Rules in accordance with the bilateral treaties between the Union of Soviet Socialist Republics and the Turkish Republic and the current national laws of the Parties.

27. The Soviet and Turkish specialists going from the Soviet Union to the Turkish Republic and from the Turkish Republic to the Soviet Union with respect to dam construction on the Akhurian (Arpa-Chai) River shall be permitted to enter the construction site with passports bearing a visa of the other Party.

28. These Rules shall terminate after the construction of the Akhurian (Arpa-Chai) dam and water reservoir is completed and final commissioning statements are made by the government commissions of the Soviet Union and the Turkish Republic.

    Annex 3 to the Soviet-Turkish Agreement dated October 26, 1973

Guidelines on the Joint Operation of the Dam and Water Reservoir on the Akhurian (Arpa-Chai) River

Unofficial Translation

General Provisions

After dam construction is completed, the Parties shall reserve the right to draw and use water they have the right to use at any place, at any time and in any quantities from the water reservoir, or downstream of the water reservoir from the border rivers of Akhurian (Arpa-Chai) and Aras, down to the border with the Islamic Republic of Iran, without violating the rights of the other Party. These Guidelines set forth the rules for the operation of the dam

and all facilities related to the water reservoir, as well as all stream gauges and installations used for observation and measurements.

To solve issues pertaining to joint water use as well as the operation of the reservoir and its facilities, a standing Commission shall be set up comprising three representatives from each of the Parties: a chief engineer for water reservoir operation, an operational specialist, and a hydraulic engineer. Each Party shall notify the other Party of the names and positions of its representatives in the standing Commission via the border commissioner.

The standing Commission shall act in accordance with these Guidelines and shall be governed by the principle that each of the Parties has the right to draw a half of water from the water reservoir or the Aras River, in any border region of the Akhurian (Arpa-Chai) and Aras Rivers that form the state border. To fulfill the decisions of the standing Commission, a sub-commission shall be set up comprising three representatives of the operational service from each of the Parties.

The border commissioners shall notify each other about any changes necessary in the composition of both commissions.

Any issues relating to the border control regime during the joint operation of the water reservoir, as well as the place, time of, and procedure for, meetings between Soviet and Turkish specialists shall be resolved via the border commissioners of the Parties.

The Parties shall permit specialists and members of the standing Commission and its sub-commission to enter their respective territories to perform the work indicated in these Guidelines, provided that they hold their respective identity cards with the place and time of border crossing indicated in them.

Functions of Standing Commission

1. The main tasks of the Commission shall be the preparation of annual water reservoir operation programs and the control of their fulfillment.
2. During its meetings convoked once a month, the Commission shall make decisions on:
    a. issues relating to the operation of the water reservoir and related facilities;
    b. the use of water by the Parties in accordance with the water use program;
    c. the sanitary condition of the water reservoir;
    d. fishing and fish farming; or
    e. disputes arising between the Parties' operational personnel.
3. The standing Commission shall adjust, as requested by one of the Parties, water use schedules and the maintenance and repair program.
4. The standing Commission shall check once a month whether the amount of water actually drawn by the Parties correspond to the current water use plan. When checking actual water use, the standing Commission shall calculate the overall balance for the Akhurian (Arpa-Chai) River and the water reservoir as provided in Form 2[4] attached to these Guidelines.

To calculate the balance of water released from the water reservoir and downstream of the dam, stream gauges with recorders shall be installed on the Akhurian (Arpa-Chai) and Aras Rivers in addition to the existing ones. Observation data processed by the operational service of each of the Parties shall be submitted to the Commission once a month in accordance with Form 3[5] attached to these Guidelines.

5. During the operation period, the standing Commission shall conduct regular visual inspections of the dam and other facilities and prepare defect records stating all deformations and damages (displacements, subsidence, cracks, etc.).

   The Commission shall decide on the measures necessary to make good the consequences of deformations and prevent their development and shall control compliance with such decisions.

6. The standing Commission reserves the right to refer issues on the rearrangement of any components of the structures to the competent authorities of both Parties.
7. The Commission shall work on a parity basis. Any disagreements arising during the Commission's work shall be referred to the competent authorities of the Parties.
8. The Commission shall have meetings in the Soviet and Turkish territories in rotation.
9. The Commission shall meet monthly as required by one of the Parties. The date and place for meetings shall be determined based on a preliminary mutual agreement.
10. To ensure the work of the Commission, a four to five-room building shall be built near the dam on each side. One of the rooms shall be provided for negotiations.

Maintenance and Repair

11. Each Party shall maintain and repair facilities on its side.
12. The dam shall be regularly observed by the operational service of each of the Parties.
13. All deformations of, and damages to, facilities shall be revealed by regular visual inspections.

    To identify displacements, the dam and other facilities shall be linked to permanent height and horizontal marks. The operational personnel shall conduct regular checks of the marks of the facilities and their components.

14. Expansion joints in the dam and other facilities shall be under ongoing control and any damaged joints shall be sealed waterproof where necessary.
15. Impermissible deformations and damages from various causes shall be remedied without delay.
16. Metal parts of facilities shall be lubricated and painted in accordance with the maintenance rules and shall be in the operating condition on an ongoing basis.
17. Water filtration from the reservoir and through the dam shall be under special control.
18. In the winter, lifting mechanisms and other equipment shall be regularly checked for mobility and shall not be permitted to freeze.

19. The dam and its facilities shall be inspected in detail every three to five years by a commission comprising responsible specialists of both Parties.

    The standing Commission shall fulfill decisions of such a commission.

20. Work during the operation period shall be conducted by each Party using its own personnel, materials and equipment.

    Each Party shall arrange additional operating facilities on its own based on a mutual agreement.

Water Apportioning

21. The Parties shall draw water from the water reservoir in accordance with the water use program.

22. The Parties may draw half of the water from the water reservoir or the Aras River in any border region of the Akhurian (Arpa-Chai) and Aras River that form the border.

23. The standing Commission shall check the amount of water used by each of the Parties for compliance with the water use program annually, at the end of the irrigation season.

24. The Parties shall use their respective portions of water drawn from the water reservoir at their own discretion at any place and time in accordance with the schedule of water withdrawal. To determine the quality of water flowing to, and drawn from, the water reservoir and the rivers, both Parties shall install necessary stream gauges with recorders.

25. The preliminary water use programs shall be adjusted to climatic conditions of the year and changes in the rivers' hydrologic regimes.

    When a water use program is adjusted, the main water apportioning principles set forth by the Protocol dated April 25, 1963, shall be complied with.

26. In terms of annual water use, the total amount of water drawn by the Parties shall be equal. The standing Commission shall determine at its monthly meetings the amount of water to be drawn by the Parties during the next months and indicate the places of water withdrawal.

    If one of the Party so requires, an extraordinary meeting shall be convoked to consider water use issues and make changes to monthly water withdrawal schedules.

27. Both Parties reserve the right to use their respective portions of water going through discharge sluices at any time and in any quantities.

28. If the Parties build hydropower plants, water releases from the water reservoir for this purpose shall not entail changes in the height of the dam or the volume of the water reservoir as set forth by project specifications. In addition, there shall be no infringements upon the interests of the other Party relating to its use of its respective portion of water in accordance with the irrigation schedule used as a basis for such project specifications.

29. The operational service of each of the Parties shall reserve the right to check the mutual amounts of water actually withdrawn. The Parties shall make check measurements of water and adjust the flow curves. The right to do checks shall extend to all stream gauges.

30. A Party, which has not used before the end of the year its portion of water determined by the water withdrawal schedule, may not use the remaining amount of water in subsequent years.

Operational Service

31. Both Parties shall have an operational service at the water reservoir on an ongoing basis throughout the year.

32. Each Party shall have the necessary amount of specialists and workers to operate the dam and water reservoir facilities.

33. Buildings for the work of the operational personnel shall be built on both sides.

34. The operational service shall:

    a. maintain, repair and rehabilitate the dam and related facilities;

    b. fulfill the work envisioned by the water use program;

    c. install and maintain stream gauges;

    d. record the amounts of water flowing to, and released from, the water reservoir;

    e. lift and drop sluice gates and regulate valves to release water from the water reservoir;

    f. manipulate lifts that exclude the possibility of freezing;

    g. ensure the passage of flood water without causing damage to the dam; and

    h. fulfill the decisions of the standing Commission.

35. The chief engineer for the operation of the dam and the water reservoir shall be a member of the standing Committee.

36. The operational service of each of the Parties shall be provided with telephones to communicate with its administrative center and waterworks.

Miscellaneous

37. Water shall be released from the water reservoir for each of the Parties in accordance with the water use program through the discharge facilities installed in the dam for the Soviet Union and Turkey. If the amount of water discharged is significant, in order to unload the discharge facilities, simultaneous water discharge through both discharge facilities may be permitted.

    The amount of such discharges shall not be deemed as consumption from the water reservoir.

38. To observe changes in the level of groundwater as a result of water filtration from the reservoir, through the dam and facilities and around the dam, wells shall be drilled during construction, the cost of which shall be included in the dam cost estimates.

These wells shall be used for regular observations of the level of groundwater. The Parties shall exchange groundwater observation data on a monthly basis.

39. Mechanisms and equipment shall be operated in accordance with manufacturers' or specially designed manuals.

40. In accordance with Article 14-И of the Protocol dated April 25, 1963, the existing Tallinn (Guven) and Oktemberyan (Sardarabad) dam controllers may be reconstructed in accordance with the prepared plan of operation to ensure necessary water withdrawal amounts. They shall be equipped with stream gauges.

    Reconstruction shall be undertaken in accordance with the projects agreed by the Parties.

    A Party, which cannot draw water it has the right to for any reason, may not object against the other Party's withdrawal of the amount of water it has the right to draw.

41. The dam, related facilities and adjacent areas shall have lighting during the night.

42. The reserve supply of construction materials, equipment and other items as may be necessary for emergency operations shall be maintained on each side.

    The list and quantities of such materials and equipment shall be determined by the standing Commission.

43. The Akhurian (Arpa-Chai) water reservoir may be used for fishing and fish farming. The terms and conditions of fishing and fish farming shall be set forth by a special agreement between the Parties.

44. Attached to these Guidelines are Forms 1, 2 and 3,[6] which shall govern water reservoir operation by the Parties.

    The standing Commission shall have the right to amend and supplement such forms or issue new forms.

Ведомости ВС СССР. 10 марта 1976 г. N 10. Ст. 168. (Bulletin of the Supreme Council of the USSR, March 10, 1976).

Сборник действующих договоров, соглашений и конвенций, заключенных СССР с иностранными государствами. Вып. XXXI.- М., 1977. 319-329. (Collection of the Existing Agreements, Treaties and Conventions between the USSR and Foreign States, 1977).

Notes

1. In the scope of this study, nine individuals from Armenia and Turkey closely involved with the operations of the Arpaçay/Akhuryan Dam and the dam reservoir were interviewed regarding the current management of the dam. All the interviewees wish to remain anonymous and not be identified as discussing the management of the dam (personal communication 2017). One of the main reasons behind the desire for anonymity is to avoid unwanted attention or to be considered a "trouble inviter" (personal communication 2017). The country affiliation of the interviewees will also be kept confidential. This section is based on the interviewees' responses.
2. Attached to the original Agreement.
3. Attached to the original Agreement.
4. Attached to the original Agreement.
5. Forms 2 and 3 are not provided.
6. Forms 1, 2 and 3 are not provided.

Revelstoke Dam, Columbia River Basin. © jmoor17/iStock.

Chapter 2 Columbia Basin

Initial Dam Filling and Flood Warning and Monitoring Mechanisms

By Glen Hearns

Summary: Three-Stage Process of Coordinated Basin Development

This case study examines the agreements surrounding the coordinated operations of facilities in Canada and the United States, the initial filling of the upstream dams in Canada, and the flood warning and monitoring mechanism shared by the two countries.

For reference, the three-stage process of coordinated basin development is presented in figure 2.1.

Identification of Opportunities and Risks

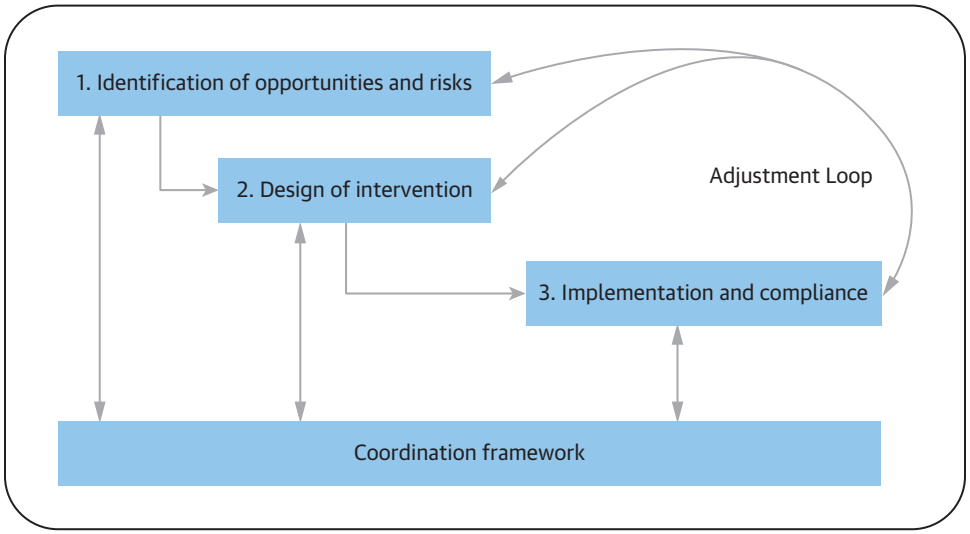
Although most of the Columbia Basin lies in the United States, approximately 15 percent of the upper headwaters lie in Canada and are the source of some 30 percent of the waters generated in the basin. The two riparian countries used the following tools to identify opportunities for benefit sharing and cooperation on the Columbia Basin:

Coordination Framework (Stage 1)

- ***Joint Technical Committees*** **(T55)**: in 1944, Canada and the United States set up the International Columbia River Engineering Board (ICREB) to "analyze use of Columbia waters with respect to: domestic water supply, navigation, efficient power, flood control, reclamation, conservation of fish and wildlife, and other benefits."

- ***Benefit Assessments* (T8)** and ***Multisector Investment Opportunity Analyses* (T9)**: joint investigations, conducted between 1944 and 1959, showed that developing reservoirs in the upper part of the Columbia River Basin and coordinating their operations with those of existing infrastructure in the United States had the potential to generate significant benefits for flood control and power generation for both countries.

FIGURE 2.1. Three-Stage Process of Coordinated Basin Development



Design of Intervention

The countries use the following tools to manage the flows of the Columbia River and increase the production of hydropower:

- ***Compensation for Operations and Maintenance (O&M) or Construction of Regulating Infrastructure* (T18)**: the initial 30-year payment of the Canadian Entitlement was used to partially finance the construction of the Canadian dams.

Coordination Framework (Stage 2)

- ***International Treaties* (T44)**: the Columbia River Treaty (CRT) optimizes flood control and power generation in both countries, after allowing for consumptive uses including irrigation. Flexibility within the agreement accommodates other interests of the Parties, such as fisheries and recreation.
- ***Amendments and Supplementary Agreements* (T46)**: to fill and operate additional storage built in the Canadian dams, an additional agreement, the 1984 Non-Treaty Storage Agreement (NTSA), was required, which took about seven years to negotiate and was based on preceding agreements. In addition to the initial 1961 Treaty and filling agreements, supplementary agreements have been developed to address evolving social and environmental concerns.

Implementation and Compliance

For regulation of flows and hydropower production in the Columbia River, the two countries use the following tools:

- ***Single-Sector Operational or Implementation Plans* (T39)**: the key planning tool to guide the operations of the dam facilities in the Columbia is the Assured Operating Plan

(AOP), which is drawn up annually and dictates how Treaty storage will operate 6 years in advance. It is used to calculate the Canadian Entitlement to downstream power benefits. The CRT requires the United States to develop a Flood Control Operating Plan (FCOP) in consultation with Canada, which is then used to develop the AOP.

- ***Conference Calls*** **(T49):** in the operation of the CRT, weekly alterations to the flow regime are determined by the Entities through a weekly "conference call" (Thursday morning) to respond to unforeseen developments.
- ***Forecasting and Early Warning Systems*** **(T30):** in the Columbia Basin, a hydrometeorological monitoring system is in place, which includes real-time measurements for snow courses, precipitation stations, stream gauges, and temperature gauges; as well as current reservoir levels, storage calculations, and inflow conditions for balancing water and ensuring flood space availability in reservoirs.
- ***Procedures for Data Sharing and Exchange*** **(T21):** the principal mechanism for data exchange is the Columbia River Operational Hydromet System (CROHMS), a data management system operated by the United States Army Corps of Engineers (USACE) that takes in data from agencies across the Columbia Basin and makes them available for coordinating operations of all projects on the Columbia River and its tributaries.
- ***Direct Payments*** **(T17):** based on the CRT, Canada obtains half of the additional power benefits derived in the United States through the coordinated operations of Canadian dams (Canadian Entitlement). In September 1964, the Unites States paid US$254.4 million upfront for the Canadian Entitlement for the first 30 years, after which it would start paying on an annual basis.
- ***Compensation for Harm*** **(T37):** during the construction of the Canadian dams, any breach by Canada to commence full operation at specified dates would have resulted in a forfeiture of its Canadian Entitlement to power benefits in an amount equivalent to the share lost by the United States.
- ***Complaint Review*** **(T68):** the CRT established the Permanent Engineering Board (PEB) to provide an independent review of CRT implementation. The PEB collects statistics, ensures that the objectives of the CRT are met, and reports to the Canadian and U.S. federal governments annually.
- ***Appointment of an Expert Commission*** **(T95)** and ***Reference to an Arbitration Tribunal*** **(T69):** if the PEB is unable to resolve differences, the issue can be referred to the International Joint Commission (IJC) that governs transboundary water issues between the United States and Canada. If the IJC does not render a decision within three months of the referral, or within a time frame agreed by the United States and Canada, either country may submit the dispute to arbitration. The arbitration panel would consist of one individual chosen by each country, and a third individual, either chosen jointly or by the International Court of Justice (ICJ).

Coordination Framework (Stage 3)

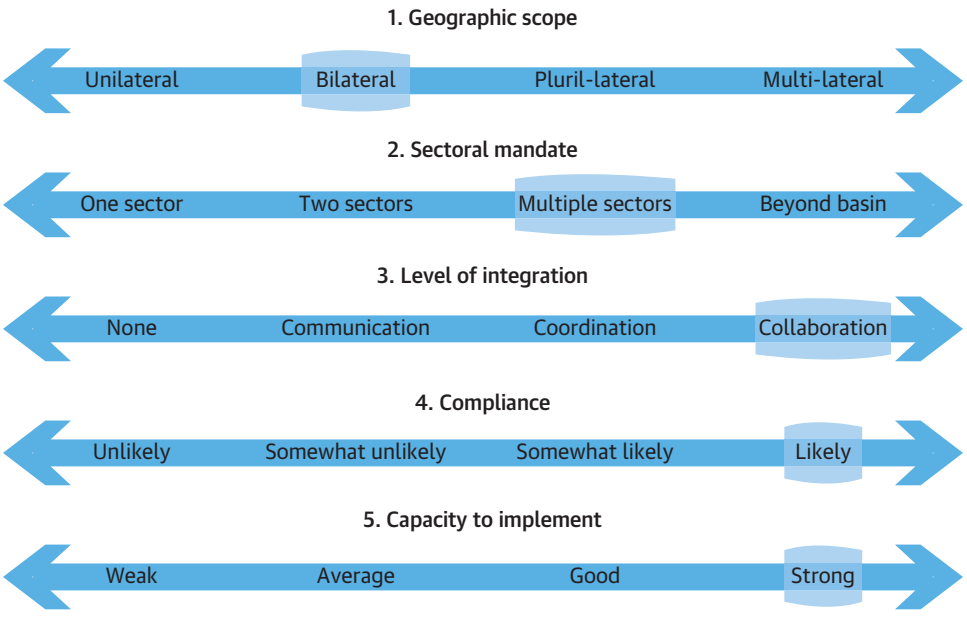
- ***International Treaties* (T44):** the CRT optimizes flood control and power generation in both countries.
- ***Executive Functions* (T51):** the CRT is implemented by the so-called Entities, which are the British Columbia Hydro and Power Authority (BCH) in Canada, and both the Bonneville Power Administration (BPA) and the Northwest Division of the USACE in the United States.
- ***Special Purpose Vehicles* (T57)** and ***Technical Entities* (T36):** an Operating Committee (OC) and the Columbia River Treaty Hydrometeorological Committee (CRTHMC) were created to assist in implementing the CRT. The OC plans, implements, and assesses the operations at the facilities, and develops operating plans. The CRTHMC is responsible for planning and operating the hydromet data gathering systems and for providing water supply forecasts and other essential information.

Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention— to the initial dam filling and flood warning and monitoring mechanisms in the Columbia Basin case is depicted in figure 2.2 and detailed below.

1. The basin is a two-country basin and is therefore managed on a bilateral basis.
2. The sectoral mandates of these agreements cover flood protection, flow regulation, and hydropower.
3. The countries collaborate in the management of flow regulation and hydropower production, among others, on the Columbia.
4. At the time the agreements were negotiated, it was expected that both countries would comply with the provisions of the agreements; these mechanisms have so far been successful. Yet the countries agreed on dispute settlement and compliance mechanisms to be prepared, should any differences emerge.

FIGURE 2.2. Application of the Five Dimensions to the Initial Dam Filling and Flood Warning and Monitoring Mechanisms in the Columbia Basin Case



5. The capacity to implement the tools and design the coordination frameworks was strong, as the two parties had well-developed mechanisms to implement the agreements.

Case Study Description

Introduction

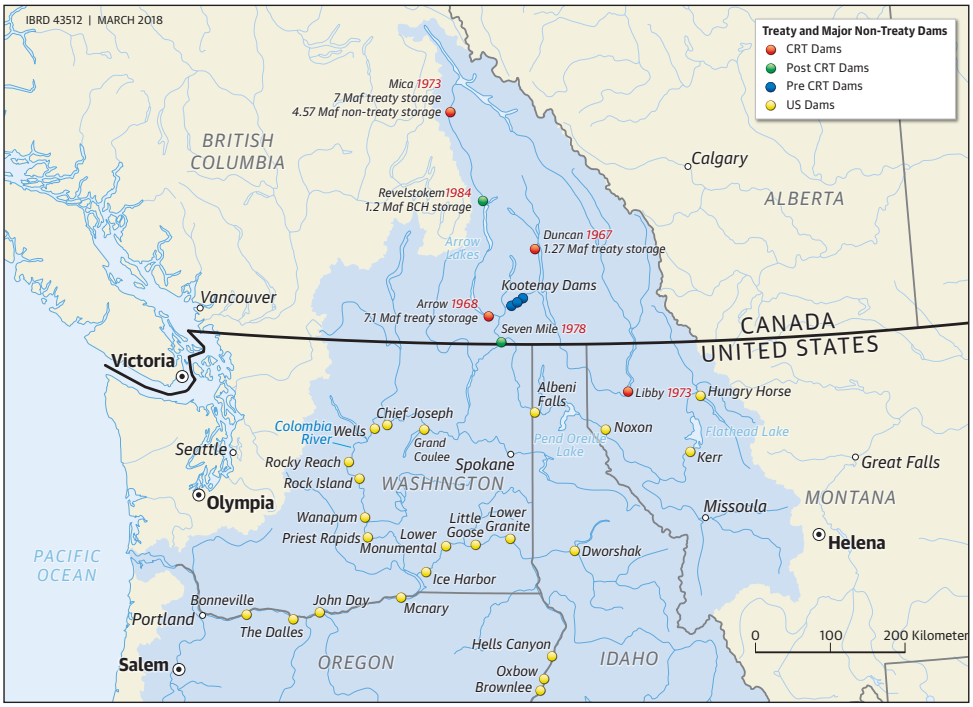
The CRT and NTSA provide a detailed and complex example of benefit sharing and cooperation between two countries (Canada and the United States), in which three dams were constructed in upstream Canada to provide improved river regulation for flood control and increased power generation throughout the Columbia River System. This case study examines the agreements surrounding the coordinated operations of facilities in Canada and the United States, the initial filling of the upstream dams, and the flood warning and monitoring mechanism. For a more comprehensive understanding of the Columbia River Basin's development and the benefit-sharing mechanisms implemented by the United States and Canada, the reader is referred to "Columbia River Treaty, Past and Future" (Hyde 2010).

The Columbia Basin covers 668,000 km^2 (the size of France or Afghanistan) and is located in the Pacific Northwest of North America (map 2.1). While most of the basin lies in the United States, some 15 percent of the upper headwaters lie in Canada, where approximately 30 percent of the waters generated in the basin originates. By 1942, the United States had already built the Grand Coulee dam as well as several other large dams;[1] however, no significant infrastructure existed in the Canadian portion. In 1944, Canada and the United States set up the ICREB to "analyze use of Columbia waters with respect to: domestic water supply, navigation, efficient power, flood control, reclamation, conservation of fish and wildlife, and other benefits" (ICREB 1959). The joint investigations, conducted between 1944 and 1959, showed that developing reservoirs in the upper part of the Columbia River Basin and coordinating their operations with those of existing infrastructure in the United States had the potential to create significant benefits for flood control and power generation for both countries (IJC 1959). The United States and Canada already had an international agreement to govern transboundary waters issues under the Boundary Waters Treaty of 1909 (BWT) and had established the IJC to do so.[2] However, the IJC had limited authority for what was envisioned in the Columbia River Basin, and a different mechanism was needed for more integrated and coordinated operations of facilities by Canada and the United States. The CRT was developed to specifically address these concerns.[3]

The CRT is an international treaty between the governments of the United States and Canada, and either country may terminate most of the provisions of the CRT after 2024 by giving 10 years notice to terminate.[4] It was originally signed in 1961, but came into force[5] on September 16, 1964, after a Treaty Protocol was signed providing for Canada's share of the additional power generated in the United States to be sold in the United States.

Under the CRT, Canada was to build and operate Duncan, Arrow-Keenleyside and Mica storage facilities in the Province of British Columbia (BC, Canada) to regulate flows on the transboundary Columbia River (map 2.1). The primary objective of the CRT is to optimize flood control and power generation in both countries, for which Canada is compensated by the United States through the sharing of downstream power and flood control benefits experienced in the United States.

MAP 2.1. Treaty and Major Non-Treaty Dams in the Columbia River Basin



Source: Modified from U.S. Army Corps of Engineers, 2017.

The CRT further permitted the United States to construct the Libby Dam and associated Koocanusa reservoir, which extends approximately 67 km into Canada. Under the CRT, Canada provided 15.5 million acre feet (Maf) of reservoir storage at Duncan (built 1967), Arrow-Keenleyside (built 1968) and Mica (built 1973). The CRT dams more than doubled the amount of storage in the basin at the time.

One of the key elements in understanding the Treaty and the subsequent discussions around filling and flood warning is that both countries benefit from coordinated operations, and thus it was in both their interests to fill and have the system operating as quickly as possible.

Canada was responsible for the construction of the dams within Canada. Consequently, it receives the flood control and power benefits in Canada resulting from CRT operations of those dams. However, both parties agreed to share the additional flood control and power benefits achieved in the United States. In accordance with Article VI(1), the United States agreed to pay Canada a total of US$64.4 million in exchange for the annual operation of 8.45 Maf of storage for flood control until 2024 (55 years from the time of estimated dam construction).[6]

Canada also obtains half of the additional power benefits derived in the United States through the coordinated operations of Canadian dams (Canadian Entitlement). The Treaty was to last for at least 60 years and so the United States paid US$254.4 million upfront for the first 30 years of the Canadian Entitlement.[7] This money was used to partially finance the

OBSERVATION 1

Both Canada and the United States benefited from the cooperative operations of the storage in the upper Columbia, and developed formulae to essentially split those additional (synergistic) benefits 50/50.

OBSERVATION 2

Downstream investment in upstream infrastructure provides an opportunity for funding capital investments and vice versa.

OBSERVATION 3

Both parties took responsibility and shared in the lost power associated with the initial filling of both the Treaty and non-Treaty waters—splitting both the "costs" and "benefits."

construction of the Canadian dams. After 30 years, the Canadian Entitlement would start being paid to Canada on an annual basis.[8]

As both the United States and Canada were to gain from coordinated operations of the treaty storage, they both agreed to assume responsibility for filling of the Treaty storage in the dams. When the dams were filled, the United States assumed the resulting power losses in the United States, and Canada assumed the resulting losses in Canada. Clearly, it was important to minimize power losses, as described in the section on "Initial Filling."

Institutional Framework

The CRT is implemented by the so-called "Entities," which are the BCH in Canada,[9] and the BPA and Northwest Division of the USACE jointly in the United States.[10] To assist implementation of the CRT, the Entities created an OC and a CRTHMC.[11] The OC plans, implements, and assesses the operations at the facilities, and develops operating plans. The CRTHMC is responsible for planning and operating the hydro-met data gathering systems and for providing water supply forecasts and other essential information.

To ensure that the Entities implement the Treaty appropriately, CRT Article XV established the independent PEB (to provide an independent review of CRT implementation). The PEB consists of four individuals, two appointed by each government.[12] The PEB is to review operations, provide recommendations to the governments, and assist with resolving any disagreements regarding implementation. The PEB is not an arbitration board, but can "find fact" with operations, meaning that it can determine an "opinion" on how operations are being conducted, any deviations from operating plans, or other problems within the scope of the Treaty. The PEB can also assist with resolving any contentious issues through dialogue and facilitation. The PEB reports out annually to each of the Parties (Canada and the United States). The PEB does not decide or make rules; however, its recommendations carry weight and are generally respected by the governments and the Entities. The PEB regularly analyzes CRT activities, writes an annual report for the two national governments, and determines whether the Entities continue to implement the terms of the CRT. Should differences persist, either the United States or Canada can refer the issue to the IJC, established by the BWT, for a decision. Yet to date, the Entities, with the assistance of the PEB, have been able to resolve their disagreements.[13]

OBSERVATION 4

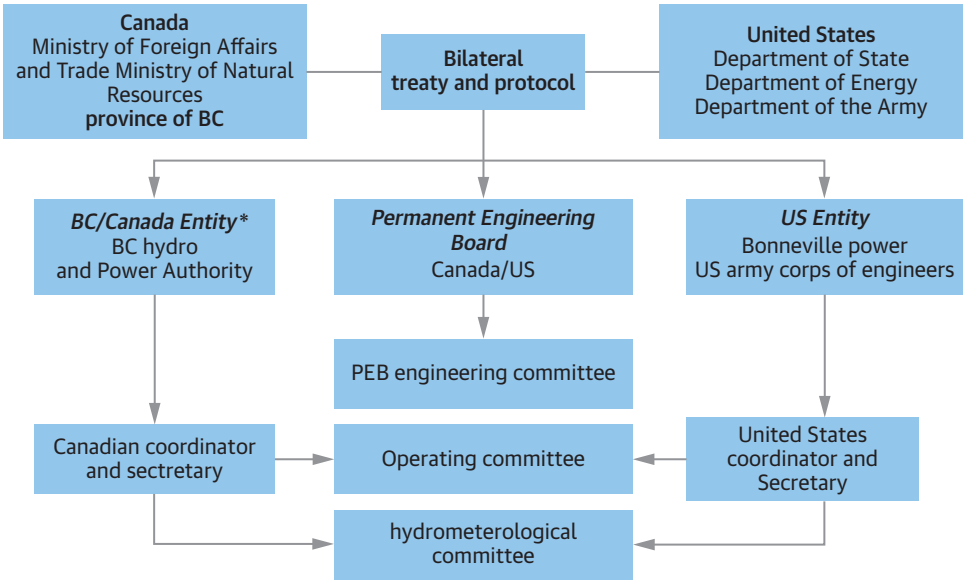
Creation of an independent overview body can help ensure implementation and resolve any misunderstandings.

The CRTHMC was established in May 1968 and was composed of representatives of each Entity, with a designated chairman of the section. The CRTHMC was charged with establishing and maintaining a monitoring system and a reporting system, and coordinating with other task forces as necessary.[14]

Operation and implementation of the non-treaty storage (NTS) waters under the NTSA is done through the NTSA-Operating Committee, which is separate from the OC for the CRT. However, there is generally personnel overlap between the two bodies to ensure communication and compliance with the provisions of the CRT. The PEB does not have any direct

involvement in oversight of the NTS waters. However, the PEB does oversee Article IV(5) of the CRT, which highlights that any additional water resource development constructed in Canada must not undermine the flood control and power benefits associated with CRT operations. The organizational structure of the Columbia River Treaty is depicted in figure 2.3.

FIGURE 2.3. Organizational Structure of the Columbia River Treaty



Note: BC = British Columbia; PEB = Permanent Engineering Board; US = United States.

Non-Treaty Storage

The "Treaty dams" proposed were designed to produce the optimum flood and power benefits for both Canada and the United States. However, during the review and assessment of the Columbia Basin, it became clear that Canada could benefit from increasing the storage from proposed Treaty dams as well as from the construction of several other dams not "required" under the CRT. Consequently, when Canada constructed the Mica dam, it purposely built 5 Maf of additional storage that had not been envisioned under the CRT. Soon afterward, BCH developed additional dams at Revelstoke (4.3 Maf) and Seven Mile (0.068 Maf) (map 2.1). The additional storage built is termed NTS. To fill and operate this additional storage required an additional agreement, the 1984 NTSA,[15] which took about seven years to negotiate and was based on several smaller preceding agreements.

Of significance, the NTSA is a commercial contract between BCH and the BPA; and involvement of the two countries is limited to ensuring that any operation of NTS does not reduce the benefits associated with CRT operating plans. The initial NTSA was a short-term agreement (from 1983 to 1993)[16] and has since undergone updates in 1990 and 2012[17] to address changing conditions in the basin system, both from a legislative and societal point of view, such as greater awareness of environmental issues (fisheries issues in particular). Importantly, operation of the NTSA must be in conformity with the objectives of the CRT such that releases or refilling of NTSA waters do not alter the actual flow across the Canada/United States border or undermine flood control interests under the CRT. Worthy of note, to ensure compliance with the CRT, Canada constructed the Mica dam with several lower-level intakes to operate within the constraints of the CRT, should filling of the

NTS be difficult due to dry weather. These lower-level intakes were subsequently deactivated when the higher-level intakes were made operable.

The NTS waters are operated and implemented under the NTSA through the OC mechanism set up by the Entities. The PEB does not have any involvement in the oversight of the NTS waters.

Benefits Beyond the Basin

Another key issue of the Treaty was the importance of the Canadian storage and operations for the United States. Power utilities in California were heavily involved in creating assurances and developing agreements that pre-bought the additional electricity associated with assured operations of Canadian Treaty dams. The Columbia Storage Power Exchange (CSPE), a consortium of 41 power utilities, had agreed to purchase 30 years of "firm power" from BPA. The purchased amount was equivalent to the estimated additional power generated from operation of the proposed Canadian dams. However, the deal did not depend on the dams being built or the CRT being agreed to. Consequently, this not only allowed the United States to pay Canada the US$254 million for the Canadian Entitlement of power benefits for 30 years, but it also put tremendous pressure on the parties to come to an agreement and construct the facilities as soon as possible; otherwise, the U.S. government and BPA would still be responsible for supplying the "firm power" to the CSPE. The importance of the regional interests in encouraging the Parties to come to an agreement should not be overlooked when analyzing Canadian and U.S. discussions. Moreover, as commercial entities, BPA and BCH benefited from coordinated operations, resulting in cooperative and amicable implementation of the Treaty, as well as flexibility in addressing different views on NTS issues.

OBSERVATION 5

Private enterprise can help raise funding for capital costs: There is more security for investment when commercial entities coordinate operations and assured energy (firm energy) production is more attractive for potential investors.

Competing Issues and Solutions

By the 1960s, the U.S. portion of the Columbia River had been developed extensively for hydropower production. Consequently, any reduction in water flow caused by upstream development in Canada constituted a significant loss of power generation in the United States and was to be avoided.

As the CRT was developed to enhance power generation throughout the basin system and to provide an assured flood control, one of the key issues of concern to the downstream U.S. Entities was the loss of *firm* and *secondary* power over key generating periods of the year while Canadian storage reservoirs were being filled.[18] Also of concern was creating an incentive to ensure that the Canadian Treaty storage would be available for both U.S. power generation and flood control at an appropriate time. Canada, for its part, wanted to take the opportunity to develop the Columbia River to the fullest extent possible and build storage capacity for power generation in addition to that identified under the CRT.

With respect to the Treaty storage, there were specific dates by which the Canadian storage needed to be constructed (see section on "Initial Filling Provisions").[19] It was understood that if Canada did not meet construction deadlines and the storage capacity was not available at the arranged time, the United States would be entitled to compensation from Canada. This was in part due to the agreement that the CSPE had entered into with the U.S. government, regardless of whether the CRT dams were built. Also, it specified that if storage became available in advance of the prescribed date, Canada would receive its share of downstream benefits earlier. Under the CRT, the countries agreed that compensation should be paid for any "act, omission, or delay amounting to breach of the Treaty other than by reason of war, strike, major calamity, act of God, uncontrollable force or maintenance curtailment."[20] Failure by Canada to commence full operation at specified dates (a Treaty breach) would result in a forfeiture in its Canadian Entitlement to power benefits in an amount equivalent to the share lost by the United States.[21] For example, if Canada were 10 months *behind* schedule, it would have to compensate the United States with an amount of power benefits equivalent to what the USA would have gained during this 10-month period. This ensured that the United States would not lose its share of negotiated additional power generation and flood protection benefits, regardless of whether Canada constructed the dams behind schedule. However, if Canada completed the dams *ahead* of schedule by 10 months, Canada and the United States would equally split the downstream power benefits for that 10-month period. This is because the United States had agreed to purchase the Canadian Entitlement (Canada's share of the power benefits) for a period of 30 years from the time of dam construction. Consequently, Canada would have its ½ share of power benefits transferred back to it 10 months earlier than envisioned.

When Canada sold its Canadian Entitlement to the United States, it was called the "Terms of Sale."[22] Under the initial Terms of Sale, the compensation payable to the United States for delayed commencement of storage operations by Canada would be an amount equal to "2.70 mills per kilowatt-hour, and 46 cents per kilowatt of the usable energy and dependable capacity for each month or fraction thereof, in United States funds," or "Canada may, at its option, supply capacity and energy to the U.S."[23]

In terms of flood control, the United States paid Canada US$64 million for flood control benefits for an assured 55 years, assuming that the "space" would be available in the different reservoirs at certain dates.[24] There were additional provisions in the CRT to compensate the United States for any flood control benefits lost if completion of the dams were delayed. For every month that the prescribed space was not available after the prescribed time, the United States would charge Canada based on the amount of storage unavailable, to a maximum of US$237,400/month.[25] However, no provisions existed for extra compensation if the dams were completed *before* the specified dates. The apparent unfairness of the latter resulted in a promise to negotiate a solution that was subsequently added to the 1964 Treaty Protocol. In actual fact, the Arrow and Duncan dams were completed prior to the specified dates and the Entities and two governments negotiated an agreement for the United States to pay half the extra benefits.[26]

With regard to Treaty storage, the United States took an equal responsibility in the filling. This meant that it was understood the U.S. power producers would lose power during the filling and this was accepted. However, this was not the case with the NTS, which was entirely Canada's choice to construct.

Mica began storage operations in April 1973 and, in accordance with the "Terms of Sale," the operating plans were designed to fill 15.0 Maf by September 1, 1975. However, this proved of great concern to BCH, as the preceding years had been relatively dry and the additional 5 Maf of NTS meant that there was 20 Maf of storage to be filled by September 1, 1973. Indeed, in 1973, filling was slow because of a drought, and BCH ran a natural gas plant to produce electricity for the United States—to compensate the country for the power losses and be able to store water in Mica rather than letting it flow downstream, as called for under the CRT. Fortunately, 1974 was marked by extreme precipitation, which filled the dead storage and Treaty storage of Mica reservoir at no cost to Canada in power losses, and no power losses in the United States because of the filling, as they probably would have had to spill the additional water. In fact, the weather of 1974 was as wet as it had been during the massive flood of 1948 in the Basin,[27] and so the additional storage probably prevented major damage. The following year was also wet, and by the end of the operating year, in August 1975, the additional 5 Maf of NTS had also been filled with water to a level in excess of the U.S. needs.

During the initial filling periods, there were three related issues that needed to be resolved.

Difference of Opinion 1

The additional 5 Maf of NTS at Mica needed to be accounted for and addressed in an equitable manner. The United States indicated that it should benefit from this additional storage; however, BCH relied on a commercial agreement between BPA and BCH and offered to compensate only for documented losses, which the United States did not present. BCH argued that much of the additional water in those wet years (1974-75) would most likely have been spilled in U.S. facilities. The United States did not push the point. However, it made it clear that it would retain any power generated in the United States by the NTS waters released from Mica, and would not allow subsequent filling of NTS water at Mica that ran counter to the CRT operating plans. The upshot of this would be that Canada could only fill NTS waters with waters that would otherwise have been spilled at downstream facilities in the United States (for example, only during very high-flow years). This left Canada in an undesirable predicament—it might not be possible to fill the NTS very often. Consequently, the additional storage was not as profitable as it could be.

OBSERVATION 6

Both Canada and the United States benefited from the cooperative operations of the storage in the upper Columbia, and developed formulae to essentially split those additional (synergistic) benefits 50/50.

By 1978 BPA and BCH had agreed on how NTS in Mica should be refilled, and the United States compensated for the earlier filling. It was agreed that storage arrangements would be beneficial for both BPA and BCH.[28] BPA agreed to supply BCH with power to allow it to fill the NTS in Mica so that both Entities could benefit from it in the future. The NTS water in Mica was seen as an element that, if managed properly, would benefit both countries.

Difference of Opinion 2

The filling of additional storage at the Revelstoke and Seven Mile dams, which would result in reduced power generation downstream, needed to be addressed. When Canada was building its "additional NTS storage," in the case of the Seven Mile and Revelstoke dams, the country felt this was allowed (even anticipated) under the CRT, without the need to compensate the United States financially.[29] The United States felt differently and requested compensation for the loss of power it experienced during the filling of Revelstoke and Seven Mile. Seven Mile was constructed in 1978 and, as it was relatively small, the issue was not raised by the United States and thus did not give rise to a dispute. However, as Revelstoke was nearing completion, in 1983, the United States felt that it had to be compensated for the loss of power, as this time the loss was significant (4.3 Maf). Through a number of commercial agreements,[30] the NTSA was signed in April of 1984. The NTSA provides for the filling of Revelstoke, compensation for the initial filling at the Seven Mile dam (post-construction), and allows the United States and Canada to each operate one half of the NTS in Canada for their own benefit under certain restrictions. One of the key restrictions is that operation of any NTS water in Canada constructed after the ratification date cannot reduce the power and flood control benefits resulting from operations under the CRT.[31] The initial NTSA agreement ran for approximately 10 years and lays out the rules by which NTS waters can be stored and used. The Revelstoke and Seven Mile reservoirs were to be filled by shifting NTS waters to fill them (or their equivalent), and the losses would be borne equally by both parties.[32] Of key importance is that both BPA and BCH agreed to "share equally the costs and responsibilities associated with the initial filling" of the dead storage[33] for the Revelstoke and Seven Mile reservoirs.[34] Also, 1.4 Maf of NTS would be periodically available, if needed, in the Revelstoke reservoir.

The NTSA addressed the issue of the previously built Seven Mile dam by having BCH release 0.068 Maf of water from Mica between October 1, 1983, and March 31, 1985 for use downstream in the United States.[35] The United States did not benefit from any power generated in Canada from the release.

OBSERVATION 7

Private investment and commercial enterprises encourage a focus on operations and economic development, and allow for more creative solutions to problems.

Difference of Opinion 3

Over the years, the issue of additional monitoring stations for forecasting and their funding kept arising. The CRT states that a "hydro-meteorological system, including snow courses, precipitation stations and stream flow gauges will be established and operated, as mutually agreed by the Entities and in consultation with the PEB, for use in establishing data for detailed programming of flood control and power operations. Hydrometeorological information will be made available to the Entities in both countries for immediate and continuing use in flood control and power operations."[36] Also, under the CRT, the Entities are responsible for establishing and operating their own stations. In 1968, the CRTHMC was established—based on the recommendation of an international task force entrusted with designing a hydromet system for monitoring, and developing procedures for data exchange. In addition

to setting up the CRTHMC, the international task force put forward recommendations for improving the monitoring system and aid in water supply forecasting. As part of their findings, they also recommended establishing new snow monitoring stations (15 in Canada and 5 in the United States).

Discussions over the years have related to which stations are needed. Canada has in the past suggested a smaller number is needed than the United States has requested. The results of the discussions are that the U.S. Entity has funded the establishment and/or automation of stations in Canada through Memoranda of Understanding (MOUs) between BCH and BPA. BCH set up and maintains the stations, paid for by BPA. To date there are some nine automated snow stations and two water temperature stations in Canada that continue to be funded through BPA.

OBSERVATION 8

Information and data exchange can be a catalyst for confidence building.

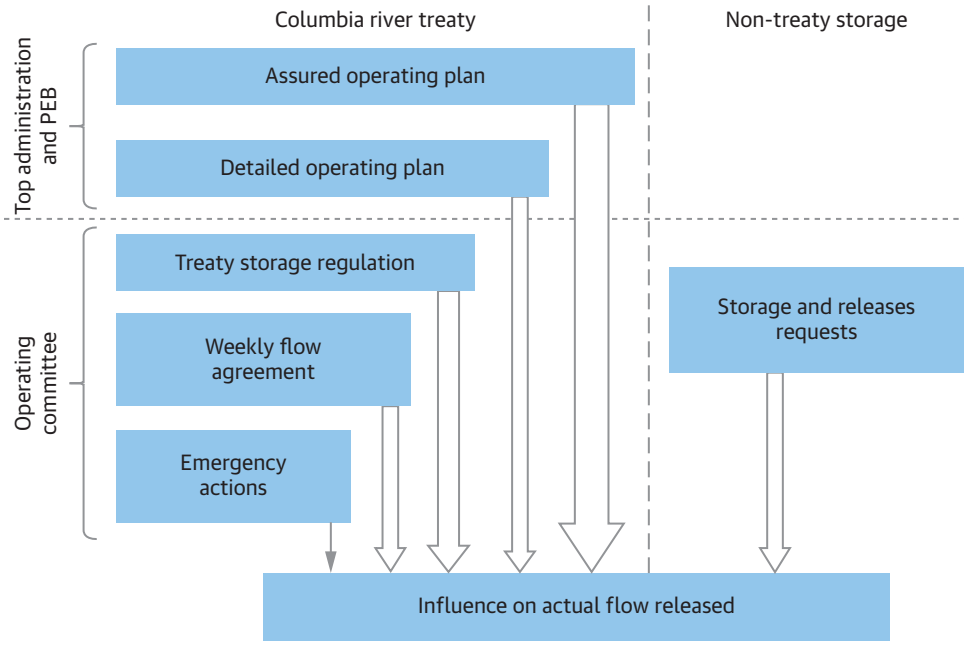
Coordinated Operations of the Cascade System

Planning, Management, and Operations

Under the CRT, planning and management is based on an operating year running from August 1 through July 31. Numerous mechanisms are involved in determining flow releases, cover long-long term planning all the way down to daily decisions (figure 2.4).

- *Assured Operating Plan (AOP).* The key planning tool guiding the operations of the dam facilities in the Columbia Basin is the AOP, which is drawn up every year "during the sixth succeeding" year (i.e., five years ahead of time). It is drawn up with the specific goal of achieving optimum power benefits within the specified flood control protection. The AOP and related studies are used to calculate the Canadian Entitlement to downstream power benefits.[37] Once signed, the AOP becomes the default, or assured, plan. For the purpose of the AOP studies, the United States is assumed to operate its Base System[38] facilities in a way that that most effectively uses the improved stream flow from Canada for power generation in the U.S. power system. However, while the U.S. reservoir operators do not necessarily have to operate in this manner, the downstream benefits for Canada

FIGURE 2.4. Relative Influence of Different Mechanisms on Actual Flow



Note: PEB = Permanent Engineering Board.

are always calculated as though they were (art III). Optimum Operating Rules are determined annually, and included in the AOP, based on the optimum production of firm and secondary (non-firm) energy and capacity.

- *Flood Control Operating Plan (FCOP).* The CRT requires the USACE to develop a FCOP in consultation with Canada (annex A (5)) and the flood control operating procedures are included in the AOP. The FCOP prescribes the maximum reservoir levels at various points over the course of the year for Mica, Duncan, Arrow/Keenleyside, and Libby, and includes flood control storage reservation diagrams (Flood Control Curves) and associated criteria for each of the dams. The Libby reservoir is included in the FCOP because the Treaty requires that the operation of Libby be coordinated.[39] The FCOP addresses both local flood control issues (immediately downstream of facilities) and system flood control requirements (as indicated at The Dalles in the lower Columbia River) to avoid damaging water levels throughout the system. The FCOP is updated as needed. The first plan was prepared in 1968, and major revisions were completed in 1972, 1999, and 2003.
- *Detailed Operating Plan (DOP).* The DOP is generally based on the AOP operating criteria, with added procedures for weekly storage operations. The Entities may prepare an annual DOP that may achieve a more advantageous operation in terms of benefits than would result under the AOP and FCOP.[40] As the DOP must be accepted by the Entities by mutual agreement, it typically requires mutual benefits, or else the AOP for that particular year is applied. The DOP may include mutually agreed non-power and non-flood control benefits such as fisheries.[41] These deviations from the AOP can be drawn up into supplementary agreements if they become consistent over years. In this manner, the flow regime associated with the operations can undergo modifications, provided they do not undermine flood control.
- *Treaty Storage Regulation (TSR).* The DOP is implemented via TSR studies that determine the monthly storage rights and obligations for the Duncan, Mica, and Arrow/Keenleyside dams (CRTHMC 2002). Studies are conducted twice monthly to determine the end of month targets of the reservoir levels in the Canadian CRT facilities. The TSR uses actual inflows to date plus the forecast for unregulated stream flows, volume of seasonal runoff, and current reservoir conditions. The TSR-specified operation can, and often is, modified by mutual agreement between the Entities.
- *Weekly Treaty Flow Agreement & Conference Call.* The actual operation of the Canadian Treaty Storage facilities (Duncan, Mica, and Arrow/Keenleyside) is determined weekly based on the TSR and supplemental operating agreements[42] and/or flood control requirements (CRTHMC 2002). A weekly conference call on Thursday sets the Treaty Flow Agreement for the following week, starting Saturday morning. The Agreement is typically finalized by noon on Friday. Within-week flow alterations may be accommodated as mutually agreed, but these are generally rare.

- *Storage and Release Requests under the NTSA*. Under the NTSA, both BPA and BCH have NTS water accounts for some water stored in Canada. They have the opportunity to fill those accounts when water flows into the system by requesting that water be stored in the Canadian facilities, and can also request to have that water released. For example, BCH needs to request BPA to either store or release BCH's NTS water in Canada, as this affects downstream reservoir levels and power generation. As a safety measure, the downstream facilities would need to have the space available to accommodate the release. BPA must request storage and release of waters from BCH for similar reasons upstream.

In the case that requests are denied, both BPA and BCH are able to store or release up to 2,000 cubic feet per second (cfs) of NTS waters during certain times of the year from their respective accounts without the other's approval. This guarantees a certain level of "firm capacity" from the NTS waters.[43]

As figure 2.4 illustrates, the AOP typically has the largest influence on the actual flow of the rivers; the DOP is derived from the AOP and any mutually agreed changes; the *monthly* TSR implements the DOP taking into account current runoff/snowpack conditions, which can be significant depending on the year; and the *weekly* alterations include the small-scale needs as well as implementing the supplemental operating agreements, which can have a significant impact depending on the period of the year. Emergency actions are usually for short periods or of minor impact overall (but may be significant for a specific instance). It should be noted that under some conditions, flood requests may be made on a *daily* basis, while the power agreement is normally weekly.

OBSERVATION 9

Incorporating adaptability into decision making and operations is critical to successfully addressing changing situations and circumstances.

The operations and management of the Columbia River System has evolved over years into the integrated and highly functioning system in place today. In discussing how this evolution has occurred, those familiar with the system indicate that an iterative process occurred whereby supplemental operating agreements were considered and implemented by both sides as needed to meet newly discovered, or increasingly important, non-power needs on both sides of the border.

Initial Filling Provisions

The filling of reservoirs depends on several factors. Of key importance are dam safety, the hydrology, and the ecology of the basin, which will dictate the physical parameters around dam filling and how much minimum flow is required downstream. Other parameters may be related to socioeconomic conditions, such as return on investment, downstream agricultural or power generation needs, and flood control, among others. In the Columbia Basin precipitation accumulates typically throughout the winter months as snow, and is slowly released from April to August through snow melt, with the greatest flows in May and June. The power interests were to have the Canadian Treaty reservoirs full, or nearly full, by the end of July so they can be released later, from November to March, for power generation downstream, when stream flows are typically lowest. The flood control interests were to

have enough space available by April to allow for floodwaters to be accommodated from April through July. This way, the U.S. power generating facilities could keep their reservoir levels relatively high throughout the year, thereby facilitating power generation. Consequently, for filling purposes, it was important to consider the period April 1-July 31 as the prime filling opportunity.

Filling Provisions for Treaty Storage

Article II (2) of the CRT outlines the obligations for Canada to develop Treaty storage, and that it was to start construction as soon as possible following ratification.[44] Under the initial CRT, the Arrow and Duncan dams were set to be completed five years after ratification, while the Nica dam was to be completed nine years after ratification.[45] However, these dates were somewhat modified after the introduction of the Terms of Sale for energy in 1964. It was agreed that the Treaty storages would be available for power purposes according to the following schedule:[46]

- Duncan—1.4 Maf on April 1, 1968;
- Arrows/Keenleyside—7.1 Maf on April 1, 1969; and
- Mica—7 Maf on April 1, 1973.

At reasonable intervals, Canada was to report to the U.S. Entities on the progress of construction of the Treaty storages. The dams were all completed on time or ahead of schedule.

Nevertheless, in anticipation of potential problems, which often arise when developing such large infrastructure projects, the parties drew up specific mechanisms to address possible scenarios. As discussed in the section on "Competing Interests and Remedies," in terms of its financial interests, the United States focused on gaining compensation for power losses associated with not having additional power at the prescribed time; and reducing flood control payments accordingly for late construction.

For example, if the dams were not available and ready in Canada at the specified date, and a flood occurred, Canada would not be liable for damage incurred in the United States; it would simply not receive its "paid for flood control" benefits and itself have to pay the compensation defined in the CRT for not having space available.[47]

In the case of power, Canada would be liable for the lost "additional" power generation anticipated in the United States thanks to improved river regulation. Canada mitigated for this by building lower intake structures at Mica so it could operate in conformity with the CRT if filling of the entire reservoir proved problematic.

Under an Exchange of Notes in September 1964 it was required that "as soon as practicable after the start of construction of each Treaty project, the Entities shall agree upon a program for filling the storage provided by the project."[48] An International Task Force was set up in March 1965 to undertake the basic studies necessary to establish criteria for the

OBSERVATION 10

An appropriate balance of incentives and penalties needs to be drawn up to help compliance and facilitate investment.

initial filling program for each of the Canadian storage reservoirs and to develop the operating procedures for these programs. This resulted in the development of Special Operating Programs (SOPs) for the initial filling of Duncan, Arrow, and Mica. These programs are similar in nature and apply the same principles. The Duncan SOP is discussed below for illustrative purposes.

Summary of Duncan Special Operating Program (1 April 1967–31 March 1968)

Recalling that Duncan was completed almost a year ahead of time, Canada benefited from the additional power generated in the United States earlier. Preliminary papers on the initial filling of Duncan were prepared in May 1966, and the Entities agreed on a SOP based on Duncan becoming fully operational prior to April 1, 1968, following a year-long trial filling and test operation period. Controlled filling of Duncan started on April 30, 1967, and the reservoir reached full supply level on July 25, 1967, and became fully operational on July 31, 1967. Consequently, none of the "what if" provisions of the SOP described below were applied. Yet it is important to understand them in the context of how filling was to be achieved and benefits and penalties allocated.

The SOP for initial filling and trial of the Duncan reservoir for the period April 30, 1967 through March 31, 1986, pertaining to initial filling, is described below.

Dam Safety as a Priority

A trial filling and test operation period was necessary to ensure that the dam would adjust satisfactorily to the increasing water pressure and that control gates and other hydraulic structures and facilities performed correctly. The test was designed and conducted by BCH, which consulted with the U.S. Entities to ensure they were able to accommodate flow reductions during that period (see maintaining minimum flow below).

The SOP was subject to the closure of the discharge works of the Duncan project once the trial filling of the reservoir was started; this meant that the SOP was only valid if the structure was ready to be tested and filled.

During the period July 31, 1967, through March 31, 1968, beginning when Duncan would become available for storage regulation (when the dam needs to consider creating storage space for flood control), the Duncan reservoir was operated by BCH, as requested by the U.S. Entity, guided by an Operating Rule Curve mutually agreed in advance. The Operating Rule Curve was based on a Critical Rule Curve and a Reservoir Refill Curve, which included volume-of-runoff forecast parameters.

OBSERVATION 11

Develop an agreed hierarchy of interests. For example, flood control or "vital needs" take precedence over power, which in turn takes precedence over other interests.

During the SOP the Entities agreed that "every effort will be made to preclude adding to the flood hazard downstream from Duncan reservoir." Moreover, if it became necessary to evacuate Duncan storage content during the high-water period, the evacuation was to be done "in a manner least detrimental to flood control operation." Also, if "deliveries of energy by either party to the other are delayed due to uncontrollable forces, such deliveries shall be made at a time and at a rate agreed by the Entities."

Recognizing Upstream Benefits for Power Generation

The intent of the SOP was to "recognize the energy benefit that might result at downstream USA power generating facilities from the operation of the Duncan reservoir." The SOP lays out how the downstream energy benefits would be delivered over the initial filling and testing period. The full benefit of the 1.4 (Maf) stored in Duncan reservoir by July 31, 1967 was estimated to be an additional 69,540 MW of energy generated at Blaine, Washington, United States between July 31, 1967 and June 30, 1968. Consequently, the Canadian share was estimated at 34,770 MW of energy averaged over the year.

Maintaining Minimum U.S. Power Requirements during Filling

BCH was to determine the trial filling of Duncan reservoir and thus the minimum flows that would be released downstream. The United States was to make full use of its hydroelectric resources consistent with the Energy Content Curve. However, if the United States found it required more flow to meet coordinated system load requirements in the United States, it could request the flow be increased up to a maximum equal to the actual inflow into the Duncan reservoir. This meant that there was a safeguard in the United States to ensure a minimum flow to meet its power load needs, once it had exhausted all possible means to meet its load needs using U.S. facilities.

Initial Transfer of the Downstream Power Benefits

Beginning on April 1, 1967 and continuing until July 31, 1967 (this is 1/3 of the year), the U.S. Entity "will advance to the Canadian Entity 11,590 megawatt-days of energy (1/3 of the total annual Canadian Share), to be delivered in uniform weekly amounts. The advance delivery of energy may be curtailed should the Canadian Entity request, but in this case the energy that is foregone shall not be delivered later." This meant the United States would give in advance the anticipated power benefits associated with the Duncan storage; however, the benefits had to be received as an average over time and could not be stored in the United States.

The assumption was that Duncan would be filled by July 31, 1967, and so for the operating year beginning on August 1, 1967, an assessment was done to determine the actual filling level of Duncan. The remaining benefits, or Canadian Share, which would be given to Canada, were calculated based on a number of potential situations:

1. Assumes that Duncan is ready for operation (available for storage regulation) and is filled by July 31, 1967.

   If Duncan is ready on time, then the Canadian Share (per day) of the benefits during the SOP year would simply be the remainder of the annual benefits spread over the rest of the 224 days of the SOP year, as follows:

$$\text{Canadian Share/day} = \frac{34,770 - 11,590}{224} \text{ average MW/day.}$$

The U.S. Entity will continue the delivery of the remainder of the Canadian Share, in uniform weekly amounts, until March 31, 1968.

2. Assumes that Duncan is ready for operation by 31 July, 1967, but only part of the 1.4 Maf is filled with usable storage for power generation downstream, and no further water is stored in August (assumes no possible storage in September). The Canadian Share in this case is calculated as follows:

$$\text{Canadian Share} = \frac{34{,}770\,\frac{(A)}{(1-4)} - 11{,}590}{224} \text{ average MW/day.}$$

Where A = usable storage content (in Maf) in Duncan on July 31, 1967.

The Canadian Share for the remainder of the SOP year is reduced by an amount proportional to the deficit of filling. The remaining megawatt-days so determined shall be divided by 244 days to determine the rate of delivery of the Canadian Share, in uniform weekly amounts, for the period August 1, 1967 through March 31, 1968.

3. Assumes that Duncan is ready for operation by 31 July, 1967, but only part of the 1.4 Maf is filled with usable storage for power generation downstream, and further water is stored during August.
   i. Any further filling in August will be requested by the U.S. Entity in consultation with the Canadian Entity.
   ii. Any Additional storage in Duncan will be taken into account when computing the Canadian Share and the rates of delivery will be increased accordingly after August 31, 1967, and delivered in weekly amounts over the period September 1, 1967, through 31 March 31, 1968. This means that the amount of the Canadian Share is adjusted for August 1-31, 1967 based on the above formula under 2). Then the usable storage content (in Maf) in Duncan is assessed on August 31, 1967, and a new Canadian Share for the period September 1, 1967 through March 31, 1968 is calculated using the formula under 2).
4. Assumes that Duncan is not ready for operation (available for storage regulation) by July 31, 1967, but is ready by December 31, 1967.
   i. The delivery of the Canadian Share will be discontinued on July 31, 1967, until storage is available or unless otherwise agreed by the Entities.
   ii. If the Canadian Entity notifies the U.S. Entity that the Duncan reservoir is available for storage regulation after July 31, 1967, the U.S. Entity shall immediately resume delivery of the Canadian Share to the Canadian Entity and continue to deliver such energy for the remainder of the period ending March 31, 1968, at a rate computed as described below.

   If the storage content of the Duncan reservoir is less than 1.4 Maf on July 31, 1967, the Canadian Share shall be computed as described in the above bullet less 11,590 megawatt-days.

The remaining megawatt-days so determined shall be divided by 244 days to determine the rate of delivery of the Canadian Share in uniform weekly amounts, assuming it had been ready on August 1, 1967. However, it is only delivered from the time it is ready until March 31, 1968.

$$\text{Canadian Share} = \frac{34{,}770\frac{(A)}{(1-4)} - 11{,}590}{224} \text{ average MW/day.}$$

Note that the advanced energy delivered between April 1, 1967 and July 31, 1967, is kept by the Canadian Entity.

5. Assumes that Duncan is not ready for operation (available for storage regulation) by July 31,1967, and is not ready by December 31, 1967.
   i. The delivery of the Canadian Share will be discontinued on July 31, 1967, until storage is available or unless otherwise agreed by the Entities.
   ii. Any portion of the advance delivery of the Canadian Share during the period April 1, 1967 through July 31, 1967 that was *not* surplus energy, will be returned to the U.S. Entity if needed to meet load demands in that country prior to March 31, 1968. This means that if energy was generated in excess of needs in the United States during the advance period, it could not be recalled, but the other energy could be recalled.
   iii. If notification is given after December 31,1967, the Canadian Share will be computed as follows:

$$\text{Canadian Share} = 95\frac{(A)}{(1.4)}\text{DMW-days}$$

Where D = the number of days from the date of notification through March 31, 1968

Where A = usable storage content (in Maf) in Duncan on date of notification.

There were several functional criteria for energy transfer:

1. The weekly delivery would not exceed an average rate of 95 megawatts, unless otherwise agreed;
2. Any given day, the energy would be scheduled by the Canadian Entity to the extent that operating limitations would permit, but would not exceed the rate of 180 MW; and,
3. The wheeling charge, in 1967, was $0.0005/KWh (unless otherwise agreed).

OBSERVATION 12

Preempt potential conflict: When creating a detailed agreement, consider all possible scenarios and possible solutions in advance.

Filling of Non-Treaty Storage (Revelstoke and Extra Storage at Mica)

The physical filling situations of the NTS waters in Mica and Revelstoke were determined in a similar fashion to those of Duncan in that priority was given to maintain flood control, ensure safety during filling, and minimize the negative impacts on downstream power benefits. Seven Mile had already been filled by the time the filling agreements were in place and the 1984 NTS Agreement was developed. As discussed in the Competing Issues and Remedies section above, the non-physical issues associated with filling were

resolved under the NTSA, which also provided for compensation for filling the Seven Mile reservoir.

The key lesson learned regarding the filling and operation of the NTS waters is how important it was that both BPA and BCH agreed to share equally the costs and responsibilities associated with the initial filling of the storage for the NTS waters.[49] The Entities split the NTS waters to be operated for individual benefit, but with highly integrated constraints and criteria that were mutually beneficial.

Flood Control, Early Warning and Data Exchange

Canada was to operate for flood control in accordance with annex A of the CRT. More specifically, 80,000 Maf at Mica, 7.1 Maf at Arrow, and 1.27 Maf at Duncan were to be available to hold back spring floodwaters.[50] The United States paid Canada US$64.4 million for half of the expected avoided flood damages for 55 years of operations at Arrow and Duncan and 51 years of operations at Mica (until 2024) under "assured annual flood control" plans.[51] The FCOP was developed in advance of any operation and is applied every year to define a maximum storage level as a function of forecasted unregulated runoff. It ensures that sufficient space has been emptied and that the Canadian storage dams achieve the best possible use of space.

Annex A of the CRT deals with "Principles of Operation" and discusses specifics such as the discharge capacity needed for the Treaty Dams. The discharge capacity was agreed to by the Entities. However, sufficient capacity was needed to allow enough water to be released (in a controlled way, that is, to avoid spilling) to account for inflow as well as enough to allow for evacuation of the reservoir to provide for flood control. Additional structural measures were taken to ensure flood control. For example, conduits, which were developed for hydropower generation with turbines, were only considered 50 percent effective in terms of evacuating the reservoirs for flood control, and so additional conduits were developed specifically for evacuation purposes.[52]

The outflows were to be in accordance with storage reservoir diagrams and "associated criteria" for flood control as well as reservoir balance relationships for power generation. While the Canadian dams could alter the outflow rate to meet their specific needs, the weekly average outflows were set to not less than 3,000 cfs for Mica, 5,000 cfs for Arrow, and 1,000 cfs for Duncan.[53] For its part, the United States submitted FCOPs, which included flood control storage reservation diagrams and associated criteria for each of the U.S. dams. BCH operated, and continues to operate, in accordance with these diagrams. "The diagrams will consist of relationships specifying the flood control storage reservations required at indicated times of the year for volumes of forecast runoff. After consultation with the Canadian Entity, the U.S. Entity may from time to time as conditions warrant adjust these storage reservation diagrams within the general limitations of flood control operation. Evacuation of the storages listed hereunder will be guided by the flood control storage reservation

diagrams and refill will be as requested by the U.S. Entity after consultation with the Canadian Entity."[54] In general, the space available for flood control should be:

- 700,000 acre-feet from Duncan by April 1, and up to 1.2 Maf by May 1, if requested;
- 80,000 acre-feet from Mica by May 1; and
- 7.1 Maf from Arrow by May 1.

Canada has the flexibility to shift the flood control space to different reservoirs, provided it affords the required level of protection.

OBSERVATION 13

Develop mechanisms for all parties to have as much internal flexibility as possible in operating their portions of the cooperative system.

Hydrometeorological Committee and Data Sharing

Following the ratification of the CRT, an "International Task Force on Hydrometeorological Network, CRT was appointed in 1965 to recommend establishment and operation of the Hydrometeorological Network and procedures for exchange of information between the two Entities" (Smith and Allerman 2008). As mentioned previously, the CRTHMC is responsible for developing and maintaining a flood warning and monitoring system.

Details regarding the types of data and mechanisms of exchange are found in the terms of reference (TOR) of the CRTHMC (see section on "Other Information and Links").

The Scope of the Data

The Hydrometeorological monitoring system includes real-time measurements for snow courses, precipitation stations, stream gauges, and temperature gauges; as well as current reservoir levels, storage calculations, and inflow conditions for water balancing and ensuring flood space availability in reservoirs. The information is processed for seasonal, medium-range (10 days) and short-range (1-10 days) forecasting. Available hydrometeorological data from any part of the basin incidentally required by either Entity is provided by the other Entity on request via an online data system set up through the CTRHMC.[55]

The Data Collection and Exchange

In developing the hydromet system, it was decided that there would be "Treaty" stations, which would be essential to the operations for the coordination of the CRT, and "Support" stations, which would provide operational and forecasting data relevant to the flow of the Columbia River at other stations as agreed to by the Entities in consultation with the PEB.[56] The "Treaty stations" focused on the Duncan, Arrow, Mica, and Libby reservoirs, as well as the Columbia and Kootenay rivers and their main tributaries.[57]

It was understood that for adequate forecasting and efficient operation of each of the facilities, a timely exchange of accurate data was necessary, and a number of methods are employed to this end. The principal mechanism for data exchange is CROHMS, a data management system operated by the USACE that takes in data from agencies across the Columbia Basin and makes them available for coordinating operations of all projects on the Columbia River and its tributaries (Smith and Allerman 2008). While the only member of CROHMS is BCH in Canada, in the United States there are 15 other agencies and public utilities,

in addition to BPA and USACE, that enter data into CROHMS. Other data exchanges occur over email, fax, and phone communications (Smith and Allerman 2008).

At the time of creation of the Hydromet system in 1968, both parties used the same standards and methods of collection and there was no specific mention of the "quality or units" of data collection in the TOR of the CRTHMC. Canada now officially uses a *metric* system; nevertheless, exchange within the CROHMS remains in *imperial* units. Data communication technologies have changed in the course of 46 years and currently quick, automated transfers of information happen in near real time, and include satellite and telemetry data from remote stations. However, the easy availability and transfer of data has led to some problems as data may originate from different sources and thus be of varying quality. Both USACE and BCH are developing new internal data management systems and forging new relationships between data managers (Smith and Allerman 2008).

Forecasting

The forecasting of water supply is not specifically mentioned under the TOR for the CRTHMC. Nevertheless, the members of the committee are generally involved in forecasting for their respective agencies. Hence, the CRTHMC "reviews all water supply forecasting procedures implemented for Treaty projects, and has to agree on the official procedures used to provide forecasts for the Columbia River TSR studies to achieve the targets for flood control" (Smith and Allerman 2008).

While each Entity is responsible for its own short-term flow forecasting, the CRTHMC has agreed to use a similar method of statistical procedures to ensure both Entities achieve the same results, thereby "removing any opportunity of one Entity to shape the outcome to their advantage" (Smith and Allerman 2008).

Cost of the Monitoring

As specified in the TOR for the CRTHMC, the Entities are to make a reasonable effort to assure continued operation of the hydro-met stations and supporting facilities designated for the hydrometeorological station. However, in the case of several snow stations in Canada, BPA has taken on the role of funding them. It should be noted that the deterioration of support for monitoring networks in Canada, particularly at the federal level is an ongoing challenge.

Monitoring, Compliance, and Reporting

The CRTHMC is to "consult, and coordinate its work, with the Columbia River Treaty Operating Committee"[58] and provide the Entities with copies of all correspondence, reports and drafts of reports, minutes of meetings, and distribution of all material.[59] This includes preparing supplemental reports as may be needed to keep the appropriate Entity informed on significant developments, alternative considerations, progress, and operation of the Treaty Facilities and Supporting Facilities.[60] Additionally, coordination is conducted with other committees as appropriate.

Adaptive Management

The Hydromet system is to be reviewed from time to time, allowing for updates as agreed to by the Entities in consultation with the PEB. Indeed, the preamble to the TOR states that "duties and functions of the CRTMTH are to be updated from time to time as changes occur in the hydrometeorological requirements or facilities." This allows for flexibility in terms of being able to adapt to changing conditions. For example, climate shifts in the upper Columbia Basin are resulting in higher winter temperatures with increased precipitation in the form of rain and less snow, which has implications for spring run-off and thus flood control. Moreover, physical changes to sites are possible over time—such as avalanche risks, fires, and flood damage, among others—that require a station to be abandoned. In such cases, an alternate (preferably nearby) location must be identified.

Disputes of Data

In the event of any substantial disagreement within the CRTMTH, the matter is referred to the respective Entities. If the matter cannot be resolved at that level, it would fall under the dispute resolution mechanism of the CRT and may be submitted to the IJC.[61] If the IJC does not render a decision within three months of the referral, or within such other period as may be agreed upon by the United States and Canada, either country may submit the dispute to arbitration. The arbitration panel would consist of one individual chosen by each country, and a third, either chosen jointly or by the ICJ. Decisions of the IJC or an arbitration tribunal (by a majority of members) are binding and definitive on the Parties. The United States and Canada may agree, by an exchange of notes, to use alternative procedures for settling differences arising under the CRT, including referring disputes to the ICJ for a decision.

Non-Treaty Storage Water

The water stored as NTS does not require any additional information exchange mechanisms, as it is related to reservoir levels and river flows, which are covered under the CRTHMC.

Conclusions

The CRT is a rich example of cooperation between an upstream and a downstream country on an international river basin. Key to its overall success has been the continued cooperation and collaboration between the various individuals within the Entities operating the facilities and implementing the CRT and the NTSA. Some of these relationships span more than three decades and involve relations on both a professional and personal level. For example, the Entities organize weekend meetings at which families are invited for special events. This high degree of respect and collaboration on a personal level has made it possible to avoid conflicts in many areas for over 50 years of Treaty implementation.

Moreover, the fact that the development of the upper Columbia was initially approached in a way that would allow both countries to benefit from it helped create a permanent

atmosphere of cooperation and collaboration. Of further significance is the fact that the principal interaction between the two countries is through commercial entities that both have an interest in generating income. Consequently, while there have been disputes and differences of opinion, these have almost invariably been addressed through dialogues and interactions between the commercial Entities themselves, with the occasional assistance of the PEB. Even when one dispute arose that reached the level of both federal governments, the commercial Entities, BCH and PBA (capable of creating mutually beneficial arrangements outside the CRT), eventually managed to resolve it by themselves.

In reviewing the filling and flood control issues, some key observations come to light:

1. Both Canada and the United States have benefited from the cooperative operations of the storage in the upper Columbia, and developed formulae to essentially split those additional (synergistic) benefits 50/50;
2. Downstream investment in upstream infrastructure provides an opportunity for funding capital investments and vice versa;
3. Both parties took responsibility and shared in the lost power associated with the initial filling of both the Treaty and Non-Treaty waters, splitting its "costs" as well as its "benefits";
4. Creation of an independent overview body can help ensure implementation and resolve any misunderstandings;
5. The private sector can help raise funding to cover capital costs—investors have more security when commercial entities coordinate operations, and assured energy (firm energy) production is more attractive for investors;
6. Private investment and commercial enterprises tend to focus on operations and economic development, thereby allowing for more creative solutions to problems;
7. Information and data exchange can act as a catalyst for confidence building;
8. Incorporating adaptability into decision making and operations is critical to successfully addressing changing situations and circumstances;
9. An appropriate balance of incentives and penalties needs to be drawn up to help compliance and facilitate investment;
10. Develop an agreed hierarchy of interests. For example, flood control or "vital needs" takes precedence over power, and power in turn takes precedence over other interests;
11. Preempt potential conflicts: When creating a detailed agreement, consider all possible problem scenarios and their solutions in advance; use similar methods of measurement, calculations, and joint modeling, among others, to ensure both Parties arrive at very similar results;
12. Develop mechanisms that ensure all parties have as much internal flexibility as possible in terms of operating their portions of the cooperative system;
13. At the core of effective cooperation is developing good personal relationships and mutual respect.

Annexes

ANNEX 2A

History and General Information

- Hyde, J. 2010. Columbia River Treaty Past and Present. Hydrovision. An in-depth case study of the Columbia River Basin

Agreements

- 1909 Boundary Waters Treaty
- 1961-64 Columbia River Treaty
- 1984 and other NTS Agreements

Hydrometeorological Data

- TOR for the CRTHMC: Appendix B of 2010 Supplemental Report of the Columbia River Treaty Hydrometeorological Committee.
- Smith, S., and R. Allerman. 2008. *Forty Years of International Cooperation: Columbia River Treaty Hydrometeorological Committee 1968-2008*. Paper presented at the 76th Annual Western Snow Conference 2008, Hood River, Oregon.

Notes

1. Rock Island Dam (1933) and Bonneville Dam (1937).
2. *Treaty Between the United States and Great Britain Relating to Boundary Waters and Questions arising Between the United States and Canada, Washington*, January 11, 1909. US-Great Britain, 36 Stat. 2449
3. *Treaty Relating to Cooperative Development of the Water Resources of the Columbia River Basin*. Opened for signature January 17, 1961, United States-Canada, 542 UNTS 244 (entered into force September 16, 1964).
4. In the case of Canada, it must have the concurrence (agreement) of BC before it can do so (Clause 4 (2)(h) of the Canada–BC Agreement).
5. Ratified by both governments and implementation has started.
6. The Canadian share of flood control benefit was one half the calculated "equal-added" allocation with the 1961 U.S. base system. Essentially those storage projects existing in 1961, plus any new U.S. projects on the Columbia mainstem.
7. *Exchange of Notes Constituting an Agreement Between Canada and the United States of America Authorizing the Canadian Entitlement Purchase Agreement Provided for Under the Treaty Relating to Co-operative Development of the Water Resources of the Columbia River Basin*, "Terms of Sale". Signed in Washington, November 17, 1961. Came into force January 22, 1964 (1964 Terms of Sale).
8. This occurred 30 years after construction of each of the Treaty dams.
9. In Canada, flood control, power generation, and transmission are dealt with by BCH.
10. The USACE is the owner/operator of many federal dams in the region, including Libby. BPA is the federal agency responsible for transmission and selling of federal hydropower in the region.
11. CRT Article XIV.
12. CRT Article XV

13. In one case the issue went to federal agencies in Ottawa and Washington before finally being resolved by the Entities.

14. TOR of the Columbia River Treaty Hydrometeorological Committee, Paragraphs A(2); B (2&3).

15. *Agreement executed by the United States of America acting by and through the Bonneville Power Administration and British Columbia Hydro and Power Authority relating to (1) Initial Filling of Non-Treaty Reservoirs; (2) Use of Columbia River Non-Treaty Storage; and (3) Mica and Arrow Reservoir Refill Enhancement*, January 1984.

16. The NTSA was signed in April 1984, but was to be effective for operations from October 1983 to July 1993.

17. The release provisions of the NTSA expired in June 2004, while storage refill provisions remained in effect for an additional seven years.

18. Firm power is that energy needed to reliably serve firm (i.e., contractually obligated) electrical loads. Secondary power is generation greater than firm power that is available to meet secondary loads, which is typically sold at lower prices, as it reflects only the reduced operating costs of displacing thermal power plants or serving optional industrial loads. The goal was to fill storage during times of surplus, as reflected in the 1967 Mica Filling Agreement: "The objective of the filling program for Mica reservoir is to attain the usable storage content of approximately 7 Maf, to the extent that it is available, by September 1, 1973, and a total storage content of approximately 15 Maf by September 1, 1975. Each Entity' shall use its best efforts to facilitate this objective without jeopardizing the ability of power system in the U.S. and Canada to meet their firm and secondary loads."

19. (CRT Art IV (6)). This meant that compensation was only for a delay due to a "manageable" issue that had not been well managed.

20. (CRT Art XVIII (1)).

21. (CRT Art XVIII (5)).

22. *Exchange of Notes Constituting an Agreement Between Canada and the United States of America Authorizing the Canadian Entitlement Purchase Agreement Provided for Under the Treaty Relating to Co-operative Development of the Water Resources of the Columbia River Basin*, "Terms of Sale". Signed in Washington, November 17, 1961. Came into force January 22, 1964 (1964 Terms of Sale).

23. Addendum to 1964 Terms of Sale, Section B (2).

24. See Article IV and VI (CRT). The United States paid US$1.2 million when 80,000 acre feet of flood space was available for Mica, US$52.1 million for 7.1 MAF at Arrow, and US$11.1 million for up to 1.27 MAF at Duncan.

25. The actual amounts were US$4,500/month for storage at Mica, US$192,100/month for storage at Arrow; and US$40,800/month for storage at Duncan. See Article VI (2) (CRT).

26. The U.S. paid Canada C$298,242 on July 1, 1970 for the early completion of Arrow and Duncan dams (see: Entity and PEB Annual Reports).

27. In 1948, the Columbia Basin was devastated by a massive flood that displaced 30,000 people and killed 50, highlighting the need for collaborative action between Canada and the United States. *2020/2014 Columbia River Treaty Review*. Bonneville Power Administration and the US Army Corps of Engineers, 2008.

28. Mica Storage Agreement, Bonneville Power Administration and British Columbia Power and Hydro Authority, Contract No. EW-78-Y-83-0069, April 26, 1978.

29. Both annex 2A and the Protocol to the Treaty refer to "generation at-site and downstream in Canada of the Canadian storages referred to in Article II (2) of the Treaty" (Protocol to CRT Para 7 (3)). Canada inferred that the reference anticipated additional generation capacity and storage. There are other references in the treaty and protocols to additional Canadian power generation that would need to be balanced with U.S. power generation interests.

30. BPA Contract DE-MS79-83BP91290 and BPA Contract DE-MS79-83BP91642 Relating to the filling of Revelstoke Reservoir. Available from download at www.bpa.gov/Projects/Initiatives/Non-Treaty-Storage-Agreement/ntsadocuments/Previous-Agreements. These contracts outline the use of NTS water in Mica and Arrow to be used to fill the inactive space at Revelstoke and provide compensation for use of NTS waters through a daily "conversion factor." Also see BPA Contract No. DE-MS79-84bp90946 Relating to the Initial Filling of Revelstoke Reservoir and Additional Uses of Storage Space in Canada, and BPA Contract No. DE-MS79-84bp90945, a Companion Agreement with 17 Mid-Columbia Project

Owners and Purchasers." In *Administrator's Record of Decision*: Bonneville Power Administration, US Department of Energy, 1984. Available from download at https://www.bpa.gov/efw/Analysis/NEPADocuments/nepa/Non-Treaty_Storage_Agreement/RevelstokeROD-January1984.pdf

31. CRT Article IV(5).
32. 1984 NTSA Para 3 (c) (1).
33. Dead storage is the water in the bottom part of a reservoir that is below the level of the intake structures and is thus never used for power generation or other purposes.
34. 1984 NTSA Para 4 (a)
35. 1984 NTSA Para 3 (e).
36. CRT Annex A Principles of Operation, Para (2).
37. The CRT requires the CE to downstream U.S. power benefits be computed as first-added to a theoretical Base hydropower system with 1961 U.S. reservoir storage, current downstream dams and thermal power plants, operated only for optimum power, and excluding import/exports and other power resources. This "theoretical" calculation does not take into account changes to the system in the United States since 1961, and thus overestimates the actual power benefits achieved through Canadian treaty storage.
38. Essentially those storage projects existing in 1961, plus any new U.S. projects on the Columbia mainstem.
39. CRT Protocol, Para. (5). Libby is included in the FCOP because Canadian storage operating plans (AOP and FCOP) must necessarily take into account Libby operation, as it is upstream of the lower Kootenay River in Canada (figure 1).
40. CRT (Art XIV (2-k)).
41. *Detailed Operating Plan for Columbia River Treaty Storage: 1 August 2007 through 31 July 2008*. Columbia River Treaty Operating Committee, July 2006.
42. Over the years, there have been numerous supplemental agreements that alter the flow and operations of the CRT facilities for mutual benefit. These range from formal agreements prepared months before that sometimes become multiyear agreements to ad hoc arrangements, meant to smooth storage operations or avoid specific problems.
43. The 2012 NTSA removed the 2000 cfs firm releases for each side, and instead gave firm release rights that are dependent on low runoff conditions.
44. CRT (Art II (3)).
45. CRT (CRT Art 3 (6)).
46. Exchange of Notes Constituting an Agreement Between Canada and the United States of America Authorizing the Canadian Entitlement Purchase Agreement Provided for Under the Treaty Relating to Co-operative Development of the Water Resources of the Columbia River Basin, January 22, 1964. Attachment to Terms of Sale, A 1 (a). For every month that this space was not available after the prescribed time, the United States would charge Canada based on the amount of storage unavailable, to a maximum of US$237,400.
47. Canada was paid in advance but would have to pay back the United States in accordance with CRT Article VI (2).
48. Exchange of Notes Constituting an Agreement Between Canada and the United States of America Authorizing the Canadian Entitlement Purchase Agreement Provided for Under the Treaty Relating to Co-operative Development of the Water Resources of the Columbia River Basin, Attachment Relating to Terms of Sale B (1), January 22, 1964.
49. 1984 NTSA Para 4 (a).
50. CRT Art IV (2).
51. After 2024, the flood control operations turn to a "called upon" flood control system wherein the United States must try to meet its flood control needs internally before calling upon Canada to assist with flood control. There are many more dams now in the U.S. portion of the Columbia than there were in 1961.
52. CRT Annex A para (3).
53. CRT Annex A Para (4).
54. CRT Annex A Para (5).

55. 1968 CRTHMC-TOR (1-C).

56. 1968 CRTHMC -TOR (B-1).

57. In 1992, there were an estimated 120 Treaty stations (approximately 80 in Canada and 40 in the United States) and 770 Support stations (approximately 70 in Canada and 700 in the United States). Note that federal funding of monitoring stations in Canada has been declining over the years and is a challenge. See Smith, S., and Allerman, R. (2008).

58. 1968 CRTHMC-TOR.

59. 1968 CRTHMC-TOR (1-v-d).

60. 1968 CRTHMC-TOR (1-v-a).

61. CRT Article XVI.

Orto-Tokoy Reservoir on Chu River. © Homocosmicos/iStock.

Chapter 3 Chu and Talas Basins

Cascade and Water Quantity Management

By Vadim Ni

Summary: Three-Stage Process of Coordinated Basin Development

This case study reports on the operation of cascade and water quantity management in the Chu and Talas Basins, shared by the Kyrgyz Republic and Kazakhstan, and describes in detail the regulatory and institutional framework developed and its implementation.

For reference, the three-stage process of coordinated basin development is presented in figure 3.1.

Identification of Opportunities and Risks

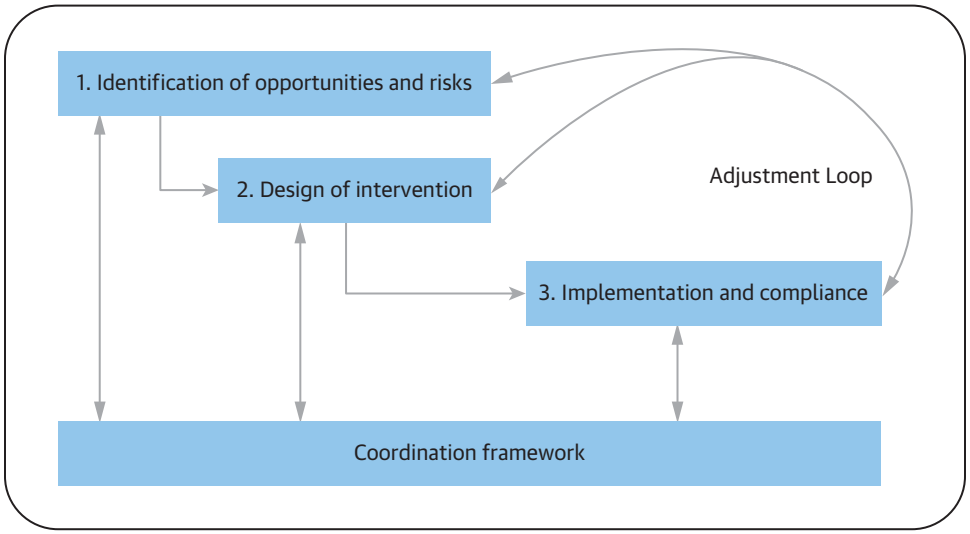
Kazakhstan and the Kyrgyz Republic share the Talas water resources equally, while 58 percent of the Chu water resources are allocated to the Kyrgyz Republic and 42 percent to Kazakhstan. Currently there are five water management facilities on these rivers that are jointly managed by the two countries under the following framework:

Coordination Framework (Stage 1)

The current transboundary cooperation in the Chu and Talas Basins is based on the following:

- ***International Treaty*** **(T44):** in 2000, the two countries signed a bilateral agreement: "Agreement between the Government of the Kazakh Republic and the Government of the Kyrgyz Republic on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas," which governs the joint management and maintenance of the water facilities in these basins.

FIGURE 3.1. Three-Stage Process of Coordinated Basin Development



- ***River Basin Organizations, Authorities or Commissions*** **(T59):** in 2005, the bilateral Commission on the Chu and Talas Rivers (the Commission) was established by Kazakhstan and the Kyrgyz Republic to implement the objectives of the 2000 Agreement; it has *advisory, executive, and regulatory powers* to manage the water facilities **(T50–52).**

Design of Intervention

In order to maintain the water facilities on the Chu and Talas Rivers, the countries have over time used the following tools:

- ***Single-Sector Operational Plans*** **(T39):** the countries agree annually on the types and volumes of repair and maintenance work to be done on the water facilities covered by the 2000 Agreement. These works are determined on the basis of an annual defect assessment of the covered installations conducted by the Kyrgyz Republic and following acceptance of the outcomes of the assessment by Kazakhstan.

Coordination Framework (Stage 2)

- ***Declarations*** **(T42)** or ***Minutes of Ministerial Meetings*** **(T43):** The water-sharing rules on the Chu and Talas Rivers were established under the 1983 Rules (non-binding) by the Soviet Union's All-Union Ministry of Melioration and Water Economy. The sharing of operational and maintenance costs is based on the 1998 Protocol signed by the national water authorities of the two countries (also non-binding).

- ***International Treaties* (T44)**: the 2000 Agreement currently governs the joint management and maintenance of the water facilities on the Chu and Talas Rivers.

Implementation and Compliance

For the implementation of the 2000 Agreement, the two countries used the following tools:

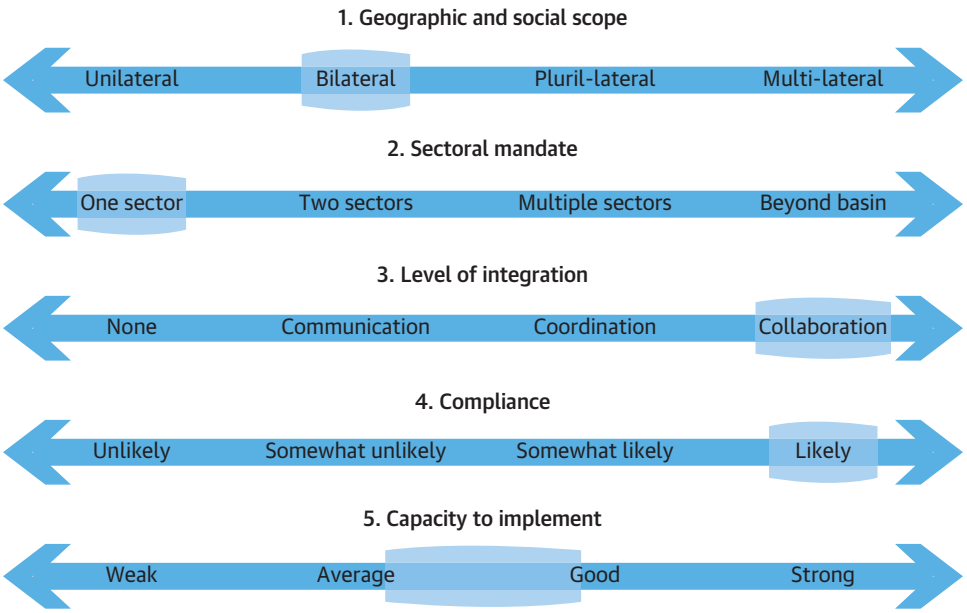
- ***Procedures for Data Sharing and Exchange* (T21)**: the Working Group on Economics, Monitoring, and Data Exchange provides the Commission with information in support of the latter's activities, monitors the work of the Commission, engages the public, and produces publications on the Commission's work. Moreover, it has created basic databases, interacts with the mass media, and reports on the work of the Commission in online and paper publications.
- ***Multi-Sector Development Plans* (T12)**: the Working Group on Legal and Institutional Issues has prepared the IWRM plans for the Chu and Talas Basins.
- ***Provisions for Extreme Events and Uncertainty* (T41)**: under the 2000 Agreement, the Parties must notify each other in the event of an accident on the facilities caused by extreme weather events or technical malfunction in their operations.
- ***Periodic Reviews* (T48)**: one of the regular agenda items of the Commission's sessions is the review of potential amendments to the 2000 Agreement and the Statute of the Commission.
- ***Compensation for O&M or Construction of Regulating Infrastructure* (T18)**: the two countries agreed that the operations and maintenance costs of the facilities specified in the 2000 Agreement would be shared on a pro rata basis in accordance with the water volume received by each party.
- ***Negotiations* (T66)**: the Commission is charged with negotiating between the two countries whenever disputes arise. In case of disagreement regarding any issue, the Parties have to conduct additional consultations and consider the issue at the next session of the Commission.

Coordination Framework (Stage 3)

- ***International Treaties* (T44)**: in 2000, the two countries signed a bilateral agreement governing the joint management and maintenance of the water facilities in the Chu and Talas Basins.
- ***River Basin Organizations, Authorities or Commission* (T59)**: in 2005, the bilateral Commission on the Chu and Talas Rivers (the Commission) was established by Kazakhstan and the Kyrgyz Republic to implement the objectives of the 2000 Agreement.
- ***Executive Functions* (T51)**: the Secretariat is responsible for the implementation of the decisions of the Commission and the heads of the Secretariat in Kazakhstan and the Kyrgyz Republic ensure the day-to-day operations of the Commission.

- ***Technical Entities* (T36)**: the Secretariat has established working groups (WGs) to deal with issues such as infrastructure safety, legal and institutional issues, water resources allocation, monitoring and data exchanges.

FIGURE 3.2. Application of the Five Dimensions to the Operation of Cascade and Water Quantity Management in the Chu and Talas Basins Case



Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention— to the operation of cascade and water quantity management in the Chu and Talas Basins case is depicted in figure 3.2 and detailed below.

1. The basin is shared by two countries and is therefore managed on a bilateral basis.
2. The sectoral mandate of this agreement covers the operation and management of the water facilities on the rivers.
3. The countries collaborate in the management of the operation and management of the water facilities.
4. At the time the agreement was negotiated, it was deemed very likely that both countries would comply with the provisions of the agreement; the mechanisms have so far been successful.
5. The capacity to implement the tools and design the coordination frameworks was probably between average and good, as the two parties had third-party assistance to implement the agreement.

Case Study Description

Introduction

This case study reports on the operation of cascade and water quantity management in the Chu and Talas Basins, shared by the Kyrgyz Republic and Kazakhstan, and describes in detail the regulatory and institutional framework developed and its actual implementation.

Currently the development of the regulatory and institutional framework for the joint management of the water facilities in the Chu and Talas Basins is based on the provisions

of the 2000 Agreement between the Government of the Kazakh Republic and the Government of the Kyrgyz Republic on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas (the 2000 Agreement).[1] In 2005, the bilateral Commission on the Chu and Talas Rivers (the Commission) was established by the governments of Kazakhstan and the Kyrgyz Republic to implement the objectives of the 2000 Agreement.[2] The Commission takes care of working regimes and the necessary expenses for O&M, and considers various aspects of coordinated efforts on transboundary water facilities on the two rivers. Water allocation on the Chu and Talas Rivers has traditionally been based on principles and conditions developed by the 1983 Soviet Ministry of Water Management regulations, which stipulated that "(Talas) water resources would be allocated equally between both Parties on an equal basis," and "(Chu) water resources would be allocated between both Parties as 58 percent for the Kyrgyz Republic and 42 percent for Kazakhstan."[3]

The Consultant reviewed the following aspects of the operation of cascade and water quantity management in the Chu and Talas Basins:

- Regulatory framework (agreements, guidelines, and informal arrangements guiding the implementation);
- Institutional arrangements (the Agreement's bodies established for the implementation of the 2000 bilateral Kazak-Kyrgyz Agreement, their composition and operational rules, public authorities of Kazakhstan and the Kyrgyz Republic represented in the Agreement's bodies, and the involvement of stakeholders);
- Actual implementation of the regulatory and institutional framework with the focus on its ability to facilitate the riparian coordination of Kazakhstan and the Kyrgyz Republic for investments with a transboundary impact on the Chu and Talas River Basins.

Initially, the study constituted a desk study of the legal and institutional frameworks for the operation of cascade and water quantity management in the Chu and Talas Basins, based on reported activities of the Commission, and interviews with its participants. Thus, the study began with the collection of texts from regulatory and institutional documents, as well as from reports and presentations on activities conducted in the framework of the Chu-Talas Commission. Sources of information included the Commission's official website and official online databases of legislation and policy documents of the two countries. Thus, sufficient, reliable, and up-to-date data were collected on the legal, institutional, and operational arrangements. Thereafter, the Consultant analyzed the collected documents with a focus on:

- Legal and actual scope of application and main commitments by the riparian countries under the 2000 Agreement and the 1983 Soviet Ministry of Water Management regulations;

- Approaches taken by the riparian countries to set up mechanisms; facilitate the achievement of mutual benefits and beneficial development outcomes; and manage, mitigate and/or prevent transboundary harm; as well as the effectiveness of these approaches;
- Conflicts or competing demands that were addressed when establishing the regulatory framework;
- Alignment of the regulatory and institutional arrangements with the needs of the riparian countries.

In the second stage of the case study the Consultant participated in the 23rd session of the Commission that was conducted on April 26, 2017, in Taraz, Kazakhstan with the involvement of more than 50 participants from the ministries of foreign affairs, national water and basin authorities, national hydrometeorological services, operators of the key water management facilities, and national experts, as well as local offices and projects of the United Nations Economic Commission for Europe (UNECE), the United Nations Development Programme (UNDP), the Organization for Security and Co-operation in Europe (OSCE), the Swiss Agency for Development and Cooperation (SDC), the International Fund for Saving the Aral Sea (IFAS), and the Central Asia Regional Environmental Center (CAREC). From May 23-25, 2017, the Consultant also participated with experts in the first session of the Working Group on Climate Change Adaptation and Long-Term Planning, which was held in Bishkek, the Kyrgyz Republic. During the case study preparation, the Consultant interviewed 11 participants, including two representatives from the national water authorities of the two countries, a representative of the Ministry of Foreign Affairs of Kazakhstan, the Cohead of the Secretariat from Kazakhstan, two members of the Working Group on Climate Change Adaptation and Long-Term Planning from Kazakhstan and the Kyrgyz Republic, four representatives of international and regional organizations (OSCE, United Nations Development Programme Global Environment Facility [UNDP-GEF] Project, United UNECE, and IFAS), and an operator of one of the covered water management facilities. All interviewees have at least 3-4 years of experience participating in the activities of the Commission and a few of them were involved in the drafting of the 2000 Agreement and the establishment of the Commission. The interviews were short (approximately 30 minutes each) and conducted during the 23rd session of the Commission on April 26, 2017, one day before the session. Thus, in addition to describing the regulatory and institutional frameworks, the paper seeks to cover the efforts undertaken by the Commission, its Secretariats, and the WGs on the coordinated transboundary water management in the Chu and Talas Basins, and the debate on some aspects of the bilateral cooperation.

Regulatory Framework on the Operation of Cascade and Water Quantity Management

The construction of large water management facilities on the Chu and Talas Rivers began in the 1950s. Currently the water management facilities of interstate status in the Chu and

MAP 3.1. Water Management Facilities of Interstate Status as Determined by the 2000 Agreement

Source: Chu-Talas Commission 2017.

Talas Basins (map 3.1) serving the joint use of the water resources by Kazakhstan and the Kyrgyz Republic consist of:

- Orto-Tokoyskoye Water Reservoir on the Chu River;
- Ferroconcrete Bypass Canals on the Chu River from the Bystrovskaya Hydropower Plant to Tokmok;
- Western Large Chu Canal;
- Eastern Large Chu Canal;
- Chumysh Hydrosystem on the Chu River;
- Kirovskoye Water Reservoir on the Talas River.[4]

During the Soviet time the joint use of water resources of the Chu and Talas Rivers was managed in a top-down approach by the All-Union Ministry of Melioration and Water Union (the Ministry), with resolution of bilateral disputes by the joint commission comprising representatives of the ministries of water economy of the two republics on parity basis.

All-Union Ministry of Melioration and Water Economy Regulations

The formal legal arrangements for sharing the water flows of the Chu and Talas rivers between the Kazakh and the Kyrgyz republics were made by the regulations of the All-Union Ministry of Melioration and Water Economy in 1983. The first regulation on the Talas River was adopted in 1948 and on the Chu River on April 31, 1931. The Ministry updated regulations on both rivers in 1983. In both cases the established water-sharing rules were applicable to all surface river flows of the two rivers, including the return waters.[5]

The regulation on the Chu River sets the share for the Kyrgyz Republic at 58 percent and the share for the Kazakh Republic at 42 percent, whereas the regulation on the Talas River provides for equal water shares for both republics. Within each year the water sharing is subject to joint decisions of the ministries of water economy of the two republics, with separate determination per vegetation and non-vegetation periods (table 3.1). For the Talas River the regulation prioritizes the water supply of municipal and industrial water users.

TABLE 3.1. Water Sharing per Vegetation and Non-Vegetation Periods on the Chu River

Republic	Unit	Vegetation period	Non-vegetation period	Year
		April–September	October–March	
Kazakh	mln. m^3	1,540	1,250	2,790
	%	34	60	42
Kyrgyz Republic	mln. m^3	3,017	833	3,850
	%	66	40	58
Total	mln. m^3	4,557	2,083	5,840

Source: 1983 regulations of the All-Union Ministry of Melioration and Water Economy.

The review of compliance with both regulations was assigned to the Management Department of the Kirovskii Canal, an inter-republican department of the Ministry at that time. The Management Department also had the competence for resolution of disputes on water sharing between the two republics and its decisions were legally binding for both Parties. Although the regulations became non-legally binding with the dissolution of the Soviet Union, the established rules on water sharing are still followed by Kazakhstan and the Kyrgyz Republic. Nevertheless, disputes do arise between the two Parties from time to time, related among other things to the assessment of the amounts of operational costs to be shared by the riparians, the repair works that need to be done annually, and noncompliance with water distribution per vegetation and non-vegetation period.[6]

Protocol on Sharing Operational Costs on the Water Management Facilities of Interstate Status

In 1998, the national management authorities of Kazakhstan and the Kyrgyz Republic reached agreement on the shared annual operational costs of the water management facilities of interstate status on the Chu and Talas Rivers, as presented in table 3.2. Yet the countries did not ratify the 1998 Protocol on the shared operational costs and, thus, it is not a legally binding document.

Bilateral Agreement on the Use of Water Management Facilities of Interstate Status

The Agreement between the Government of the Republic of Kazakhstan and the Government of the Kyrgyz Republic on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas was signed on January 21, 2000, in the city of Astana, Kazakhstan. It was ratified by the Kyrgyz Republic on June 12, 2001, and by Kazakhstan on March 7, 2002, and entered into force on April 17, 2002.

The scope of the 2000 Agreement is limited to the joint management and maintenance of the water facilities of interstate use on the Chu and Talas Rivers to achieve mutual benefits

TABLE 3.2. Agreed Operational Costs under the 1998 Protocol

(US$, thousands)

Water management facility	Kazakhstan	Kyrgyz Republic	Total
Orto-Tokoyskoye Water Reservoir on the Chu river	80	308	388
Kirovskoye Water Reservoir on the Talas river	264	71	335
Chumysh Hydrosystem, Eastern and Western Large Chu Canals	319	1,442	1,761
Total (5 water management facilities)	663	1,821	2,484

Source: The Bilateral Commission.

on a fair and reasonable basis. The provisions of the 2000 Agreement cover the following aspects of the bilateral cooperation on those facilities:

- Joint annual financing of the operational and technical maintenance costs based on the previously established shared use of the water resources of the Chu and Talas Rivers (Articles 3, 4, and 6);
- Establishment of joint commissions to ensure safe and reliable operation of the water management facilities of interstate status (Art 5);
- Joint emergency preparedness for and response measures to accidents that may occur on the water management facilities of interstate use and the nearby areas that could be affected by the negative effects of accidents (Art 7-9);
- Joint scientific research and field studies on the issues of the rational and efficient use of the water resources and water management facilities on the Chu and Talas Rivers (Art 10);
- Assistance with transboundary movements of vehicles, equipment, raw and construction materials as necessary for the joint maintenance of the water management facilities of interstate status (Art 11);
- Administrative provisions of the bilateral Agreement (entry into force, duration and prolongation, amendments, withdrawal, official languages, dispute resolution, and interpretation) (Art 12-14).

The core provisions of the 2000 Agreement relate to the joint annual compensation of the operational and technical maintenance costs based on the previously established shared use of the water resources of the Chu and Talas Rivers, in accordance with the 1983 All-Union Ministry of Melioration and Water Economy regulations. Articles 3 and 4 require the Parties to share the operational and technical maintenance costs of the water facilities of interstate status and take other agreed actions according to the received share of the water. Article 6 of the 2000 Agreement clarifies that the Parties should ensure the provision of the necessary means to cover the operational and technical maintenance costs of the water management facilities of interstate status on the Chu and Talas Rivers on an annual basis.

The provisions on joint emergency preparedness and response measures of the 2000 Agreement are less detailed than the provisions of the UNECE Convention on the Transboundary Effects of Industrial Accidents. Nevertheless, they are very important in the context of Kazak-Kyrgyz water cooperation because only Kazakhstan is a Party to the UNECE Convention.[7] The provisions of the 2000 Agreement require the Parties to take the following emergency preparedness and response measures in relation to the water management facilities of interstate use on the Chu and Talas Rivers:

- To protect jointly the facilities and the areas that could be affected by the negative effects of floods, mud slides, and other extreme weather events (Art 7);
- To notify each other in the event of an accident on the facilities caused by extreme weather events or technical malfunction in their operation (Art 8);
- To use each other's construction, repair, and industrial capacities to undertake emergency response measures promptly and efficiently (Art 9).

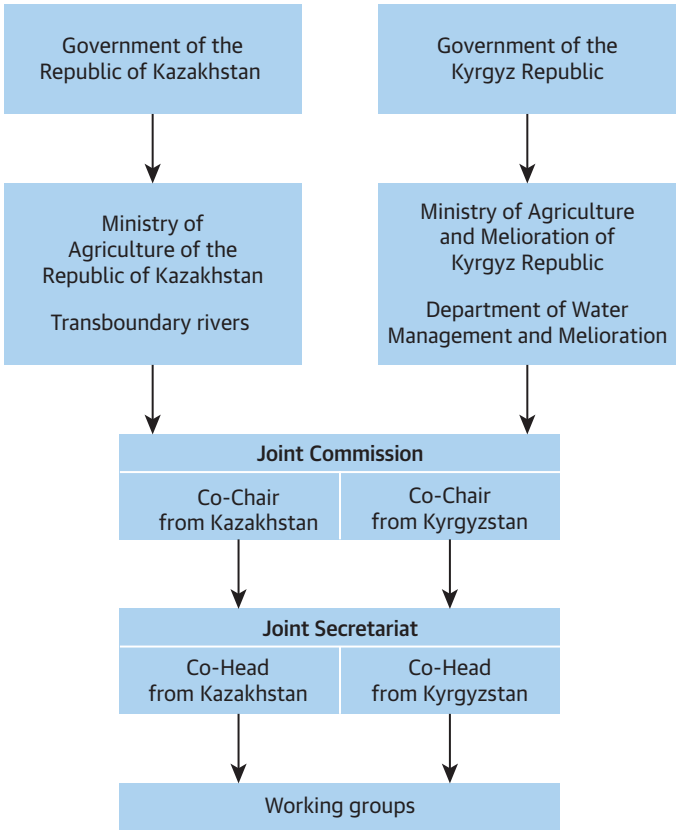
The provisions of the 2000 Agreement on joint scientific research, assistance with transboundary movements, and the administrative provisions are facilitative measures for the implementation of the core provisions of the Agreement, and are very similar to those of other global and regional environmental and water agreements.

Institutional Arrangements for Transboundary Water Cooperation in the Chu and Talas Basins

Article 5 sets out the institutional framework for the implementation of the 2000 Agreement. It requires the establishment of joint commissions with the mandate to ensure the safe and reliable operation of the water management facilities of interstate status by setting the regime of their operation and determining the associated operational and maintenance costs.

On December 21, 2005, the governments of Kazakhstan and the Kyrgyz Republic signed the Protocol on the Establishment of the Commission on the Use of the Water Management Facilities of Interstate Status on the Chu and Talas Rivers. The Statute of the Commission was approved by both Parties on July 26, 2006, and defines the scope, guiding principles for activities, main competences, and functions of this Agreement's body.[8] The scope of activities of the Commission is limited to the protection and proper maintenance, as well as allocation of funds to manage the water management facilities of interstate status—the Orto-Tokoiskoye Water Reservoir on the Chu river, the By-Pass Ferroconcrete Chu Canals on the Chu river from the Bystrovskaya Hydropower Plant to the city of Tokmok, the Western and Eastern Large Chu Canals, the Chumysh Hydrosystem on the Chu river, and the Kirovskoye Water Reservoir on the River Talas. Also, through joint activities, the Parties to the 2000 Agreement protect the facilities and adjacent territories from adverse effects of natural disasters, mitigate emergencies of natural and technical character, and ameliorate the aftermath thereof.

FIGURE 3.3. Structure of the Commission and Its Secretariat



Source: The Bilateral Commission.

According to Section 4 of the Statute of the Commission, this body's main functions are to:

- Coordinate and consider the activities of the Parties related to the implementation of the Agreement;
- Develop and implement joint activities to satisfy the Parties' public and business demand for water resources;
- Provide a comprehensive assessment and forecast of the status of water bodies, and regulate water resources use to ensure mutually equitable and reasonable benefit sharing;
- Agree on the standard indicators of water consumption, water abstraction, and water assessment and measurement;
- Agree on the documents regulating the procedures for organizing the operation of the water facilities of interstate status and the cost-sharing of repair, operations, maintenance, flood control and other measures, with a view to ensuring the safety of these facilities;
- Agree on the operational regimes of water reservoirs and adjust the regimes and limits in accordance with the actual water content and water users' needs;
- Establish a joint emergency response procedure, coordinate releases in the case of high water flows, flood control, mud slides control, and other natural disaster control activities;
- Organize an exchange of hydrological forecasts and data related to water management in the Chu and Talas Basins and other up-to-date information;
- Agree on and coordinate the programs for water bodies' monitoring, water and hydrotechnical facility assessment, and water inventory in order to develop a common basin-based water monitoring and assessment system in the Chu and Talas Basins;
- Organize joint scientific research and development in the areas of interstate water facilities operation, maintenance and safety, and regulation and efficient use of the Chu and Talas water resources;
- Consider any other matters related to the Commission's activities.

The parity and equal rights of the members are the guiding principles for the activities of the joint Commission. The Parties appoint the Commission's members on a parity basis and two Co-Chairs, representing the governments of Kazakhstan and the Kyrgyz Republic,

who coordinate the activities of this body. Biannual sessions are the Commission's main activities. If necessary, extraordinary sessions may be held upon a written request received from any of the Commission's Co-Chairs. As of November 30, 2016, the Commission had held 22 sessions, which have taken place twice a year on each of the Party's territory. The Commission makes consensus-based decisions. In case of disagreement regarding any issue, the Parties need to conduct additional consultations and consider the issue at the next session of the Commission. The outcomes of the sessions are incorporated into the minutes, in which individual paragraphs cover individual issues.

The implementation of the decisions of the Commission is the responsibility of the Secretariat, and the heads of the Secretariat in Kazakhstan and the Kyrgyz Republic ensure the day-to-day operations of the Commission. The Secretariat was established at the first session of the Commission in 2006. Its Statute defines the main tasks and functions related to the activities, the rules of procedure, and the rights and responsibilities of the Secretariat.[9] The Secretariat consists of an equal number of representatives from Kazakhstan and the Kyrgyz Republic. The main activities are regular sessions and as of July 15, 2016, the Secretariat had held 21 sessions, whose outcomes were incorporated into the minutes.

The Secretariat's main tasks are the following:

- Organizing the meetings and logistics necessary to enable the Commission to do its work and its decisions to be implemented;
- Organizing the drafting of proposals on the interaction of the Commission with the governments of the Parties, relevant national ministries and agencies, water management institutions, local self-governance bodies and administrations, other stakeholders, economic entities, communities, and citizens; and participating in their implementation;
- Drafting amendments to the 2000 Agreement and Statute on the Commission;
- Drafting proposals on strengthening the national water legislation of both countries as necessary for the joint management of the water management facilities of interstate status, the shared funding of their operational costs, and the establishment and implementation of mechanisms for the use and distribution of water resources between the two countries;
- Participating in the forecasting and planning of measures on rational use and protection of water resources and fulfillment of the plans;
- Participating in the preparation of proposals on the development of target basin programs, project documentation, and scientific and research developments;
- Providing information on the activities of the Commission, the Secretariat, and the Secretariat's WGs;
- Participating in the development of measures enabling the safe operation of the water management facilities of interstate status by means of timely allocation and targeted use of financial and other resources, and monitoring the implementation of these measures;

- Organizing the review of compliance with water use limits and established operational regimes for the water structures and reservoirs;
- Providing funding for the development and implementation of the programs, projects, and works within its competence;
- Coordinating the legal, scientific, and research projects supported by donors;
- Organizing and coordinating the activities of WGs and experts;
- Preparing proposals for the Commission on stakeholders' involvement in its activities;
- Developing and organizing the implementation of annual and perspective plans on the activities of the Commission, as well as proposals on cooperation with international and donor organizations;
- Preparing proposals to improve procedures and mechanisms for funding of the activities of the Secretariat;
- Preparing documents and information for sessions of the Commission, and for meetings and consultations of its Co-Chairs;
- Keeping records and archiving the Commission's documentation;
- Providing access to information on the activities of the Commission;
- Fulfilling other tasks as determined by the Commission.

A number of WGs have been established under the Secretariat to provide expert and analytic support and prepare the information and recommendations as necessary for the activities of the joint Commission. Since the establishment of the Commission, over 400 people have been involved in activities of the WGs, including representatives of public authorities and experts from Kazakhstan and the Kyrgyz Republic as well as from other countries (Armenia, Azerbaijan, Belarus, Belgium, Georgia, Moldova, Mongolia, the Slovak Republic, the Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan). The WGs were established to deal with the following thematic areas of the Secretariat's activity:

- Legal and institutional issues;
- Water resource allocation issues;
- Hydrotechnical engineering works and reconstruction of structures;
- Economics, monitoring, and data exchange;
- Safety of hydrotechnical structures;
- Environmental protection;
- Climate adaptation and long-term planning;
- Transboundary Diagnostic Analysis (TDA).[10]

The Working Group on Legal and Institutional Issues aims to strengthen the legal and institutional frameworks for the Commission's operation. In recent years, it has led the process

of drafting and discussion of amendments to the 2000 Agreement as well as the Statute of the Commission and its Secretariat, aimed at strengthening their status and enhancing the procedures and mechanisms for the efficient distribution and use of the shared water resources of the Chu and Talas Rivers. It seeks to identify approaches for harmonization of national water laws and regulations of the two Parties. It also manages the interaction of the Commission with the governments, water management organizations, and local authorities. The group also coordinates strategic plans of action for future development of the Commission and interacts with international agencies and donors. The WG has been in charge of the preparation of the integrated water resources management (IWRM) plans for the Chu and Talas Basins.

The Working Group on Annual Water Resources Allocation aims to analyze and review compliance in water distribution, as stipulated by the 1983 Regulations; plan water resources allocation and stocktaking of the Talas and Chu River Basins; and conduct analyses of water demand and supply. It determines the order of coordinating the operation regimes of the water reservoirs, implements corrections to these regimes and limits for water use (based on actual water supply and water users' needs). This WG has been involved in testing and introduction of a computerized model for assessing distribution of water resources of the Chu and Talas Rivers.

The Working Group on Hydrotechnical Engineering Works and Reconstruction of Structures aims to determine the share of each Party in maintenance and current and capital repairs of the water management facilities of international status on the Chu and Talas Rivers. In addition, the WG has conducted a needs assessment to guide the allocation of funds from state budgets for the implementation of the IWRM plans in the Chu and Talas Basins. In this context, it took inventory of all hydrotechnical installations on the territory of Kazakhstan and the Kyrgyz Republic to determine their functional capabilities.

The Working Group on Economics, Monitoring, and Data Exchange is in charge of supporting the activities of the Commission with information, as well as monitoring the work of the Commission, engaging the public, and producing publications about the Commission's work. It has created Basin databases, interacts with the mass media, and reports on the work of the Commission in online and paper publications.

The Working Group on Safety of Hydrotechnical Installations oversees the dams at the Orto-Tokoyskoye Water Reservoir of the Chu River and the Kirovskoye Water Reservoir on the Talas River. The group has worked to ensure the safety of the Kirovskoye water reservoir at the Talas River, with support from UNECE. It consists of experts from Kazakhstan and the Kyrgyz Republic, as well as independent experts from Russia. The WG aims to establish a full-fledged monitoring system for the dams and develop criteria for dam safety.

The Working Group on Environmental Protection regularly conducts a strategic environmental assessment of the Chu and Talas Basins, and identifies their sources of pollution. The WG promotes cooperation between the two hydrometeorological services of the two countries with support from the UNDP-GEF project. It also takes into account international best

practices for capacity building such as the experience of the International Sava River Basin Commission.[11]

The Commission recently set up two additional WGs, one dealing with climate change adaptation and long-term planning, and one on TDA of the water quantity, quality, and ecosystem degradation.

Actual Implementation of the Regulatory and Institutional Framework

Reported Activities of the Bilateral Commission, Its Secretariat, and Working Groups

The meetings of the Commission, its Secretariat, and the WGs are reported in their minutes and, in the case of the Commission, most documents can be found online (http://chui.at.kg). However, in the case of the Secretariat and its WGs, only documents from a few meetings are available to the public. Since its establishment in 2006, the Commission has convened regularly twice a year, while the Secretariat has convened much less regularly (1-3 meetings). As the WGs have met with even less regularity, this case study is basically limited to the activities reported on during sessions of the Commission, not of the Secretariat and its WGs.[12]

During its sessions, the Commission reviews the implementation of the provisions of the 2000 Agreement on joint financing of the operational and technical maintenance costs on the covered five water management facilities of interstate status, as well as implementation mechanisms, annual plans on water distribution and their implementation, exchange of information, and capacity-building activities supported by international and donor organizations. The Kazakh and the Kyrgyz Republic Coheads of the Secretariat report regularly to the Commission on the activities undertaken during intersessional periods and provide updates on progress toward the implementation of the core provisions of the Agreement on shared financing of the operational and maintenance costs, and transboundary water distribution.

The Parties agree annually on the types and volumes of repair and maintenance work to be done on the facilities covered by the 2000 Agreement. They determine the types and volumes of needed repair works on the basis of an annual defect assessment of the covered installations conducted by the Kyrgyz Republic side and following acceptance of the outcomes of the assessment by the Kazakh side. Kazakhstan subsequently hires companies to do the repair works on the water management facilities through a tendering process. According to data provided by the Kyrgyz Republic at the 23rd session of the Commission, the O&M costs were shared by Kazakhstan and the Kyrgyz Republic in 2013-2015 in the way presented in table 3.3. While there are no complete data on the funding for 2016-2017, it is known that in 2017 Kazakhstan allocated 75 KZT (Kazakhstani Tenge) million to operations and maintenance (O&M), the equivalent of about US$240,000at the April 2017 exchange rate.

One of the regular agenda items of the Commission's sessions is the review of potential amendments to the 2000 Agreement and the Statute of the Commission. For example,

TABLE 3.3. Financing of the Operations and Maintenance Costs by Kazakhstan and the Kyrgyz Republic, USD thousands

Year	Water management facility	Kyrgyz Republic	Kazakhstan
2013	Kirovskoye Water Reservoir	244.8	264.0
	Orto-Tokoyskoye Water Reservoir	199.6	80.0
	Chumysh Hydrosystem, Western and Eastern Chu Canals	983.4	165.9
	Total 5 water management facilities	1,427.8	461.6
2014	Kirovskoye Water Reservoir	180.6	110.6
	Orto-Tokoyskoye Water Reservoir	164.9	27.7
	Chumysh Hydrosystem, Western and Eastern Chu Canals	875.1	276.4
	Total for 5 water management facilities	1,220.6	414.7
2015	Kirovskoye Water Reservoir	193.7	48.8
	Orto-Tokoyskoye Water Reservoir	170.0	16.3
	Chumysh Hydrosystem, Western and Eastern Chu Canals	911.9	179.0
	Total for 5 water management facilities	1,275.6	244.1

Source: The Bilateral Commission.

the amendments to Article 2 were initially proposed at the third session of the Commission and aimed to include additional water management facilities, namely the Kozh Canal on the Talas River, and the Karataki, Tomentamga, and Akmolda Canals on the Kurkureusu River. Thereafter, the amendments were discussed regularly by the Commission until a final text was adopted at its 16th session as a protocol to the 2000 Agreement.[13] Currently, in accordance with the provisions of Article 13, the adopted amendment *is* part of the 2000 Agreement but cannot be implemented until it has been ratified by both Parties.

The Commission also considered amendments to Articles 4, 5, and 11 of the 2000 Agreement. The amendments to Articles 4 and 5 were intended to ensure funding from the national budgets of the Parties for the activities of the Secretariat. The Parties have not yet reached agreement on the amendments and currently the Secretariat's activities depend heavily on donor support. In the absence of explicit provisions on the Secretariat in the initial text of the 2000 Agreement, it is highly unlikely that funding by the Parties will be ensured through adoption of the amendments to Articles 4 and 5. The amendments to Article 11 of the 2000 Agreement aimed to ensure free transboundary movements of vehicles, equipment, and raw and construction materials for the joint maintenance of the water management facilities of interstate status. It became necessary to alter Article 11 after the establishment of the Customs Union and thereafter the Eurasian Economic Union by Belarus, Kazakhstan, and Russia. These amendments were discussed in the Commission between 2006 and 2013, and the problem was only resolved in 2015—when the Kyrgyz Republic joined both the Customs Union and the Eurasian Economic Union.

Another regular agenda item of the Commission's sessions is discussion of the reports produced by the Secretariat's WGs. For example, the WGs have reported on the following assigned tasks:

- Joint examination of the safety of the dams of the Kirovskoye and Orto-Tokoyskoye water reservoirs;
- Joint measurements of water outflows from the covered water reservoirs;
- Review of compliance with the limits set for shared water use in vegetation and non-vegetation periods;
- Assessment of possible consequences of construction of a water reservoir on the Aspara River;
- Review of the information on the construction of a bypass canal on the Chu River, financed by the Asian Development Bank;
- Exchange of monitoring data from hydro posts and production of an online hydrological bulletin.

The sessions of the Commission also serve as a platform for reporting on progress made in project activities supported by international and donor organizations to assist Kazakhstan and the Kyrgyz Republic with transboundary water management in the Chu and Talas River Basins.

Stakeholder View of the Process

The stakeholders generally agree that the 2000 Agreement and the established bilateral Commission are a good example of transboundary water cooperation that provides a unique experience of sharing O&M costs of the management facilities between two riparian countries. While the political will in both Kazakhstan and the Kyrgyz Republic exists to continue this transboundary cooperation, the activities most reported on of the Commission, and the Secretariat and its WGs, rely on support from international and donor organizations. The reliance on donor support is considered one of the main weaknesses of the Commission's activities. The Commission and the Secretariat have no legal personality, and therefore do not have funds earmarked in the national budgets of Kazakhstan and the Kyrgyz Republic to cover the operational costs of the activities of the Agreement's bodies.

Additionally, a number of the stakeholders were of the opinion that the scope of the 2000 Agreement and the Commission should be expanded because currently it is limited to the shared coverage of the O&M costs of five water management facilities. According to the Secretariat, some amendments to the Agreement and the Statute of the Commission are under consideration, but the relevant decision-making process is very slow. While the Commission did adopt amendments on the inclusion of four additional water management facilities on the Talas and Kurkureusu Rivers, they are not yet legally binding—the

protocol on this point, adopted at the 16th session of the Commission on May 21, 2013, cannot be implemented until ratified by both Parties.[14] The Commission discussed the possibility of reallocating part of the funds earmarked for the Kirovskoye water reservoir to finance repair work on the Kozh Canal on the Talas River but so far Kazakhstan has failed to do so.

Development partners have indicated the need to expand the scope of the 2000 Agreement and the competence of the Commission to other thematic areas, namely, monitoring water quality, preventing and controlling environmental pollution in transboundary waters, and conducting transboundary environmental assessments. Currently, the GEF-UNDP-UNECE Chu-Talas Regional Project is dealing with the environmental aspects of transboundary water management on the Chu and Talas Rivers. However, the issues go beyond the Commission's current competence, but this problem can be resolved through appropriate amendments to the 2000 Agreement.

During the interviews some people mentioned divergences between the Parties' positions on the sharing of O&M costs and the assessment of annual repair works that need to be done on the water management facilities covered by the 2000 Agreement. Usually representatives of national water authorities resolve such disputes through informal consultations. However, the Commission has not established mechanisms for settling disputes and for reviewing noncompliance. Two interviewees said such mechanisms should be in place to ensure the effective implementation of the provisions of the Agreement, while another interviewee argued that such legal procedures could actually complicate disputes and that it was better to continue the current practice of informal bilateral consultations.

According to the Secretariat, the decisions of the Commission on the establishment of an interstate Basin Council and stakeholder engagement (4th session, September 2007, and 9th session, April 2010) have not yet been implemented. The Basin Council was to be a consultative and advisory body for the Commission—meant to involve NGOs, representatives of the public, and water users in the interstate decision-making process on the use and protection of water resources in the Chu and Talas Basins. One of the international organizations mentioned that they would be interested in supporting the activities of the Commission on stakeholder engagement.

The Commission made a decision on the replacement of the control and measuring equipment and the creation of an automated information management system for the control of dam safety on the Kirovskoye water reservoir (17th session, February 2014). According to the Secretariat, it will probably cost US$250,000 to US$300,000 and it has been marked as a project that will require donor funding.

The Commission is generally viewed as a useful platform for joint discussions on planned investments for construction and reconstruction of water management facilities in the Chu and Talas Basins. However, the current scope of the Agreement in most cases does not

give the Commission the competence to deal with such cases and their possible transboundary effects.

Most stakeholders were familiar with the investments in the Chu and Talas Basins only in the form of technical assistance and grants, and the main expectations are associated with financing of equipment and experts working in areas that are currently not covered by the Commission. Investment tools such as loans and guarantees are considered appropriate for the activities falling under the individual competences of the Parties to the 2000 Agreement.

Analysis of the Implementation of the Regulatory and Institutional Framework

In the absence of reporting and compliance mechanisms, it is difficult to provide a more comprehensive analysis of the implementation of the regulatory framework of the 2000 Agreement. The minutes of the Commission sessions are brief, while presentations made at those sessions are informal and publicly available only for a limited number of the sessions.

The website provides detailed information on the activities of the Commission and recent activities of the Secretariat and its WGs.[15] It shows that the Commission and the Secretariat are fully operational, even though their activities still rely heavily on support from international and donor organizations. Also, as mentioned above, there are no provisions in the 2000 Agreement on the Secretariat and its WGs, and some of the activities they undertake go beyond the scope of the 2000 Agreement. Moreover, according to the Cohead of the Secretariat from Kazakhstan, the legal status of the Statute of the Secretariat has been challenged because the document was signed by its former Cohead and not adopted by the Commission. In addition, there are no provisions on the Secretariat in the 2000 Agreement and thus, the status of this body remains unclear.

Nevertheless, the desk study based on legal documents, the documents of the Commission's sessions, and the interviews conducted allowed the Consultant to collect sufficient, reliable information on the implementation of the 2000 Agreement, summarized in table 3.4.

TABLE 3.4. Summary of the Information on Implementation of the 2000 Agreement

Agreement's provision	Obligation	Information on implementation measures by Parties	Commission activities
Article 1	Objective and principles	According to the stakeholders the objective is achieved and principles are followed.	The Commission acts for mutually beneficial goals on a fair and reasonable basis.
Article 2	List of covered facilities	Practical implementation is carried out on all five water management facilities. The Protocol on four additional canals on the Talas and Kurkureusu for inclusion into the Agreement is pending ratification by the Parties.	Commission reviews implementation activities on all five water management facilities. The Commission adopted the Protocol to the Agreement on four additional canals at its 16th session on May 31, 2013.

table continues next page

TABLE 3.4. continued

Agreement's provision	Obligation	Information on implementation measures by Parties	Commission activities
Article 3	Compensation of costs by Kazakhstan of the operational costs of the Kyrgyz Republic	Kazakhstan finances annual repair works on all five water management facilities. However, there are regular disputes on fairness of sharing the costs by the Parties.	Commission regularly reviews the implementation of the measures on compensation of the operational costs by the Parties.
Article 4	Parties shall ensure the shared financing costs on the maintenance of the facilities and other agreed activities in accordance with shared water flows.	The financing of the five covered water management facilities is carried out in accordance with the 1983 rules on sharing water resources on the Chu and Talas Rivers.	Commission regularly reviews the implementation of the measures on sharing the costs and water flows in accordance with the 2000 Agreement and the 1983 Rules
Article 5	Parties should establish joint commissions to regulate the regime and determine the shared costs for the maintenance of the facilities.	The Commission was established in 2006. The Protocol on establishment of the Commission was signed by the governments of Kazakhstan and the Kyrgyz Republic on December 21, 2005	The Commission is fully operational and convenes its sessions twice annually. Its competence covers the implementation of the provisions of Article 5.
Article 6	Parties should ensure financing from their budgets for the O&M costs of the facilities.	Both Parties finance the maintenance costs on the covered facilities and funds are provided from the national budgets. The Kyrgyz Republic claims that funds provided from Kazakhstan are insufficient and should be increased. Kazakhstan has requested a substantiation of these claims from the Kyrgyz Republic.	The Commission regularly reviews the implementation of this commitment and its Cochairs report to the respective governments on the funds needed to cover the O&M costs of the facilities.
Article 7	Parties shall undertake joint measures to protect the facilities and adjacent zones from floods, mud slides, and other extreme weather events.	Recently the Parties have begun jointly dam safety inspections of the Kirovskoye and Orto-Tokoiskoye water reservoirs.	
Article 8	Parties shall notify each other in the event of an accident on the facilities caused by extreme weather events or technical malfunction in their operation.	No information is available on the implementation of the provisions of Article 8 by the Parties.	No information is available on activities of the Commission related to the implementation of the provisions of Article 8 by the Parties.
Article 9	Parties use each other's construction, repair, and industrial capacities to take emergency response measures promptly and efficiently.	No information is available on the implementation of the provisions of Article 9 by the Parties.	No information on the activities of the Commission on the implementation of the provisions of Article 9 by the Parties.
Article 10	Jointly conduct scientific research and field studies on the rational and efficient use of the water resources and water management facilities.	The Parties conducted some joint research and field studies in projects supported by donor organizations.	The powers of the Commission and the Secretariat cover the implementation of Article 10 of the Agreement.

table continues next page

TABLE 3.4. continued

Agreement's provision	Obligation	Information on implementation measures by Parties	Commission activities
Article 11	Assistance with transboundary movements of vehicles, equipment, and raw and construction materials as necessary for the joint maintenance of the covered water management facilities.	Membership in the Customs Union and the Eurasian Economic Commission enables the Parties to implement the provisions of Article 11.	The Statute of the Commission does not contain explicit provisions on the competence of the Commission to deal with implementation of the provisions of Article 11 of the Agreement.
Article 12	In case of a dispute, the Parties shall seek a solution through negotiation or consultation.	It seems that disputes are indeed solved through negotiation or consultations of the Parties but these are not documented.	Representatives of national water authorities and ministries of foreign affairs settle disputes arising during the sessions bilaterally rather than through the Commission.
Article 13	Amendments to the Agreement shall be adopted as protocols.	The Amendments to the Agreement on four additional canals are pending ratification by the Parties and thus not yet legally binding.	The Commission adopted the Protocol on four additional canals at its 16th session on May 31, 2013.

Conclusions and Recommendations

It seems that the regulatory and institutional framework of the 2000 Agreement is being implemented, even though it is slow process because of regular staff changes at the Commission and some divergences between the positions of Kazakhstan and the Kyrgyz Republic. The Commission is fully operational, the Secretariat is firmly established and fully operational, two WGs are currently operational, and the information support of the activities of the Commission is excellent. The 2000 Agreement does not include provisions on the Secretariat and the Secretariat's WGs; rather, they operate on the basis of informal institutional arrangements, for instance, the Statute of the Secretariat signed by former Cosecretaries from both Parties. Further, all the activities of the Commission, Secretariat, and WGs are supported by donor organizations. Currently, support is being provided by the GEF-UNDP-UNECE Chu-Talas Regional Project, the UNECE Project on Planning Climate Adaptation in the Chu-Talas Basin, and projects on accounting of water and online hydrological bulletins by the SDC.

The water-sharing rules for the Chu and Talas Rivers were established under the 1983 Rules (non-binding) and the sharing of O&M costs is based on the 1998 Protocol signed by the national water authorities of the two countries (also non-binding). Some stakeholders have expressed doubts about the possibility of resolving the problem of the non-binding nature of the water-sharing rules on the Chu and Talas Rivers, as they could "open the flood gates" and have unpredictable, undesirable consequences—such as not reaching a new agreement on water sharing.

The objectives set forth in the agreements (2000 Agreement, 1983 Rules on water sharing, and 1998 Protocol on sharing of the operational costs) are implemented by the Commission

despite the eruption of regular disputes between the Parties. From time to time, the Kyrgyz Republic claims a full share of operational costs on the covered water management facilities, and Kazakhstan requests transparency of the operational costs and better substantiation of those claims by the Kyrgyz Republic, as the basis for possibly increasing the share of funding of the operational costs. Currently, the share of financing to be borne by Kazakhstan is based on the annual assessment of repair works that need to be done on the covered facilities. However, the provisions of the Agreement also refer to the sharing of full operational costs. Since different provisions of the 2000 Agreement support both approaches, this area has become one of the sources of disputes between the Parties. Furthermore, the current challenges of the Commission relate to timely and effective delivery of information, and interactive exchange between the two Parties' national water authorities and institutions. With the strengthening of the data related to the use and distribution of water resources, as well as to current and future needs in maintenance and reconstruction of the covered facilities of interstate status, the Parties may wish to come back to the idea to expand the scope of the current Agreement.

Recommendations:

1. *The provisions of Articles 3-5 of the 2000 Agreement need to be clarified by the Commission with a view to determining the costs that shall be covered by each Party and the mechanisms for their compensation;*
2. *The information and data on cost sharing by the Parties should be reported officially and not based on presentations, and the Commission should establish a reporting mechanism for this.*

The actual scope of activities of the Commission is much broader than stipulated by the 2000 Agreement; for instance, it covers environmental aspects and climate adaptation. The de facto scope of activities of the Commission derives from the interest of donor organizations in supporting activities that lie beyond the formal scope of the 2000 Agreement. At the same time, the de jure competence of the Commission is limited by the scope of the 2000 Agreement, with its main focus on sharing the costs of the covered water management facilities of interstate status by the riparian countries. There is an obvious need to expand the scope of the 2000 Agreement and most interviewees recognized this. The discussion on the possibility of expanding the list of covered rivers and water management facilities was initiated seven years ago, but there still is a lack of progress—even with the ratification of the Protocol of May 31, 2013, on the inclusion of additional water management facilities in the Agreement. There are also some broader areas where the scope of the 2000 Agreement and the competence of the Commission need to be expanded. For example, the 23rd session the Commission reviewed the actions undertaken in areas not covered by its competence, such as planning and implementation of climate adaptation measures, stakeholder involvement, and dam safety monitoring.

Recommendations:

1. *The governments of Kazakhstan and the Kyrgyz Republic should initiate the process of ratification of the Protocol of May 31, 2013, on amendments to the 2000 Agreement or alternatively include into the Agreement an explicit provision on the competence of the Commission to determine additional water management facilities of interstate status; and*
2. *The Commission should consider the possibility of thematic expansion of the scope of the 2000 Agreement and its competence, among others, with prevention and control of pollution of transboundary waters of the Chu and Talas Basins, environmental impact assessments in transboundary context, prevention of transboundary accidents, and climate change adaptation.*

The activities of the Commission and the Secretariat and its WGs are supported by international and donor organizations and the financial instruments employed are projects of technical assistance. The bilateral financing is currently limited to repair works on the water management facilities listed in the 2000 Agreement by assignment and paying for repair works by Kazak companies.

The possibilities for using loans and guarantees are very limited under the current provisions of the 2000 Agreement. The formal scope of the Agreement is limited to the existing water management facilities as its provisions do not formally cover investments in new infrastructure development. At the same time, the construction of new water facilities in the Chu and Talas Basins may have negative transboundary impacts and raise concerns about the current water-sharing rules, possible flooding and loss of agricultural lands, and the possibility of reconsideration of the current informal water-sharing rules on the Chu and Talas Rivers. Even at the 23rd session of the Commission, the Kyrgyz Republic raised the issue that no compensation was paid by the Kyrgyz Republic for the loss of agricultural lands resulting from construction of the Kirovskoye water reservoir during the Soviet time. Kazakhstan expressed concerns about increased possibilities for the Kyrgyz Republic to reduce water flows to Kazakhstan. At the same time, the Commission provides a good institutional framework for bilateral negotiation and consultations on such development plans and their potential negative transboundary effects. For instance, at earlier sessions, the Commission reviewed the plan developed by Kazakhstan to construct a new water reservoir with an expected volume of water stored of up to 10 million c^3, but no formal decision has yet been taken on this project.

Recommendation:

1. *The 2000 Agreement should give the Commission the competence to deal with the development of plans for the construction of new water management facilities and the reconstruction of the covered water management facilities, including the joint consideration of their potential negative transboundary impacts.*

Notes

1. See the website of the Bilateral Commission, at http://chui.at.kg/eng/pravovye-dokumenty/soglashenie-2000-goda.html.
2. The government of the Kyrgyz Republic approved the Statute of the Bilateral Commission on November 3, 2004, see at http://chui.at.kg/ru/pravovye-dokumenty/polozhenie-o-komissii.html, the government of Kazakhstan adopted the document on December 21, 2005, see at http://adilet.zan.kz/rus/docs/P050001260.
3. See the website of the Bilateral Commission, at http://chui.at.kg/eng/pravovye-dokumenty.html.
4. See the website of the Bilateral Commission, at http://chui.at.kg/eng/sooruzhenija-mezhgos-polzovanija.html.
5. See the website of the Bilateral Commission, at http://chui.at.kg/ru/pravovye-dokumenty.html.
6. See minutes of the Bilateral Commission, e.g. the 20th session, at http://chui.at.kg/media/uploads/files/events/18_protokol.pdf.
7. See the UN Depository website at https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-6&chapter=27&clang=_en.
8. See the website of the Bilateral Commission, at http://chui.at.kg/eng/pravovye-dokumenty/polozhenie-o-komissii.html.
9. See the website of the Bilateral Commission, at http://chui.at.kg/eng/pravovye-dokumenty/polozhenie-o-sekretariate.html.
10. See the website of the Bilateral Commission, at http://chui.at.kg/ru/rabochie-gruppy/naznachenie-funkcii-rabochih-grupp.html.
11. http://savacommission.org/.
12. See the website of the Bilateral Commission, at http://chui.at.kg/ru/meroprijatija.html.
13. See the website of the Bilateral Commission, at http://chui.at.kg/ru/meroprijatija-2/zasedanija/16_zasedanie_komissii_respubliki_kazahstan_i_kyirgyizskoy_respubliki_po_ispolzovaniyu_soorujeniy_mejgosudarstvennogo_polzovaniya_na_rekah_chu_i_talas.html.
14. See the website of the Bilateral Commission, at http://chui.at.kg/ru/meroprijatija-2/zasedanija/16_zasedanie_komissii_respubliki_kazahstan_i_kyirgyizskoy_respubliki_po_ispolzovaniyu_soorujeniy_mejgosudarstvennogo_polzovaniya_na_rekah_chu_i_talas.html.
15. See the website of the Bilateral Commission, at http://chui.at.kg/eng/meroprijatija.html.

Lake Saimaa, Vuoksi Basin. © cesa53rone/iStock.

Chapter 4 Vuoksi Basin

Flow Regulation and Hydropower Operations

By Antti Belinskij, Marko Keskinen, and Niko Soininen

Summary: Three-Stage Process of Coordinated Basin Development

This case study details the long history of cooperation between Finland and the Russian Federation over the Vuoksi River and the tools used to manage flow regulation and hydropower production as well as compensation procedures for harm.

For reference, the three-stage process of coordinated basin development is presented in figure 4.1.

Identification of Opportunities and Risks

Finland and Russia share 19 major transboundary watersheds of which the Vuoksi is the most important. The Vuoksi became a transboundary river after World War II, forcing the countries to cooperate, as it was an important source of hydropower.

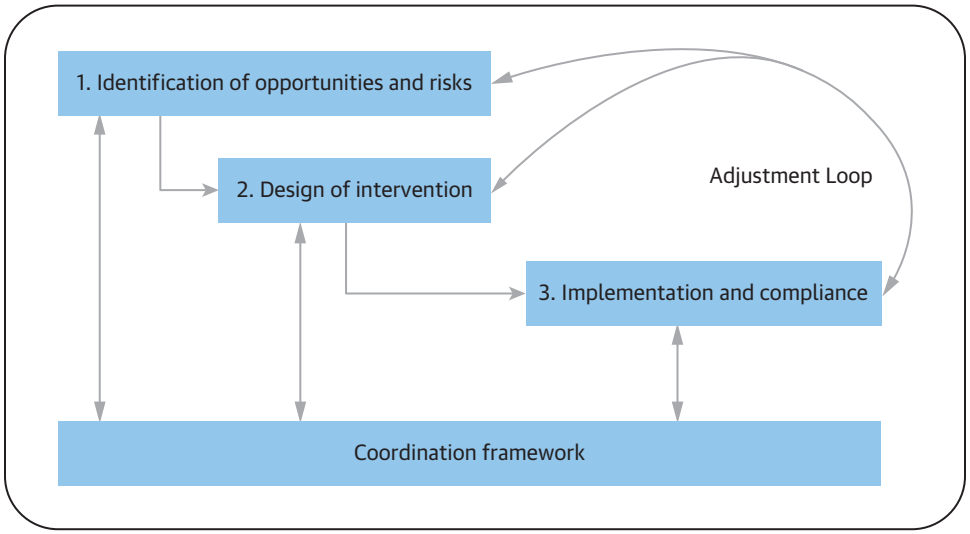
Coordination Framework (Stage 1)

The current transboundary cooperation in the Vuoksi River Basin is based on the following:

- ***International Treaty*** **(T44)**: the two countries signed an agreement, the 1964 Frontier Watercourses Agreement, which includes all frontier waters shared between Finland and Russia, and provides the main substantive and procedural principles for transboundary water cooperation;

- ***River Basin Organizations, Authorities or Commissions* (T59)**: based on the 1964 Agreement, the countries established the Joint Finnish-Russian Watercourses Commission with advisory, executive, and regulatory powers **(T50–52)** to manage the use of the waters as well as to settle disputes through negotiations **(T66).**

FIGURE 4.1. Three-Stage Process of Coordinated Basin Development



Design of Intervention

To manage the flow of the Vuoksi and Lake Saimaa and regulate the production of hydropower, the countries use the following tools:

Coordination Framework (Stage 2)

- ***International Treaties* (T44)**: the 1989 Vuoksi Agreement governs the management of the release of water from Lake Saimaa to the Vuoksi to prevent damages caused by high and low water flows on both sides of the border. In addition, the 1972 Hydropower Agreement specifies the daily regulation of the Vuoksi in a manner that is satisfactory to all the power stations.

Implementation and Compliance

For the regulation of flows and hydropower production on the Vuoksi, the two countries use the following tools:

- ***Single-Sector Operational or Implementation Plans* (T39)**: according to the Vuoksi Discharge Rule, a water release program must be discussed and approved by the Finnish-Russian Commission.
- ***Conference Calls* (T49)**: officers and technical experts are in direct contact by phone, with the Finnish regional authority having a Russian-speaking expert at its disposal to overcome the language barriers.
- ***Forecasting and Early Warning Systems* (T30)**: according to the Vuoksi Discharge Rule included in the Vuoksi Agreement, the process of adjusting the natural flow rate to increase or reduce the flow must be based on forecast predictions carried out by Finland.
- ***Procedures for Data Sharing and Exchange* (T21)**: Finland collects data and makes approximations on the water flow rate of the Vuoksi and the water levels of Lake

Saimaa on a monthly basis, and informs the dam operator as well as the Russian representative of these levels. Finland must also inform them of any changes in flow management, and continuously monitor the factors that influence or result from the natural release of water. In addition, Finland is obliged to prepare and transmit a preliminary appraisal of water conditions in Lake Saimaa for the 3-5 month periods specified by the Vuoksi Discharge Rule.

- ***Direct Payments*** **(T17)**: based on the 1972 Agreement, Russia must on a permanent basis compensate Finland for the losses of 19,900 megawatt hours (MWh) per year caused by the Svetogorsk station by supplying free electricity to the Finnish hydropower company.
- ***Compensation for Harm*** **(T37)**: according to the 1964 and 1989 Agreements, the Party that adopts measures that cause loss or damage in the territory of the other is liable for reparations to the other Party. Finland has compensated Russia in the range of less than €1 million for hydropower losses caused by exceptional overflows.
- ***Negotiations*** **(T66)**: the commission is charged with negotiating disputes that arise between the two countries. If the Finnish-Russian Commission cannot resolve the conflict, both governments are notified.

Coordination Framework (Stage 3)

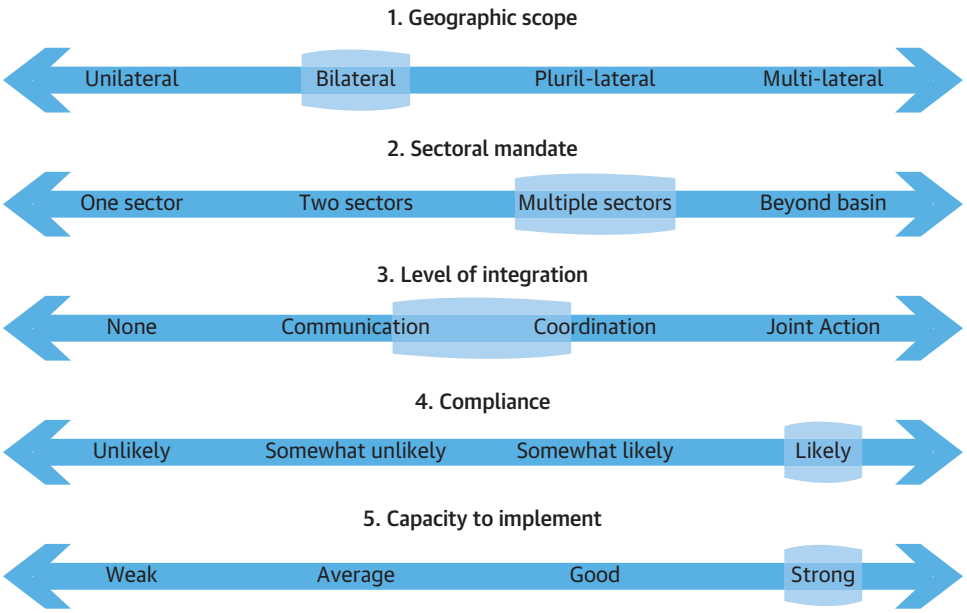
- ***International Treaties*** **(T44)**: the 1964, 1972, and 1989 Agreements provide the framework for implementing the regulation of transboundary waters between Russia and Finland generally, and the Vuoksi specifically.
- ***River Basin Organizations, Authorities, or Commission*** **(T59)**: the 1964 Agreement between the countries established the Joint Finnish-Russian Watercourses Commission, which implements all three agreements applicable to the Vuoksi.
- ***Agreements of Private Law Character*** **(T45)**: the 1972 Agreement largely delegates flow management within the framework of the Agreement to hydropower companies. Also, the private sector representatives from hydropower companies that operate the dams on the Vuoksi have the right to voice their concerns in matters related to the regulation of flows, generation of hydropower, and matters of compensation at Commission meetings.
- ***Executive Functions*** **(T51)** and ***Technical Entities*** **(T36)**: the Finnish-Russian Commission established WGs on IWRM, water quality, border control, and fisheries; these WGs are the functional institutions that prepare Commission protocols.

Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention— to the Vuoksi flow regulation and hydropower operations case is depicted in figure 4.2 and detailed below.

1. The basin is a two-country basin and is therefore managed on a bilateral basis.
2. The sectoral mandates of these agreements cover flood protection, pollution control, flow regulation, and hydropower.
3. The countries collaborate in the management of flow regulation and hydropower production on the Vuoksi.
4. When the agreements were negotiated, it was considered very likely that both countries would comply with the provisions of the agreements; mechanisms have so far been successful.
5. The capacity to implement the tools and design the coordination frameworks was probably strong, as the two parties have well-developed mechanisms to implement the agreements.

FIGURE 4.2. Application of the Five Dimensions to the Vuoksi Flow Regulation and Hydropower Operations Case



Case Study Description

Introduction

The transboundary water cooperation between Finland and Russia[1] is a success story. Two very different neighboring states have, despite their difficult history, established a well-functioning cooperative regime that covers all the transboundary freshwater watercourses between them, and has lasted more than 50 years (Belinskij 2015).

The management of the Vuoksi River is at the center of this collaboration. Historically, the Vuoksi was located entirely within Finnish territory until 1944. It was a source of Finnish national pride and provided crucial hydropower for a rapidly developing nation. At the end of World War II, the Vuoksi River was transformed into a transboundary river, with Finland losing two of the four newly built hydropower dams to Russia. This situation started an era of ongoing transboundary water cooperation that involves, among other things, flow regulation and hydropower operation.

This case study reviews the key aspects of transboundary cooperation between Finland and Russia in the Vuoksi River Basin from both a regulatory (formal agreements and procedures) and practical point of view (actual implementation). The study focuses on flow regulation and the related operation of the hydropower cascade in the Vuoksi River Basin. As the Finnish-Russian cooperation builds on the 1964 Frontier Watercourses Agreement[2]

that covers all the transboundary watercourses and basically all water uses, this study also discusses Finnish-Russian cooperation at a more general level.

The main goals of the study are to:

1. Understand how the formal agreements on water cooperation were established and which challenges they aim to address;
2. Describe the institutional arrangements related to the Vuoksi River, including different agreements as well as key organizations and institutions;
3. Analyze how the agreements are actually implemented, including flow regulation and operation of the hydropower cascade; and
4. Study the possible differences between formal regulations and their practical implementation, including informal cooperation arrangements.

In addition, the terms of reference (TOR) agreed with the World Bank included a more detailed set of questions that are described—and answered—in annex 4A and 4B.

Study Context

The Vuoksi is a 150 km long transboundary river flowing from Finland to Russia. It originates in Lake Saimaa, flows 13 km through Finland, and empties into Lake Ladoga in Russia. Three quarters of the 70,000 km² Vuoksi catchment area lies in Finnish territory. (see map 4.1)

While Finland and Russia share 19 major transboundary watersheds, the Vuoksi watershed is the most important one for transboundary water cooperation. With an average flow of 600 m³/s, the Vuoksi River comprises more than three-quarters of the total 780 m³/s water flow from Finland to Russia. The river is used for various activities, such as hydropower production on both sides of the border, and also functions as the sole outlet for Lake Saimaa (4,400 km²), which is Finland's largest and Europe's fourth largest lake. Therefore, Vuoksi also plays a crucial role in flood protection of this important lake system.

Originally, the Finnish-Russian cooperation on frontier watercourses—both generally and specifically at Vuoksi—was driven by the development and operation of hydropower production, as well as the need for pollution control. Flood management, fisheries, and transportation have been topical throughout as well, while the importance of log floating has declined considerably since the 1960s.[3]

MAP 4.1. The Transboundary Vuoksi Watershed

Source: Modified from Rahaman 2015.

More recently, adaptation to climate change in flood risk management, and water quality objectives of the European Union (EU) Water Framework Directive (2000/60/EC),[4] binding Finland, have posed new challenges and possibilities for collaboration between the two countries.[5]

The report is structured thematically. After this introductory section, the overall development and setting of the regulatory framework in the Vuoksi River Basin and in the Finnish-Russian transboundary cooperation more generally is described. This section also includes a text box summarizing the main phases of Finnish-Russian cooperation in the Vuoksi River Basin (box 4.1).

The main part of the analysis is presented in the following three chapters, which cover the key themes of the study: institutional cooperation (theme 1); flow regulation in the Vuoksi River (theme 2); and compensation mechanisms (theme 3). Each of the three chapters follows the same structure by establishing first the formal regulatory framework relevant to the theme, followed by a discussion of its actual implementation (based on literature, Commission records, and expert interviews). The three thematic sections are followed by the Discussion and Conclusions section, which summarizes the key findings of the report and answers the main research questions.

BOX 4.1. Main Phases of Finnish-Russian Cooperation in Vuoksi

Five key phases in the history of the Vuoksi River Basin can be recognized based on literature (e.g., Korjonen-Kuusipuro 2013) and expert interviews. These form a critical foundation to understand the current situation with transboundary cooperation in the Vuoksi River Basin.

1. **1920s–1930s: Vuoksi as a source of national pride and hydropower for Finland**
   - → After Finland gained its independence from Russia in 1917, Vuoksi was Finland's internal river and an important source of hydropower as well as national pride and cultural value for the young nation.
2. **1940s–1950s: Learning to cooperate in a new transboundary Vuoksi River**
   - → After World War II, Finland lost part of its Eastern land areas (including most of the Vuoksi River) to the Soviet Union: this created a new, transboundary Vuoksi river. While the two wars and related peace treaties were bitter and the general atmosphere was suspicious and even hostile, the importance of Vuoksi for both countries forced them to start negotiations about transboundary cooperation right after the war. Although the seeds for the Vuoksi cooperation were already sown during the peace negotiations (where Vuoksi and its hydropower played a key role), the cooperation was not easy as both countries focused strongly on their own interests only.

box continues next page

BOX 4.1. continued

3. **1960s–1980s: Trust building with formalized water cooperation**

   → Finland and the Soviet Union formalized their water cooperation with the 1964 Frontier Watercourses Agreement that was based on key international models for transboundary water management and covered all transboundary watercourses.

   Vuoksi played a key role in the work of the joint Commission that was established based on the Agreement, with focus on flood protection, pollution control, flow regulation, and hydropower. In contrast to earlier eras, broader geopolitics played only a minor role in the cooperation during (and after) this era.

4. **1990s–2000s: Practical collaboration in a new geopolitical era**

   → The collapse of the Soviet Union in 1991 and Finland's EU membership in 1995 radically changed the geopolitical relationship between Finland and Russia. While newly emerged Russia faced major political and economic challenges, the latter did not influence the cooperation in the Vuoksi River Basin. The Vuoksi Discharge Rule of 1989 established clear guidelines for the discharge, aimed at maintaining natural water levels in Saimaa. The era also saw joint projects, which considerably improved the cooperation also at lower management levels and enhanced the common understanding of the Vuoksi River Basin.

5. **2010s: Fluent collaboration at appropriate management levels**

   → Today, the Vuoksi cooperation functions smoothly and also at lower levels than before—management of the Discharge Rule in Finland having been moved from central governmental authority to regional environmental centers in 2011. Although there are geopolitical tensions between Russia and the EU, the Finnish-Russian cooperation over Vuoksi management is open, and currently even includes the possibility of a renegotiation of the old (and potentially contested) compensation mechanism related to the flow regulation.

Development of the International Regulatory Framework in the Vuoksi River

Geopolitical Background: Finish-Russian Relations

Finland and Russia differ considerably in size, and share a long but unstable history. The population of Finland is roughly 5.5 million people, with a total area of about 340,000 km^2. By contrast, the population of Russia is over 140 million people, and the country covers an area of about 17 million km^2. Finland was part of Russia from 1809 (when Sweden lost Finland to Russia) until gaining its independence in 1917.

The early stages of cooperation for managing the Vuoksi were by no means easy, as the sole reason for the need for such cooperation was Finland having lost significant

areas—including part of the Vuoksi Basin—to the Soviet Union, following the Moscow Armistice that ended the war between the two countries in 1944.[6] Although the 150 km long Vuoksi had belonged entirely to Finland until 1940, less than 15 km of the Vuoksi's upper reaches were left on the Finnish side after 1944 (Korjonen-Kuusipuro 2013, 1).

The Vuoksi had been used as a significant source of hydropower in Finland since the late 19th-century, and Finland was finalizing the last hydropower stations in the river when the war broke out. In accordance with the Moscow Armistice, two of the four Finnish hydropower stations built along the river were ceded to the Soviet Union. This loss had a remarkable impact on the energy security and overall development of Finland (which were already severely hampered by the war). Finland's total hydropower output was reduced by 30 percent. The new border demanded transboundary cooperation to use the Vuoksi effectively for hydropower production in both Finland and Russia (Korjonen-Kuusipuro 2013, 1-2).

Before studying the agreements related to water cooperation, it is important to understand the general treaties formed between Finland and the Soviet Union after the Second World War. In 1948, Finland and the Soviet Union concluded the Agreement of Friendship, Cooperation, and Mutual Assistance[7] ([Ystävyys-, yhteistyö- ja avunantosopimus [[YYA-sopimus]]] the YYA Treaty, for its acronym in Finnish). The treaty required that the two countries act in a spirit of cooperation toward the development of economic relations (Arts. 4-6). The Agreement was in force until 1992, when the new Treaty on Relations between Finland and Russia was concluded.[8]

The last 30 years have witnessed some remarkable geopolitical changes affecting Finnish-Russian relations. First, the Soviet Union collapsed in 1991, which meant that Russia as the successor state became the other party to the agreements concluded between Finland and the Soviet Union. Second, Finland became a Member State of the EU in 1995, and is therefore obliged to comply with the EU legislation, including the Water Framework Directive and the Directive on the assessment and management of floods (2007/60/EC).[9]

Most recently, the international sanctions that the EU countries, among others, have imposed on Russia have challenged the collaboration between the EU and Russia on many fronts. While all these events have had a significant impact on the general collaboration between Finland and Russia, none of them have had a major impact on the water cooperation between the two countries.

Water Cooperation between Finland and Russia

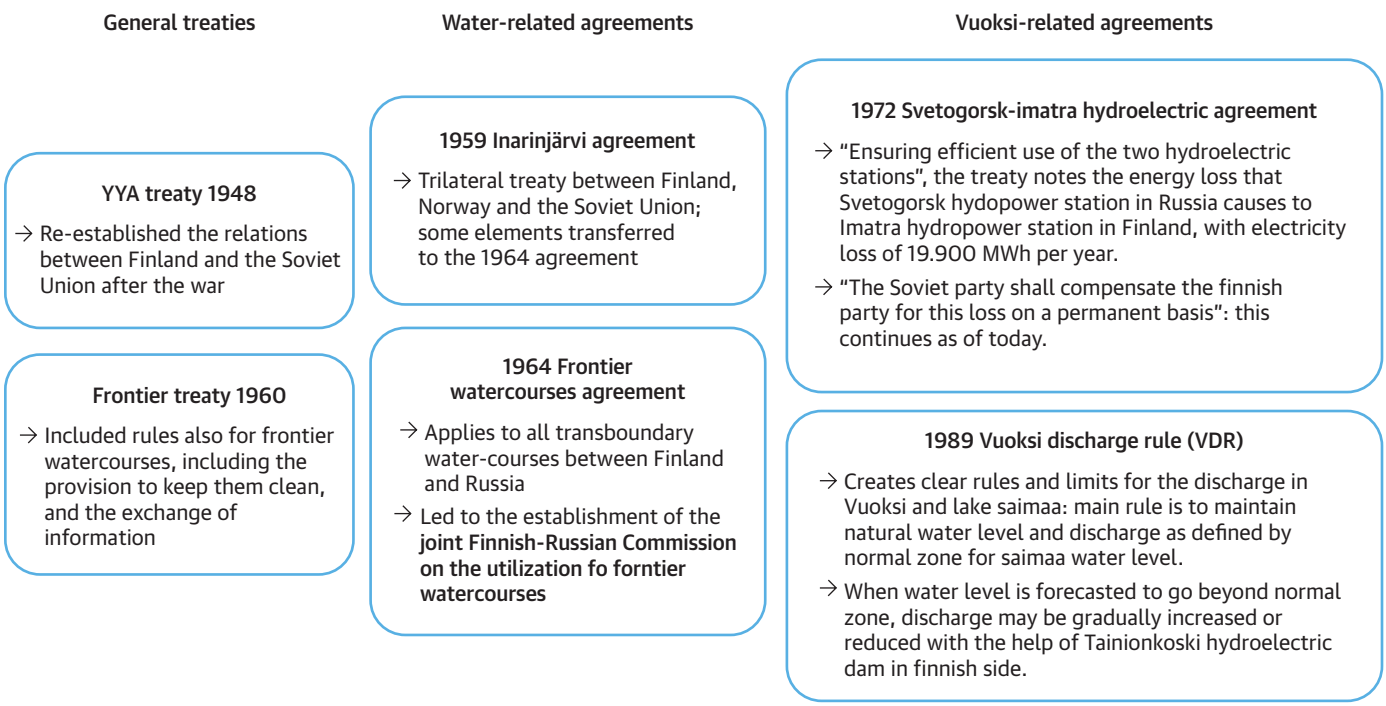
Finland and the Soviet Union began transboundary water cooperation soon after Finland gained its independence in 1917. In 1922, the two countries concluded an agreement regarding log floating and maintenance of river channels, and regulation of fishing in frontier watercourses.[10] The early cooperation was partly motivated by the great floods in Lake Saimaa in 1924.[11] Soon after the Second World War, Finland and the Soviet Union concluded

the 1947 Agreement on the Regulation of Lake Inari in northern Finland, which was later replaced by the 1959 Agreement between Finland, Norway, and the Soviet Union.[12]

The current transboundary cooperation in the Vuoksi River Basin is based on three agreements: the 1964 Agreement Concerning Frontier Watercourses and two Vuoksi-specific agreements, namely the 1972 Hydropower Agreement[13] and the 1989 Vuoksi Agreement related to the Discharge Rule on Lake Saimaa and the Vuoksi River[14] (figure 4.3). All these agreements are introduced below more generally. A deeper analysis of the agreements is conducted in the thematic chapters.

The 1964 Frontier Watercourses Agreement includes all frontier waters shared between Finland and Russia (Art 1). Such watercourses range from major rivers to small lakes and brooks, and their total number has been estimated at more than 700 (Mihejev 2015). The 1964 Agreement provides a general framework, and the main substantive and procedural principles for transboundary water cooperation between the two countries. The Agreement prohibits such unilateral measures in frontier watercourses that may alter them and cause damage or harm in the territory of the other party, block or alter the fairways, or cause harmful consequences due to pollution (Art 2-4). In this way, the Agreement covers all water uses having or likely to have transboundary impacts.[15] It also establishes the Joint Finnish-Russian Watercourses Commission, and lays down detailed procedural provisions for the Commission (Art 6-12).

FIGURE 4.3. Key Treaties and Agreements Related to Transboundary Water Cooperation between Finland and Russia



As to international water law, both Finland and Russia are parties to the 1992 United Nations Economic Commission for Europe (UNECE) Water Convention,[16] while Finland is also a party to the 1997 UN Watercourses Convention.[17] As both of these international conventions were concluded after the key bilateral agreements between Finland and Russia, they have not had a major influence on Finnish-Russian cooperation. In actuality, Finnish-Russian water cooperation was one of the examples used when negotiating and concluding the two global conventions.[18]

Cooperation in the Vuoksi River Basin

The 1989 Vuoksi Agreement is the main regulatory instrument for managing the discharge of the Vuoksi and the levels of Lake Saimaa. The Agreement regulates the release of water from Lake Saimaa to the Vuoksi to prevent damages caused by high and low water flows on both sides of the border (Preamble of the Agreement). During the negotiations, Finland's interests were focused on managing the flood and drought risks in Lake Saimaa, while the Soviet Union paid special attention to hydropower production (Jaatinen 1995, 13-15).

The Vuoksi Agreement makes a reference to the 1964 Watercourses Agreement and the Finnish-Russian Commission deals with them both (Art 6 of the Watercourses Agreement; Art 2 of the Vuoksi Agreement). In this way, the Watercourses Agreement and the Vuoksi Agreement form a coherent whole for the Finnish-Russian transboundary water cooperation in the catchment area of the Vuoksi River.[19]

The 1972 Hydropower Agreement regulates the production of hydropower in the part of the Vuoksi bounded by the Imatra hydropower station on the Finnish side and the Svetogorsk hydropower station on the Russian side. Its objective is to regulate the Vuoksi in a manner that is satisfactory to all the power stations (Preamble of the Agreement). The Agreement regulates the streamflow and the water levels at the Svetogorsk station in a way that causes no greater losses of streamflow or energy at the Imatra station than has been stipulated in the Agreement (Art 1). Based on the Agreement, Russia must on a permanent basis compensate Finland for the losses of 19,900 MWh per year caused by the Svetogorsk station (Art 3). See the profile and power stations of the Vuoksi River in figure 4.4.

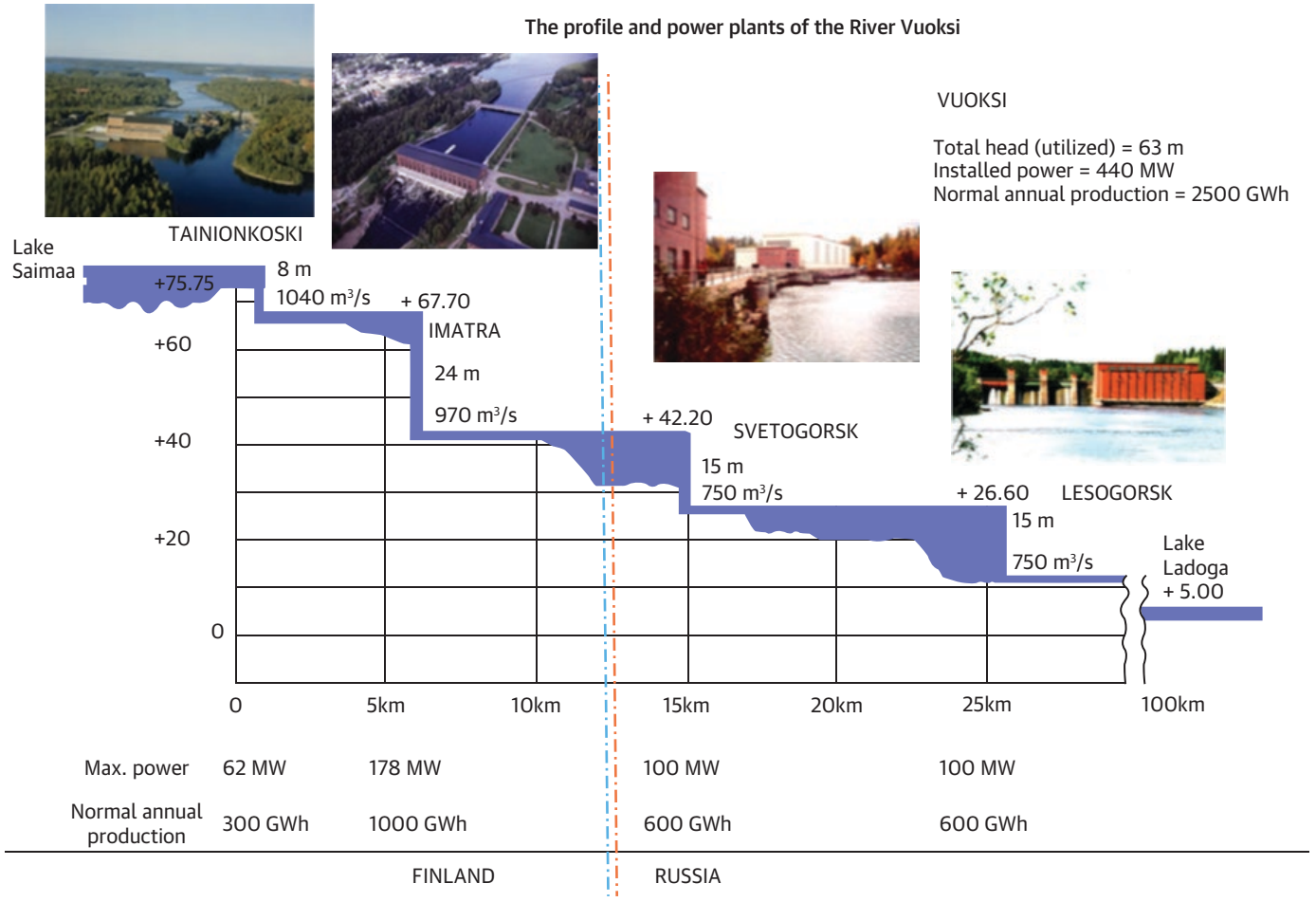
Theme 1: Institutional Cooperation

Regulatory Framework for Cooperation

The 1964 Frontier Watercourses Agreement (1964 Agreement) requires the two countries to establish a joint commission on the utilization of frontier watercourses ("the Commission") to deal with the matters provided in the Agreement (Art 6). Both countries appoint three members and three alternates to the Commission as well as make available a secretary and any necessary experts (Art 6). It is noteworthy, however, that the Agreement does not require any secretariat to be established for the Commission.

The Commission's competence includes all matters relating to the utilization of frontier watercourses and compliance with the 1964 Agreement. It may examine these matters on

FIGURE 4.4. Profile and Power Stations of the Vuoksi River



Source: Hanski 2013.

the instruction of both Parties and on its own initiative. The Agreement also requires the Commission to observe and monitor the status of waters in the frontier watercourses (Art 8). Further, the Agreement requires the Commission to take into account the provisions of Finnish and Russian law in its decision making (Art 10).

The 1989 Vuoksi Agreement on Discharge Rule in Lake Saimaa and the Vuoksi River (1989 Agreement) and the 1972 Hydropower Agreement further elaborate the competences of the Commission in the specific context of Lake Saimaa and the Vuoksi. The 1989 Vuoksi Agreement states that the Commission monitors its implementation, and it also settles any differences arising on the interpretation or application of the Agreement (Art 2). According to the 1972 Hydropower Agreement, the Commission verifies its implementation on matters concerning the utilization of water resources, while the Finnish and Russian ministries verify the supply of compensatory power from Russia to Finland (Art 5). Both the 1989 Agreement (Art 2) and the 1972 Agreement (Art 5) state that if the Commission is not unanimous, the differences are settled through diplomatic channels.

According to the 1964 Agreement, the Parties may refer planned measures having transboundary effects to the Commission for a decision or opinion (Art 9). Prior to this, the Parties must notify these measures to the government of the other Party, which may provide any necessary observations in two months' time (Art 9). If a measure would cause significant harm in the territory of the other country, or if the Commission fails to reach a decision in a matter referred to it, the Commission must submit the matter to the governments of both Parties for consideration (Art 10). In matters that have been referred to the Commission, a unanimous decision of the Commission binds both Parties if neither of them objects to such a decision in two months' time (Art 11).

The Watercourses Agreement is rather flexible in matters related to the rules of procedure of the Commission. It states that a Finnish or a Russian member of the Commission holds the Commission chairmanship alternately. In other respects, the Commission can decide its rules of procedure (Art 7).

The Commission may arrange for any necessary technical research and obtain any appropriate clarification when taking care of its duties (Art 10). The national authorities must provide to the Commission any necessary information and otherwise assist the Commission in fulfilling its duties (Art 12). If a planned measure deliberated by the Commission requires permission from the national authorities, the Commission must request the opinion of the competent authorities before reaching a decision (Art 10). It is also worth noting that the agreements establish hydropower operators (companies) directly as important actors in the implementation of the agreements.

Cooperation in Practice

Finnish-Russian Commission

The Vuoksi cooperation is largely based on institutions (Belinskij 2015, 311). The most important formal institution is the Commission, which has since its establishment convened annually, with only a few exceptions.[20] It is notable that the Commission does not have a fixed secretariat, and its operation is run with the help of bilateral WGs and their meetings.[21] According to our interviewees, the establishment of a secretariat has not been discussed, and both countries are content without one.[22]

Much of the preparatory work for the Commission meetings is done at the central and regional government levels in both countries. The Commission chairmanship determines which country is responsible for preparing the draft protocol for each annual meeting.[23] It is also worth noting that although the Commission has a formal mandate to deliberate water management projects with cross-border effects that are referred to it, something that is extensively regulated in the formal agreements, these projects have never been referred to the Commission for a decision. Such projects have only been noted by the Commission.[24] A systematic practice for planning and informing of projects with transboundary effects was established in 1967.[25]

The Commission and the WGs function as arenas for lively discussion on the matters in their mandate. Despite this, the decisions of both institutions have, for the most part, been unanimous with only occasionally differing views.[26] The most important discussions often take place in the working groups (WG), or unofficially through direct discussions between the Finnish and Russian officers and experts.[27] Sometimes differing views are debated off the record, and formal meetings may require short breaks to facilitate the establishment of a common ground.[28]

Overall, the experts interviewed for this study noted that well-functioning personal relationships between officers facilitate cooperation, but even staff changes at the Commission or the WGs have not upset this cooperation.[29] The main reason for this is the strong regulatory mandate provided by the key agreements ("the formal backbone") as well as the long history of cooperation, which has facilitated a shared understanding of the modes of operation in the Commission and the WGs. Furthermore, both states aim to choose the most suitable people for the institutions, and the officers are usually well briefed by the former members of the Commission and the WGs.[30]

Working Groups and Technical Experts

The work at the Commission level is only the tip of the iceberg for transboundary cooperation. Most of the preparatory work is done in WGs established by a Working Order on April 28, 1966.[31] The WGs meet annually to prepare an agenda for the annual Commission meetings.[32] The Watercourses Agreement does not explicitly require the establishment of WGs, but they were seen as functional institutions for preparing Commission protocols. The preparatory role of the WGs is presently well established in practice, and they are seen as compensating for and explaining the lack of a secretariat.[33]

The WGs are organized thematically. Originally, in 1966, there were WGs for log (timber) floating, water quantity management, and water quality.[34] In 1967, these groups were complemented by WGs on fisheries management, and by a WG tasked specifically with preparing Commission protocols.[35] In 1968, groups on border control and integrated water resources management (IWRM) were established.[36] A chairman WG—which is formed by a high-level officer from both countries—was established in 1972 to iron out issues that could not be resolved in other WGs.[37]

The present WG configuration was introduced in 1977: (1) IWRM WG; (2) Water Quality WG; (3) Border Control WG; (4) Fisheries WG; and (5) Chair WG.[38] In current practice, the IWRM WG and Water Quality WG are the two main working bodies of the Commission (Kaatra 2012, 60-61; Belinskij 2015, 314). In addition, border control issues are discussed in a dedicated WG but matters concerning fisheries have been integrated into the IWRM WG. Presently, the main topic in the Finnish-Russian cooperation in the Vuoksi is flow regulation, with water quality, fisheries, and border control being smaller but nevertheless important issues.[39] Unsurprisingly, the IWRM WG is particularly important for transboundary

cooperation as it prepares issues related to water quantity management and hydropower for the Commission.[40]

Because the WGs are established by a Working Order and are not explicitly required by the Agreement(s), there is flexibility to discontinue outdated WGs, and establish new ones as needed. The discontinuation of the log floating WG, and the establishment of the IWRM WG are a testament to the diminishing role of log floating on both sides of the border, and the increasing need to manage water resources in an integrated manner.

Day-to-Day Practices in Cooperation

The official and unofficial communication has benefited greatly from the development of communication and monitoring technology.[41] Presently, officers and technical experts at regional level are in direct contact by phone, with the Finnish regional authority having a Russian-speaking expert at its disposal to bridge the language barriers.[42] One Finnish expert went as far as saying that cooperation with the Russian officers and experts at the practical level is as functional as cooperation within Finland.[43]

New technology is also present in the cooperative monitoring of the hydrology of watersheds. In recent years, partly encouraged by significant flooding and droughts, the exchange of data even on smaller watercourses (including small tributaries on the Russian side flowing to Lake Saimaa) has improved considerably: the availability of such data is crucial for reliable forecasts, and for the effective and equitable management of the river.[44] As noted by practitioners working on Finnish-Russian cooperation, functioning transboundary water cooperation starts with the establishment of joint facts.[45] For this reason, joint monitoring programs and the establishment of mutual understanding over monitoring methods have been the cornerstones of functioning water cooperation.[46]

It is also important to note that private sector actors—that is, the hydropower companies[47] operating the dams in the Vuoksi River—play an active role in the institutional framework. They have the right to participate in the meetings of the Commission and the work of the WGs, and they have an active role at the WGs in preparing matters for the Commission. At the Commission's meetings, the private sector representatives have a right to voice their views and concerns in matters related to the regulation of flows, the generation of hydropower, and matters of compensation. In other matters, hydropower companies only have an observatory role at the Commission.[48]

Cornerstones of Well-Functioning Cooperation in the Vuoksi River Basin

The reasons for the well-functioning and professional (rather than political) cooperation are naturally manifold. In the Vuoksi River Basin, the expert interviews and Commission protocols revealed four particularly important themes for successful cooperation:

1. Clear formal mandate at an appropriate level of management;
2. Focus on facts and technical cooperation;

3. Combination of formal and informal collaboration and engagement of all key actors (including the private sector);
4. Pride in and commitment to cooperation.

First, there is a common understanding in both Finland and Russia of the strong and clear formal mandate given to officers at the appropriate (commonly regional) management level to negotiate and agree on the day-to-day management of the Vuoksi.[49] This mandate is not and has not been questioned by the government in either country.[50] A testament to this is that the cooperation on the Vuoksi and the work of the Commission and the WGs has been separated from the general politics between the two countries.[51] According to our interviewees, there has never been a need to refer questions falling under the mandate of the Commission to a higher political level in either country.[52] Even the present EU sanctions on Russia have had no visible effect on the Vuoksi cooperation.[53] Overall, the formal framework, coupled with established practices, brings the kind of certainty and trust that are essential for a functioning cooperation, but also facilitates flexibility to change WG composition to address new challenges.

Secondly, and closely related to the first, both the Commission and the WGs are driven mostly by factual questions regarding water flows and water quality.[54] The processes at the Commission and the WGs are expert-driven regardless of whether the issue at hand is figuring out the hydrology of the river, managing the flows, or compensation.[55]

Thirdly, although the cooperation between the Parties is based on formal agreements, the well-functioning informal cooperation and long-standing history of working together through the Commission and the WGs have removed redundant bureaucracy and stiffness from the cooperative practices.[56] This comity has facilitated the creation of an atmosphere that harbors mutual understanding and trust in managing the Vuoksi waters.[57] This has also enhanced engagement with all key actors, including private hydropower operators.

Finally, government officials on both sides take great pride in implementing the agreements and fulfilling their formal mandate. This, in turn, translates into commitment to cooperate.[58] The Vuoksi cooperation is a source of pride for Russia and Finland alike, and it is also referred to in international contexts. It is clear, however, that successful cooperation requires taking mutual benefits as a starting point and, hence, certain compromises are needed on both sides. Compromises and shifting the emphasis from national interests to a community of interests thinking is crucial as flood- or drought-management measures often have mixed effects across the border. Often measures having positive flood- or drought-reduction effects in Finland (upstream) have negative effects in Russia (downstream), and vice versa.[59] Despite this, the two countries have common interests in the regulation of the Vuoksi.[60]

Theme 2: Flow Regulation in the Vuoksi

Regulatory Framework for Flow Regulation

The 1964 Frontier Watercourses Agreement sets general rules for the management of transboundary water resources, while the 1989 Vuoksi Agreement includes more specific provisions on the flow regulation of the Vuoksi and related water levels in adjacent Lake Saimaa. In addition, the 1972 Hydropower Agreement specifies the daily regulation of streamflow at the Svetogorsk hydroelectric station on the Russian side of the border. Arguably, the 1989 Vuoksi Agreement is the most significant and detailed regulatory outcome of the Finnish-Russian cooperation (Belinskij 2015, 314).

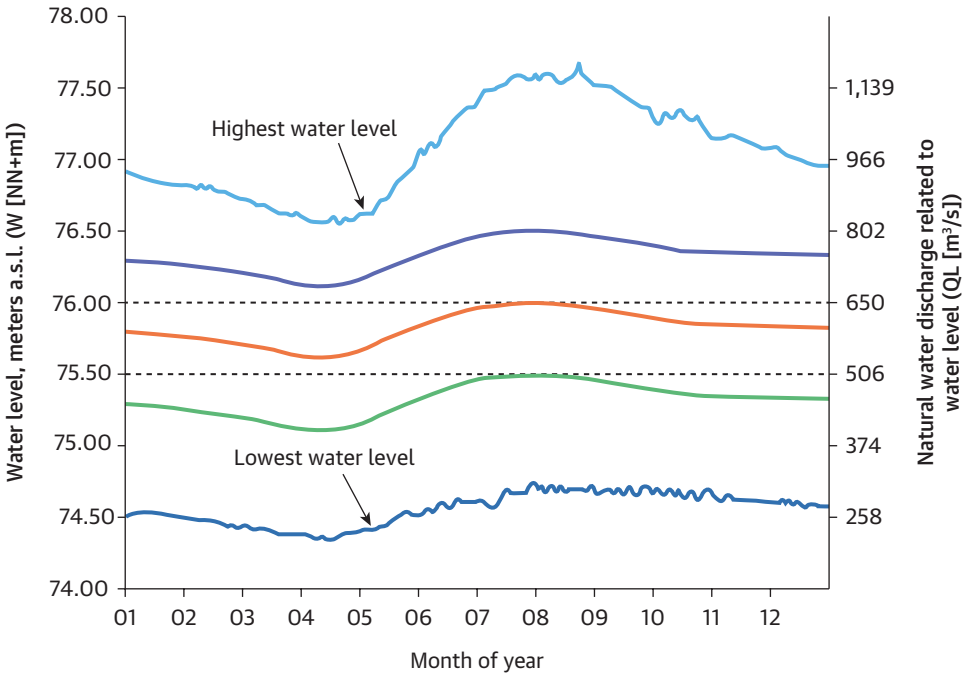
The 1964 Agreement requires that the procedure concerning planned measures (discussed above) is followed when it comes to the altering of a transboundary watercourse or blocking of its fairway (Art 2). Accordingly, measures that may alter the position, depth, level, or free flow of frontier watercourses in the territory of the other Party in a way that causes damage or harm to private or public interests, or measures that alter or block the fairway or change its course cannot be taken in disregard of such a cooperation procedure (Art 2). Private and public interests include, for example, damages or harm to property, flooding risks, and significant loss of water (Art 2). Also, the Parties must otherwise ensure that the main fairways of frontier watercourses are kept open for the free flow of water, transport, log floating, and fish passage (Art 3).[61]

The centerpiece of the 1989 Vuoksi Agreement is its Appendix on the Regulations Governing Lake Saimaa and the Vuoksi River (the Vuoksi Discharge Rule, figure 4.5). The Finnish Government must manage the flow of the river based on these regulations (Art 1). The main principle is that the water level of Lake Saimaa and the corresponding flow in the Vuoksi must remain as much as possible within normal limits corresponding to "natural conditions," as defined in annex 4A and 4B of the 1989 Vuoksi Agreement. The annex specifies the average natural water levels and flows seasonally, and is based on the measured values between 1847 and 1984. Annex 4A and 4B also provide upper and lower limits for water levels and flows considered normal, limited to +/− 50 centimeters as measured from the median water level (appendix, para 2.4).

The Vuoksi Discharge Rule notes that the flow in the Vuoksi may be adjusted upward or downward to prevent any anticipated damage (appendix, para 1 and 2.4). It also requires that every effort be made to prevent or reduce a rise in the water level of Lake Saimaa to NN+76.60 meters or lowering the water level below NN+75.10 meters during the shipping season and NN+75.00 meters at other times (appendix, para 1.1).

The 1989 Vuoksi Agreement does not make exact provisions for the flow rates of the Vuoksi. With regard to the maximum flows, the Agreement states that when preventing or reducing the rise of Lake Saimaa to the aforementioned NN+76.60 level, every effort must be made to minimize any possible damage to the Vuoksi (appendix, para 1.1). While such damages are not explicitly defined, annex 3A of the Vuoksi Agreement notes that the lowest common

FIGURE 4.5. The Principle of Saimaa and Vuoksi Discharge Rule



Source: Kaatra 2012.

Note: a.s.l = above sea level; NN = normal null; m^3 = cubic meter; ml = milliliter; QL = .quantity level.

denominator in maximum carrying capacities of the four hydropower stations is 800 m^3/s, after which the two Russian hydropower stations start to experience overflow and loss of hydropower. At the other end of the spectrum it is stated that every effort must be made to maintain a flow rate of not less than 300 m^3/s, provided this does not result in the lowering of the water level below the natural level for a given period (appendix 1.1).

To minimize flood and drought harm in Lake Saimaa, the Vuoksi Discharge Rule provides possibilities for temporary deviations of the Saimaa water levels at the first hydropower dam on the Finnish side (Tainionkoski). The water level may deviate from the estimates on account of certain expedient and operational aspects of the process (appendix, para 2.3). Nevertheless, the deviations cannot be more than +/− 5 cm and they can only be used when the water level is no more than 40 cm higher or lower than the average level (appendix, para 2.3).

The 1972 Hydropower Agreements sets clear limits for the Svetogorsk hydropower station on the Russian side of the Vuoksi for the water levels and the backwater and daily streamflow regulation practice to prevent a loss of streamflow and energy at the Imatra hydropower station in Finland (Art 1). The Agreement requires that the daily regulation of streamflow be carried out in a way that the water level in the tail bay of the Imatra station does not exceed certain average daily levels defined in the Agreement for the different flow rates of the Vuoksi (Art 2). In addition, the water levels at the Svetogorsk hydropower station cannot exceed NN+43.20 meters at any time (Art 2).

Both the 1989 Vuoksi Agreement and the 1972 Hydropower Agreement also include procedural provisions for the regulation of flows. The latter Agreement largely delegates flow management within the framework of the Agreement to hydropower companies. Accordingly, the water levels of the head bay of the Svetogorsk (Russia) hydropower station corresponding to the levels measured at the Finnish gauging station are determined in accordance with the protocol drawn up between the Finnish company "Imatran Voima" and the then Soviet "Lenenergo."

According to the Vuoksi Discharge Rule included in the Vuoksi Agreement, the process of adjusting the natural flow rate to increase or reduce the flow must be based on forecast predictions (appendix, para 1.1), instead of some fixed value for water level in Lake Saimaa. The adjustment process must be initiated gradually and any subsequent increase or decrease in the adjustments must be based on changes in water conditions (appendix, para 1.1). The adjustments of the flow rate must cease once conditions have been restored and the natural flow rate resumes (appendix, para 1.1).

As the upstream party, Finland is responsible for monitoring changes in water conditions in the Vuoksi River system on a daily basis. It must also carry out weekly analyses with a view to restoring natural water and runoff levels for Lake Saimaa (appendix, para 2.1). Finland collects data and makes approximations on the water flow rate of the Vuoksi and the water levels of Lake Saimaa on a monthly basis, and informs the Tainionkoski dam operator as well as the Russian representative of these levels (appendix, para 2.1). Finland must also inform Russia and the hydropower operators of any changes in flow management, and monitor on a continuing basis the factors that influence or result from the natural release of water (appendix, para 2.1). In addition, Finland is obliged to prepare a preliminary appraisal of water conditions in Lake Saimaa for the 3-5 month periods specified in the Vuoksi Discharge Rule and transmit the appraisal to the manager of the Tainionkoski dam and to the Russian representative (para 2.1).

According to the Vuoksi Discharge Rule, the water release program must be discussed and approved by the Finnish and Russian parties every year (appendix, para 2.2). At the same time, the two countries discuss a report that indicates the adjustments made to the natural flow and any possible damages or benefits resulting from them (appendix, para 2.2). Upon completion of a closed cycle of deviations from the natural flow rate, Finland must draw up a final balance sheet of the damages and benefits resulting from the alteration of flows (appendix, para 2.2).

Flow Regulation in Practice

Historical Development of Practices

The regulation of flows at the Tainionkoski dam in the Vuoksi in Finland began in 1949,[62] but it was not until the establishment of the 1964 Agreement and the first meeting of the Commission in 1966 that official transboundary cooperation started to form. While the Commission meetings in 1966 and 1967 were mostly occupied with water quality, fisheries, ditching, and timber floating, the 1968 Commission agenda shows records of discussions for regulating the flows in several Finnish-Russian transboundary rivers.[63] The 1970 Commission record shows Russia's extensive work on building capacity, acquiring knowledge, and establishing practices for dealing with the regulation of flows.[64] Since then, the regulation of flows in transboundary rivers has taken over most of the Commission's agenda.[65] The Commission and the WGs were first occupied with establishing practices for the exchange of information concerning the natural flows, hazardous water levels on the

Finnish and Russian sides, and information on the practices of water regulation at existing power stations.[66]

In 1971, there is a first record of discussions concerning the short-term regulation of the Vuoksi. The Finnish power company, "Imatran Voima Oy," had expressed an interest in short-term regulation of flows in River Vuoksi to compensate for the losses in hydropower caused by the Svetogorsk dam on the Russian side. The Commission referred the issue to the power companies in both countries for establishing a mechanism to solve the issue.[67] The importance of short-term regulation to the Finnish power company was highlighted in the 1972 Commission meeting.[68] In the end, the 1972 Agreement established that harm to the Finnish power company would be compensated by providing "Imatran Voima Oy" with free electricity to compensate for its losses caused by the Svetogorsk station.

Matters concerning the regulation of the Vuoksi, and the effects of exceptional high and low flows, have been continuously on the Commission's agenda throughout its operation. In 1978, both Finland and Russia stated that they had acquired further information on the negative and positive effects of high and low flows.[69] As high flows were anticipated, it was agreed that both parties investigate the upstream and downstream effects of flows as high as 1,100 m^3/s. It was also agreed that both state parties would carefully monitor the regulation of flows and its effects.[70] Throughout the end of the 1970s and 1980s, ad hoc and permanent WGs, which included representation from the power companies, were crucial in building common understanding on the rational regulation of flows in the Vuoksi River. This period also saw the willingness of both countries to study the maximum and minimum flows that could be maintained without extensive damages to either party.

At the end of the 1970s and in the beginning of the 1980s, initial discussions over the Vuoksi Discharge Rule made their way into the agenda of the Commission. The Commission proposed a new bilateral agreement on the regulation of Lake Saimaa and the Vuoksi. The Commission stated that the Agreement should be prepared pursuant to maximizing the benefits and minimizing the harm of regulation on both sides of the border.[71] This goal was reiterated in the Commission's 1985 and 1987 meetings.[72] At this point, a view started to develop that the regulation of flows in River Vuoksi should be set as close to natural flows as possible.[73] The decisions were referred to the governments of both countries in 1987.[74] The Vuoksi Agreement was signed on October 26, 1989.

Following the view established at the negotiating process, the Vuoksi Discharge Rule was set to follow the natural water levels of Lake Saimaa. To optimize the production of hydropower, the power company operating the upper hydropower dams can make short-term deviations from the natural flows of the Vuoksi, provided the deviation stays within the "normal zone" set in the Vuoksi Discharge Rule as a weekly average. Regulation along the lines of natural flows is important for avoiding flooding and extreme drought, improving conditions for transportation and fish, minimizing harm to properties and recreation, and improving the conservation conditions for the endangered Saimaa ringed seal. The seal is the flagship species of Finland, and the Finnish Nature Conservations Act and the European

Habitats Directive strictly protect it.[75,76] Actual flow regulation measures are used only when a flood or drought is emerging according to forecasters' predictions.

Present Practices of and Challenges for Flow Regulation

Lake Saimaa in Finland and the Vuoksi on both sides of the border are used for various activities that are adversely affected by floods and droughts. One of the main challenges in regulating the Vuoksi is that the natural deviation of flows is quite high between seasons and years, ranging from roughly 200 m^3/s to 1,150 m^3/s, with flows of about 600 m^3/s on average (Ollila and Rozkov 1995, 21). The regulation of flows at River Vuoksi is a vital issue for both states as an increase or decrease of each 100 m^3/s of flow has a considerable effect (up to 30-40 cm) on the water levels up- and downstream.[77] Since 2007, the Commission has shown an increasing interest in studying the effects of climate change in the Vuoksi River Basin.[78]

With flow rates below 200 m^3/s or above 800 m^3/s, the harmful effects up- and downstream the Vuoksi increase rapidly. With flow rates below 200m^3/s, production of hydropower is at minimum, transportation and water abstraction is difficult, and negative impacts are visible on fisheries and aquaculture, as well as on recreational uses of the river.[79] By contrast, high flow rates of more than 800 m^3/s cause harm to hydropower production. As the maximum capacity of the Russian hydropower turbines is about 800 m^3/s (in contrast to about 1,000 m^3/s at the Finnish hydropower stations), all excess discharge will overflow past the hydropower turbines, causing potential losses to the Russian hydropower operators. High flows can also damage properties and industries located close to the riverbank.[80]

The spirit of cooperation between Finland and Russia is well illustrated by the fact that Finland has been able to increase the maximum flows of the Vuoksi to alleviate the flooding of Lake Saimaa, despite the increased harm caused to Russia by the high flows. In the 1981 Commission meeting it was established that the regulation of the Vuoksi could be set as high as 830 m^3/s unilaterally by Finland. In 2004, the parties agreed to push the limit on unilateral management to 900 m^3/s.[81] In the Vuoksi Discharge Rule, this translates to enabling Finland to reduce the worst floods in Lake Saimaa by 0.5 meters, and severe floods by 0.2-0.5 meters to prevent damage to housing and recreation, infrastructure, cropland, and industry such as wood processing and pulp mills. In practice, it is estimated that the application of the Discharge Rule lowered the water level of Lake Saimaa by 30 cm compared to its natural state in 2012, and thus prevented much damage to construction on the shores of the lake.[82] In dry years, the water levels may be increased by 0.5 meters to mitigate drought-related harm (Ollila and Rozkov 1995, 22-26; Kaatra 2012, 63).

In terms of a functioning cascade, one of the main challenges at present is the difference in capacity between the Finnish upstream power stations, and the Russian downstream power stations (1,000 m^3/s in Finland versus 800 m^3/s in Russia).[83] The difference in capacity means that the limit for using all the flow in the river for hydropower is reached more quickly in Russia than in Finland.[84] This limits the possibility to increase the high flows beyond

800-900 m^3/s, which would help mitigate flooding in Lake Saimaa. The Russian turbines have been modernized within the time frame of the existing agreements, but the capacity of the turbines is yet to be increased.[85]

All in all, the Vuoksi Discharge Rule has served the interests of both countries. In addition to the optimization of hydropower benefits, it enables activities such as flood risk management.[86] It can be seen as a great example of an instrument enabling integrated transboundary watercourses management (Ollila and Rozkov 1995, 22-23; Kotkasaari 2008, 135-136; Kaatra 2012, 61-70; Belinskiij 2015, 314-315).

Theme 3: Compensation Mechanisms

Regulatory Framework for Compensations

The 1964 Frontier Watercourses Agreement provides the basic regulations on the compensation of transboundary losses and damages. In addition, the 1989 Vuoksi Agreement includes specific provisions on the compensation of losses related to the regulation of flows, and the 1972 Hydropower Agreement includes provisions concerning the losses in hydropower to a Finnish hydropower company.

According to the 1964 Agreement, the Party that permits measures that cause loss or damage in the territory of the other is liable for reparations to the other Party (Art 5). The Parties may also agree that reparations are made by granting the Party suffering the loss or damages certain privileges in other transboundary watercourses (Art 5). Such a provision is possible as the Agreement covers all the transboundary watercourses between Finland and Russia. Allowing compensation in an entirely different watercourse emphasizes the principle of broader benefit sharing, and can be seen as a very progressive mechanism that is—to our knowledge—unique on a global scale.

According to the Discharge Rule of the 1989 Vuoksi Agreement, Finland reports the adjustments made to the natural flow of the Vuoksi and any damages or benefits resulting from these adjustments. Finland also provides a final balance sheet of the damage or benefit, which is used as the basis for the consideration of possible compensations (appendix, para 2.2).

The 1972 Hydropower Agreement is very clear when it comes to the compensation of hydropower losses caused by the Svetogorsk hydropower station in Russia to the Imatra hydropower station on the Finnish side of the river. According to the Agreement, the energy losses resulting from the flow regulation on the Russian side are 19,900 megawatt hour (MWh) per year, and the responsible Russian party (i.e., hydropower operator) must compensate the affected Finnish party (i.e., hydropower operator) for this loss on a permanent basis (Art 3). Compensations must be made annually by supplying free electricity from the Russian hydropower station to the Finnish hydropower company (Art 4). The hydropower companies are mandated to agree on the actual supply of the compensatory power in more detail (Art 4).

Compensation Mechanisms in Practice

Compensations under the 1972 Agreement

Issues of compensating hydropower-related losses were first raised in the 1970s. The 1971 Commission record shows that the losses caused by the Russian Svetogorsk dam to the Finnish power company (Imatran Voima Oy) would be compensated by either lowering the top water level of the Svetogorsk's reservoir or providing the Finnish power company with free electricity.[87] The issue was resolved with the 1972 Hydropower Agreement.[88]

Under the 1972 Hydropower Agreement, a Russian hydropower company compensated losses to the Finnish company upstream by providing it with the amount of electricity (19,900 MWh) defined in the Agreement. This instrument was first invoked in 1977, when the Finnish members of the Commission noted that the maximum water levels set in article 2 of the 1972 Agreement had been exceeded, causing a loss of hydropower to the Finnish company "Imatran Voima Oy." The compensation mechanisms were, however, reported as functioning well and according to the Agreement.[89] Since then, the compensation from Russia to Finland has been paid annually, with only a few exceptions due to the collapse of the Soviet Union and the reorganization of the Russian energy companies.[90] Apart from these minor delays, no problems have been reported with the compensatory regime of the 1972 Agreement.

Compensations under the 1964 Agreement and 1989 Agreement

The first official documentation at the Commission concerning harm to Russian interests caused by flow regulation is from 1982, when the Russian delegates presented an evaluation of harm concerning exceptional overflows in Russian hydropower stations.[91] Finland was forced to release exceptional overflows between February 1981, and March 1983 due to heavy and varying precipitation.[92] The Russian delegation evaluated the loss of hydropower on its side at roughly 11.2 million kilowatt hours (KWh). This evaluation was accepted by the Finnish delegation. The Commission agreed that Finland would take measures to compensate the losses.[93]

The exceptional overflows continued in 1984.[94] This time, the Russian evaluation of losses in hydropower was roughly 54 million KWh. These calculations were subjected to Finnish verification.[95] The Commission decided in 1986 that Finland would pay the amount of Rub 840,000 to Russia to compensate for the losses of hydropower. In Finland, the issue was referred to the parliament for a final decision.[96] The payment was made in full in December 1986.[97] Exceptional overflows occurred again between 1987 and 1989. This time, the Russian evaluation of hydropower losses was 96 gigawatt hour (GWh), translating to Rub 1.44 million. The Commission agreed that Finland would compensate these losses in full.[98] Next year's Commission record documents the payment of this amount to Russia.[99]

Since the 1989 Vuoksi Agreement, there have been two instances in which Finland has paid such compensations to Russia: the first compensation was paid in child food and the second in cash. In 1992, Russia calculated a loss of 21 GWh in hydropower due to

overflows, totaling roughly 1 million Finnish marks. At the same time, it was agreed that 800 m^3/s would be the maximum natural flow rate, above which Russia would be entitled to compensations for lost hydropower due to overflows.[100] The Commission's 1994 records document the payment in full.[101] Exceptional overflows were recorded again 10 years later. In November 2004, the chairmen of the Commission agreed to allow the flow of 850 m^3/s.[102] In 2007, Finland agreed to compensate hydropower losses caused by overflows to Russia in the amount of €620,768. The total volume of lost Russian hydropower amounted to 60,417 MWh.[103]

In total, the compensations from Finland to Russia have been in the range of less than €1 million,[104] whereas it has been estimated that by 2012 the use of the Vuoksi Discharge Rule had prevented damages in Finland of about €10 million (Kaatra 2012, 65.). Since 2004, high flows have been an issue, but no losses in hydropower have been recorded as the regulation of flows has been maintained within the limits agreed to in the Vuoksi Discharge Rule.[105]

As an upstream country, Finland provides many of the factual information related to compensations.[106] The sum of compensation is, however, based on a Russian evaluation of lost hydropower and the market value of electricity.[107] Interestingly, compensating the loss of hydropower has been a technical, rather than political matter.[108] This applies similarly, or even more so, to the compensations from Russia to Finland under the 1972 Hydropower Agreement.[109] Despite their potentially political nature, compensations have thus maintained a similar technical and expert-driven nature, as have most other matters dealt with by the Commission and its WGs.

The flow regulation of the Vuoksi River has also mitigated drought-related risks. At the end of 1990, Finland was forced to limit the flows of the river to prevent drought-related harm to properties, shipping, and to the Saimaa ringed seal (*Pusa hispida saimensis*). This resulted in the loss of 70 million KWh of hydropower in the Russian power stations.[110] Finland had to limit the flow rate of the Vuoksi to 350 m^3/s, although the natural flow of the river would have been roughly 400 m^3/s. According to the Finnish estimate, the normal flow would have caused several million Finnish marks worth of damages to the Finnish side if harm had been left completely unmitigated.[111] Due to exceptional natural circumstances, both parties agreed that no compensations would be paid due to lost hydropower.[112] Mitigation of droughts in Lake Saimaa has been a recurring theme ever since. In 1999, 2000, 2002-03, and 2006, Finland was forced to alter the flows of the Vuoksi to minimize drought- related harm. Although both Finland and Russia recorded harm due to low flows in the river (roughly from 300 m^3/s to 400 m^3/s), no compensations were claimed.[113]

It is important to note that the compensation regime of the 1964 and 1989 Agreements has only covered losses to (potential) hydropower production, although the Agreements would in principle also cover damages caused by flooding and droughts in general.[114] Drought-related harm has not been compensated because it has been deemed the result of natural conditions, and has not resulted in a loss of hydropower caused by state actions up- or downstream.[115]

There have been some discussions concerning the impact of droughts on fisheries and aquaculture, but only unofficially.[116]

At this very moment, there are some ongoing discussions—initiated by Finland—concerning the regulatory fundaments of compensating the "non-natural" excess flows to the Russian hydropower stations.[117] The discussion revolves around the interpretation of Art. 5 of the 1964 Agreement. From the Finnish perspective, most of the compensated damages to the Russian hydropower interests are the result of joint management of the Vuoksi, which do not belong, literally interpreted, to the realm of compensation under Art. 5 of the 1964 Agreement. Despite this, there has been an established practice of paying compensation for the hydropower loss related to the excess flows. Part of the reason for this practice seems to be old Finnish water law, which included such compensation for Finnish rivers. The practice was extended to also cover the transboundary Vuoksi River.[118] Presently, there are no such regulations in the municipal water law of either country.

At present, a shift toward an integrated evaluation of harm and benefits across the border is being discussed.[119] A good illustration of this is the Flood Risk Management Plan currently under preparation. This plan compiles hydrological data on the development of flooding and droughts in both countries, and establishes principles and best practices for land use planning along the riverbanks in both countries to minimize damages to properties and industries.[120]

Conclusions

This concluding section discusses the key findings and summarizes them at two interrelated levels: Finnish-Russian transboundary cooperation and cooperation in the Vuoksi River Basin.

Finnish-Russian Transboundary Cooperation

The transboundary cooperation between Finland and Russia builds on the 1964 Frontier Watercourses Agreement, which covers all transboundary watercourses between the countries—including the Vuoksi River Basin. Given the importance of the Vuoksi for both countries, they are also closely linked. As summarized by one expert: while the 1964 Agreement forms the backbone of Finnish-Russian water cooperation, the cooperation over Vuoksi forms the spinal fluid that keeps it running. In this sense, it is also important to look at the general context of Finnish-Russian cooperation.

The 1964 Frontier Watercourses Agreement has five key characteristics. Firstly, the Agreement covers all transboundary watercourses between the two countries, ranging from major rivers to lakes and brooks. It has been estimated that there are altogether hundreds of such watercourses, and the general framework set in the 1964 Agreement regulates all of them. Secondly, the key principles of the 1964 Agreement were very advanced for their time, and included a compensation mechanism that many transboundary agreements lack even today. As a result, the Agreement has served as an example for later global, as well as bilateral agreements,

on transboundary water cooperation, and both countries take great pride in its durability and success.

Thirdly, the 1964 Agreement has endured unchanged the tumultuous times between the two countries, including the collapse of the Soviet Union in 1991 and, more recently, the international sanctions imposed on Russia. Fourthly, unlike many other global transboundary agreements, the 1964 Agreement has been successfully implemented through a joint Commission that has no secretariat but that operates through a set of thematic WGs comprising members from both countries.

Finally, and related to the points above, the Finnish-Russian cooperation has well-established mechanisms to also include private sector representatives in the work, with the status of hydropower operators defined in the relevant agreement (the 1972 Hydropower Agreement) as well as WGs and meetings of the Commission. The well-functioning collaboration between public and private sector actors, both within and between the countries, is particularly important in the Vuoksi, as private companies operate its hydropower dams.

Cooperation in the Vuoksi River Basin

Based on the study, four special aspects of the Vuoksi cooperation can be identified with respect to transboundary cooperation in general. First, the basic idea behind the 1989 Vuoksi Discharge Rule is to balance the negative impacts on the upstream party (flooding in Lake Saimaa, Finland) with the benefits for the downstream party (hydropower production on the Russian side). Commonly the situation is the other way around, with the upstream riparian reaping the benefits (usually in terms of hydropower), while the downstream country feels the negative impacts in terms of flow changes. Secondly, the Parties agreed to base flow regulation in the Vuoksi on maintaining natural conditions and the associated water levels in Lake Saimaa, and not on hydropower production. Such a focus is rather unusual in a transboundary river with several hydropower dams in both countries.

This also indicates the third aspect, which is the fact that cooperation over the Vuoksi builds on the idea of broad benefit sharing aimed at maximizing joint benefits—and minimizing joint harm—both across the border and across sectors (e.g., hydropower, flood management, recreation, fisheries). Indeed, the government representatives interviewed pointed out that Vuoksi cooperation was more about minimizing joint harm, than maximizing the benefits for one country or one sector.

Fourthly, the compensation mechanism in the Vuoksi cooperation—although focusing on hydropower—is formally established and well-functioning. It is also important to note that the compensations go both ways: Russia compensates Finland for energy losses, while Finland compensates Russia for the potential losses to Russian hydropower in exceptional years, when overflow is required for flood protection.

It is thus clear that the Finnish-Russian transboundary cooperation—in the Vuoksi River Basin as well as more broadly—is a success story, which can be used as an example for other

countries sharing transboundary water bodies. But what have been the enabling factors that have led to its success?

Enabling Factors for Cooperation

The following five enabling factors have been particularly important for the success of Finnish-Russian cooperation:

- **Well-established regulatory framework and institutions, with formal and informal cooperation supporting each other**

  → Agreements provide a clear framework for collaboration that is implemented through well-established institutions, that is, the joint Commission and its WGs. While informal connections also exist, most of the cooperation takes place within this formal framework, ensuring both clarity and continuity.

  The regulatory framework also allows for some flexibility: for example, while the Vuoksi Discharge Rule has certain set values for water levels, it also allows flow rates to be adjusted based on forecasts, rather than on the set values. This increases the flexibility of flow regulation.

- **Long-term, step-by-step process for building trust and enhancing cooperation**

  → Finnish-Russian transboundary cooperation was formally established over 50 years ago, and its backbone—the 1964 Agreement—has survived major geopolitical changes such as the collapse of the Soviet Union unchanged.

  Yet, cooperation has not always been easy, and it has taken decades to build, requiring contribution and commitment from different governance levels (from local to top level) in both countries.

- **Focus on technical aspects, that is, largely leaving out broader politics**

  → The beginning of transboundary cooperation in the Vuoksi was not easy, as the sole reason for it was the fact that Finland had lost territory to the Soviet Union after World War II. Yet, negotiations concerning the Vuoksi cooperation started immediately after the war, and focused from the beginning largely on technical aspects such as flow regulation, flood protection, and pollution control.

  Several experts emphasized the importance of facts and clearly defined numerical values (e.g., in terms of water levels in Lake Saimaa). Securing the willingness to cooperate requires accuracy and precision in the data collected, and sharing of key information between the parties.

  It is also important to note that while the political relations between the countries have seen highs and lows, these have generally not been reflected in the water cooperation.

- **Focus on broader benefit sharing and minimizing joint harm, and clearly defined compensation mechanisms**

  → The main challenge of transboundary cooperation is commonly the riparian countries' focus on their own needs, with broader benefit sharing getting much less emphasis.

The Vuoksi cooperation has taken a different view from the very beginning, by focusing on joint benefits and, importantly, on minimizing the joint harm to the two countries. Such an approach has meant that the benefits of flow regulation are looked at broadly, and consequently issues such as flood protection are emphasized over optimization of hydropower production.

It is also important that the agreements include references to compensation mechanisms (although the compensations relate to hydropower production and not other issues). Such compensations have successfully been implemented both ways, with Russia compensating the lost hydropower due to its water level regulation and Finland compensating the potential losses to hydropower production in Russia in exceptional flood years.

- **Engagement of key parties (including private sector actors) at different levels**

→ Flow regulation forms the foundation for the Vuoksi cooperation, as it enables both flood protection (important particularly for Lake Saimaa in Finland) and optimal hydropower protection. As the hydropower stations in both countries are operated by private companies (with some state ownership), the engagement of private sector actors is critical and generally works very well, both within and between the countries.

The engagement also links to collaboration across different levels of management. While the formal transboundary cooperation (including the Commission's annual meetings) takes place at the central government level, that is, ministries, the actual cooperation (e.g., the meetings of the WGs and joint projects) builds partly on the expertise at lower levels, that is, regional and even local management officials.

Annexes

ANNEX 4A

Key Agreements and Treaties

Armistice Agreement between the Union of Soviet Socialist Republics and the United Kingdom of Great Britain and Northern Ireland, on the one hand, and Finland on the other (signed and entered into force 19 September 1944).

The Agreement between the Government of the Union of Soviet Socialist Republics, the Government of Norway and the Government of Finland Concerning the Regulation of Lake Inari by means of the Kaitakoski Hydro-Electric Power Station and Dam (signed and entered into force 29 April 1959) 346 UNTS 16.

The Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning Frontier Watercourses (signed 24 April 1964, entered into force 6 May 1965) 537 UNTS 231.

Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning the Production of Electric Power in the Part of the Vuoksi River Bounded by the Imatra and Svetogorsk Hydro-electric Station (signed 12 July 1972, entered into force 7 February 1973).

Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning the Regulations Governing Lake Saimaa and the Vuoksi River (signed 26 October 1989, entered into force 9 October 1991) 1663 UNTS 325.

Convention on the Protection and Use of Transboundary Watercourses and International Lakes (signed 17 March 1992, entered into force 6 October 1996).

Convention on the Law of the Non-navigational Uses of International Watercourses (signed 21 May 1997, entered into force 17 August 2014).

ANNEX 4B

Methodology

Methodologically, this report is based on regulatory and doctrinal analyses, as well as a literature review and interviews. The regulatory framework is analyzed by studying the legal rights and obligations emanating from the relevant formal agreements. The study of implementation builds on semistructured interviews with select experts, as well as on all the available records (minutes) from the joint Commission's meetings. The experts included central and regional Finnish government officials who are serving or have served on the Finnish-Russian Transboundary Water Commission.

Altogether, five expert interviews were carried out between April 10 and May 2 of 2017. The interview with experts B and C was conducted simultaneously. All experts were Finnish, as it proved impossible to agree interviews with Russian officials responsible for Finnish-Russian transboundary water cooperation, given the tight time frame.

- **Expert A:** central government official at a high political level.
- **Expert B:** central government official with several years' experience in the Finnish-Russian and Finnish-Swedish cooperation.
- **Expert C:** central government official with several years' experience in the Finnish-Russian cooperation.
- **Expert D:** regional government official with several years' experience in the Finnish-Russian cooperation.
- **Expert E:** central government official at a high political level with several years' experience in the Finnish-Russian cooperation.

The **specific research questions** that guided this study are presented below, together with the answers given.

- Describe the regulatory framework, including (i) Objectives and benefits to be achieved and (ii) Conflicts or competing demands that were addressed when establishing the framework.
  - Described particularly under "Development of the regulatory framework in Vuoksi River basin" section as well as the first thematic section on institutional cooperation._o3f2fa5hfmn0

- Describe institutional arrangements: institutions and their departments and staff involved in implementation.
  - Described particularly under the first thematic section on institutional cooperation.
- Describe actual implementation of the framework:
  - Is regulatory framework fully implemented?
    - Yes; see particularly the first thematic section on institutional cooperation.
  - Are there any informal management arrangements that guide implementation, which are not captured in formal agreements?
    - Partially yes; most importantly the WGs that are not officially included in the agreements (although their formation is encouraged). It is noteworthy that the WGs function so well that there has never really been a need for a secretariat for the Commission.
  - Does the implementation successfully achieve the goals laid out in the agreements?
    - Yes; this was emphasized both in the literature and in the interviews.
  - What are/were the implementation challenges that have been overcome over time?
    - The key challenges in the management of the Vuoksi River have revolved around flood protection (particularly in Lake Saimaa, Finland) and its impacts on hydropower operation (particularly on the Russian side, where the maximum flow capacity is lower) and downstram flooding. These challenges have been solved in effect with the establishment of the 1989 Vuoksi Discharge Rule.
  - If objectives have not been achieved, what are the hindrances? What would need to be done to achieve the objectives?
    - Based on our study, it can be concluded that all the main objectives set in the agreements have been achieved. There are naturally always minor issues still requiring work, with key aspects currently being discussed, including the joint Flood Risk Management Plan (with the aim to enhance risk preparedness and adaptive management) as well as the possibility of renegotiating some parts of the compensation mechanisms.

Notes

1. In this report, Soviet Union and Russia are used interchangeably. All the agreements concerning the regulation of River Vuoksi have been signed by Finland and the Soviet Union. Despite this, the agreements are legally binding on Russia as a successor to the Soviet Union.
2. Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning Frontier Watercourses (signed April 24, 964, entered into force May 6, 1965) 537 UNTS 231.
3. Expert E. See also Jaatinen 1995.
4. Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. OJ L 327, 23.10.2000.

5. Kotkasaari 2008, p. 123, 133; Kaatra 2012, p. 58-68; Belinskij 2015, p. 310-311. On the impacts of climate change for regulating and managing Lake Saimaa, see Veijalainen et al. 2010.

6. Armistice Agreement between the Union of Soviet Socialist Republics and the United Kingdom of Great Britain and Northern Ireland, on the one hand, and Finland on the other hand, signed and entered into force September 19, 1944.

7. The Agreement of Friendship, Cooperation, and Mutual Assistance between The Union of Soviet Socialist Republics and The Republic of Finland (signed April 6, 1948) 48 UNTS 156.

8. Agreement on the Foundations of Relations between the Republic of Finland and the Russian Federation (signed January 20, 1992) Finnish Treaty Series 63/1992.

9. Directive 2007/60/EC on the assessment and management of flood risks. OJ L 288, November 6, 2007.

10. Convention Between The Republic Of Finland And The Russian Socialist Federal Soviet Republic Concerning The Maintenance Of River Channels And The Regulation Of Fishing On Watercourses Forming Part Of The Frontier Between Finland and Russia (signed October 28, 1922) 19 LNTS 194.

11. Expert E.

12. Agreement between the Government of the Union of Soviet Socialist Republics, the Government of Norway and the Government of Finland Concerning the Regulation of Lake Inari by means of the Kaitakoski Hydro-Electric Power Station and Dam (signed and entered into force April 29, 1959) 346 UNTS 167.

13. Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning the Production of Electric Power in the Part of the Vuoksi River Bounded by the Imatra and Svetogorsk Hydro-electric Station (signed July 12, 1972, entered into force February 7, 1973).

14. Agreement between the Republic of Finland and the Union of Soviet Socialist Republics Concerning the Regulations Governing Lake Saimaa and the Vuoksi River (signed October 26, 1989, entered into force October 9, 1991) 1663 UNTS 325.

15. Expert E.

16. Convention on the Protection and Use of Transboundary Watercourses and International Lakes (signed March 17, 1992, entered into force October 6, 1996).

17. Convention on the Law of the Non-navigational Uses of International Watercourses (signed May 21, 1997, entered into force August 17, 2014).

18. Expert E. See also Belinskij 2015, 310.

19. Experts A and E stated that the 1964 Agreement forms the backbone for Finnish-Russian water cooperation but the Vuoksi River cooperation forms its spinal fluid.

20. Expert B, C, E. It is notable that in the early life of the Commission (1966-68), meetings were held twice a year, see Finnish-Russian Watercourses Commission April 28, 1966; Finnish-Russian Watercourses Commission August 6, 1966; Finnish-Russian Watercourses Commission April 27, 1967; Finnish-Russian Watercourses Commission September 20, 1967; Finnish-Russian Watercourses Commission June 17, 1968; Finnish-Russian Watercourses Commission October 24, 1968. According to Expert E, one meeting in the 1990s was a *per capsulam* meeting.

21. This practice started forming from the first meetings of the Commission onward. In the first meeting of 1966, it was agreed that the obligation to take minutes and draft a record of each Commission meeting follows the chairmanship of the Commission agreed in the 1964 Agreement. See Finnish-Russian Watercourses Commission April 28, 1966, p. 2-3.

22. Expert A, B and C.

23. Expert A and E.

24. Expert A and E. This is visible in the Commission records as well, see for example Finnish-Russian Watercourses Commission December 3, 1992. There are also examples to the contrary. In 2001, the Finnish-Russian Watercourses Commission (30.8.2001, § 16) stated that the plans to build a hydropower station on the Hiitolanjoki River would cause more harm to fisheries and recreation than the overall benefit of the project. The Commission did not recommend the approval of the project.

25. See Finnish-Russian Watercourses Commission September 21, 1967, p. 8-9. The aim of planning and sharing of information was to facilitate effective utilization of transboundary water resources across the border.

26. Expert B and C. This is also apparent from the Commission records. Before the establishment of the present Vuoksi Discharge Rule, there was an ongoing discussion throughout the end of 1960s, 1970s, and 1980s over the regulation of the Vuoksi River. Based on the official documentation, all the discussions were held in remarkably cooperative atmosphere despite the harm that were caused by and to both parties, see for example Finnish-Russian Watercourses Commission September 20, 1981, p. 4. On the cooperative spirit of the work of the Commission, see Jaatinen 1995.

27. Expert B and C. Interestingly, the Russian chair stated in the first meeting of the Commission that WG members should be allowed to meet flexibly without being entirely tied to the formal schedule of the Commission, see Finnish-Russian Watercourses Commission April 28, 1966, p. 5-6.

28. Expert D.

29. Experts A, B, C, and E. Expert E states that many of the Finnish and Russian chairs of the Commission have served a long time and the changes in personnel have not paralyzed the work of the Commission in any way. Changes in the composition of the Commission and the WGs have been dealt with in an atmosphere of mutual support for and trust in continued cooperation, see for example Finnish-Russian Watercourses Commission September 21, 1967, p. 1-2, which noted a change of the Finnish chair to the Commission, and the Russian support for this change.

30. Expert A and E.

31. There is a record of establishing the first ad hoc WGs in the Commission at this time, see Finnish-Russian Watercourses Commission April 28, 1966, p. 3. The main WGs were at this point working on timber floating and water quality. More permanent WGs were established in the next year's meeting, see Finnish-Russian Watercourses Commission April 27, 1967, p. 3.

32. The WGs started life being tied to Commission meetings. The 1970 Commission record shows that around that time WGs had started to work and meet between official Commission meetings as well, see Finnish-Russian Watercourses Commission September 3, 1970, p. 3.

33. Expert B and C. On the importance of the WGs, see Kaatra 2012, p. 60-61.

34. Finnish-Russian Watercourses Commission April 27, 1967, p. 3.

35. See Finnish-Russian Watercourses Commission April 27, 1967, p. 3-4. The monitoring of fisheries was already on the agenda before establishing the WG on Fisheries, see Finnish-Russian Watercourses Commission April 27, 1967, p. 6-7.

36. Finnish-Russian Watercourses Commission June 17, 1968, p. 3.

37. Finnish-Russian Watercourses Commission September 21, 1972, p. 4. See also expert B and C. In practice, the chairman WG comprises the Chairman and Vice-Chairman of the Commission, as well as other high-level delegates.

38. Finnish-Russian Watercourses Commission August 24, 1977, p. 4.

39. Expert D.

40. Expert B and C.

41. Expert A.

42. Expert D.

43. Expert D.

44. Expert D. Russia has shown interest in learning and sharing of best practices in monitoring since the beginning of the Commission. See e.g. Finnish-Russian Watercourses Commission June 17, 1968, p. 2, which shows Russian interest in familiarizing itself with the Finnish technology of automatically operated water quality monitoring. Expert E noted that Russia has received a lot of useful data from Finland on the Vuoksi.

45. Expert B, C, D and E.

46. A good illustration of this is the 2nd meeting of the Commission in 1968, which illustrates a shared understanding over the monitoring methods of water quality and quantity (flows), see Finnish-Russian Watercourses Commission 1968, p. 5.

47. It is good to note that while they are indeed private companies, they also have considerable amount of state ownership.

48. Expert A and E. See also Kotkasaari 2008, p. 134.

49. Expert A.

50. Expert E. A good illustration of this is that the Commission has only noted broader political developments, see for example Finnish-Russian Watercourses Commission September 3, 1970, p. 3.

51. Expert A and E.

52. Expert A, B, C, D and E. There are, however, some exceptions, such as the regulation of the Vuoksi River. The 1970 Commission record shows that the Russian delegation had notified its government on the issue of high water levels at the Svetogorsk power station, see Finnish-Russian Watercourses Commission September 3, 1970, p. 4. Naturally, questions regarding new bilateral agreements, such as the 1989 Vuoksi Discharge Rule, were referred to the governments of both countries.

53. Expert A.

54. Experts B and C went as far as saying that up to 95 percent of the questions discussed at the WGs and the Commission revolved around facts, not so much on policy, or interpretation of the regulatory framework. This factuality and professionalism of cooperation is immediately apparent at the first meeting of the Commission that dealt mostly with questions of establishing monitoring locations and methods for the frontier rivers and waters. See Finnish-Russian Watercourses Commission April 28, 1966, p. 6-8. This work continued in the next Commission meeting, see Finnish-Russian Watercourses Commission August 6, 1966, p. 3-5. The professionalism of transboundary issues is clearly visible in the official Commission protocols throughout its operation from 1966 to the present. This is also well illustrated by a series of scientific seminars at the Commission meetings that have dealt with various aspects of water cooperation, such as fisheries. See e.g. Finnish-Russian Watercourses Commission September 21, 1967, p. 6-7.

55. Expert A, B, C, D and E.

56. Expert A and E.

57. Expert A.

58. A good illustration of this is the opening speech at the 1974 Commission meeting given by the Russian Chair. The speech emphasized the extreme importance of Finnish-Russian transboundary cooperation for both countries. This view was shared by the Finnish Vice-chair. See Finnish-Russian Watercourses Commission September 13, 1974, p. 2.

59. Expert D.

60. Expert E.

61. See Belinskij 2015, 311-314, as a more detailed introduction to the 1964 Frontier Watercourses Agreement.

62. Expert E.

63. Finnish-Russian Watercourses Commission October 24, 1968, p. 2-3 and 6-7. Among others, the Vuoksi River and Jänisjoki River were discussed.

64. The official record shows Russia being “extremely busy” with such issues, see Finnish-Russian Watercourses Commission September 3, 1970, p. 2-3.

65. See e.g. Finnish-Russian Watercourses Commission September 11, 1973.

66. Finnish-Russian Watercourses Commission October 22, 1971, p. 6.

67. Finnish-Russian Watercourses Commission October 22, 1971, p. 8.

68. Finnish-Russian Watercourses Commission September 21, 1972, p. 7.

69. Finnish-Russian Watercourses Commission September 14, 1978, p. 2-3.

70. Finnish-Russian Watercourses Commission September 20, 1981, p. 4.

71. Finnish-Russian Watercourses Commission September 14, 1978, p. 7-8.

72. Finnish-Russian Watercourses Commission September 7, 1985, p. 9; Finnish-Russian Watercourses Commission September 19, 1987, p. 8.

73. Finnish-Russian Watercourses Commission September 7, 1985, p. 10.

74. Finnish-Russian Watercourses Commission September 19, 1987, p. 8.

75. Council directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. OJ L 206, July 22, 1992.

76. Expert D.

77. Expert D.

78. Finnish-Russian Watercourses Commission August 29, 2007, § 17.

79. Expert D.

80. Expert D.

81. Bilateral discussions are always needed when going over or below the levels set in the Vuoksi Discharge Rule, see Finnish-Russian Watercourses Commission November 25, 2004, § 11. See also Kotkasaari 2008, 136.

82. Finnish-Russian Watercourses Commission 2014, p. 10.

83. Expert D.

84. Expert D.

85. Expert D and E.

86. Expert E. See also Korobova et al. 1989, 5; Kaatra 2012, 70.

87. Finnish-Russian Watercourses Commission October 22, 1971, p. 10-11.

88. Both countries demonstrated content with this agreement at the Commission, see Finnish-Russian Watercourses Commission September 21, 1972, p. 2-3.

89. Finnish-Russian Watercourses Commission September 21, 1972, p. 10.

90. See e.g. Finnish-Russian Watercourses Commission October 5, 1982, p. 7; Finnish-Russian Watercourses Commission September 10, 1983, p. 6; Finnish-Russian Watercourses Commission September 25, 1984, p. 5; Finnish-Russian Watercourses Commission September 7, 1985, p. 7; Finnish-Russian Watercourses Commission September 19, 1986, p. 6; Finnish-Russian Watercourses Commission September 19, 1987, p. 7; Finnish-Russian Watercourses Commission September 23, 1988, p. 5; Finnish-Russian Watercourses Commission September 23, 1989, p. 5; Finnish-Russian Watercourses Commission September 22, 1990, p. 4; Finnish-Russian Watercourses Commission September 21, 1991, p. 4; Finnish-Russian Watercourses Commission December 3, 1992, p. 4; Finnish-Russian Watercourses Commission September 9, 1993, p. 3. The same practice has continued ever since. Due to political unrest in Russia in 1993, the compensation of losses to Finland were delayed, see Finnish-Russian Watercourses Commission September 29, 1994, p. 3. Delays were seen again in 2005 when compensations were paid behind schedule due to reorganization of the Russian energy companies, See Finnish-Russian Watercourses Commission August 29, 2007, § 11.

91. Finnish-Russian Watercourses Commission October 5, 1982, p. 6.

92. Finnish-Russian Watercourses Commission September 10, 1983, p. 5 and Annex 8.

93. Finnish-Russian Watercourses Commission September 10, 1983, p. 5.

94. Finnish-Russian Watercourses Commission September 25, 1984, p. 4.

95. Finnish-Russian Watercourses Commission September 7, 1985, p. 9.

96. Finnish-Russian Watercourses Commission September 19, 1986, p. 8.

97. Finnish-Russian Watercourses Commission September 19, 1987, p. 9.

98. Finnish-Russian Watercourses Commission September 22, 1990, p. 5.

99. Finnish-Russian Watercourses Commission May 30, 1990, p. 5.

100. Finnish-Russian Watercourses Commission September 9, 1993, p. 4.

101. Finnish-Russian Watercourses Commission September 29, 1994, p. 3

102. Finnish-Russian Watercourses Commission August 16, 2006, § 12.

103. Finnish-Russian Watercourses Commission August 29, 2007, § 13; Finnish-Russian Watercourses Commission August 5, 2008, § 14.

104. Expert D and E.

105. Finnish-Russian Watercourses Commission August 5, 2008, § 13, Finnish-Russian Watercourses Commission September 20, 2013, § 7; Finnish-Russian Watercourses Commission August 20, 2014, § 7.

106. Expert E.

107. Expert B and C.

108. Expert A and E.

109. See e.g. Finnish-Russian Watercourses Commission October 5, 1982, p. 7; Finnish-Russian Watercourses Commission September 10, 1983, p. 6; Finnish-Russian Watercourses Commission September 25, 1984, p. 5; Finnish-Russian Watercourses Commission September 7, 1985, p. 7; Finnish-Russian Watercourses Commission September 19, 1986, p. 6; Finnish-Russian Watercourses Commission September 19, 1987, p. 7; Finnish-Russian Watercourses Commission September 23, 1988, p. 5; Finnish-Russian Watercourses Commission September 23, 1989, p. 5; Finnish-Russian Watercourses Commission September 22, 1990, p. 4; Finnish-Russian Watercourses Commission September 21, 1991, p. 4; Finnish-Russian Watercourses Commission December 3, 1992, p. 4; Finnish-Russian Watercourses Commission September 9, 1993, p. 3.

110. Finnish-Russian Watercourses Commission September 21, 1991, p. 4.

111. Finnish-Russian Watercourses Commission September 21, 1991, Attachment 9, p. 1.

112. Finnish-Russian Watercourses Commission December 3, 1992, p. 4.

113. Finnish-Russian Watercourses Commission September 8, 2000, § 10; Finnish-Russian Watercourses Commission November 25, 2004, § 11; Finnish-Russian Watercourses Commission August 29, 2007, § 12.

114. Expert D.

115. Expert D and E.

116. Expert D.

117. Expert B and C.

118. Expert B and C.

119. Expert B and C.

120. Expert D.

Miranda Dam on the Douro River between Portugal and Spain. © Raiden32/Wikimedia Commons.

Chapter 5 Douro Basin

Basin Operations

By Afonso do Ó

Summary: Three-Stage Process of Coordinated Basin Development

This case study provides an overview of the tools used to manage the Douro and the cooperative mechanisms that exist between Spain and Portugal at the transboundary level.

For reference, the three-stage process of coordinated basin development is presented in figure 5.1.

Identification of Opportunities and Risks

Portugal and Spain share three major transboundary watersheds of which the Douro has the highest potential for hydropower generation. Motivated by the desire to reap the benefits of this hydropower potential, the riparians have a long history of cooperation on the Iberian watercourses, with most early agreements narrowly focused on its economic use.

Coordination Framework (Stage 1)

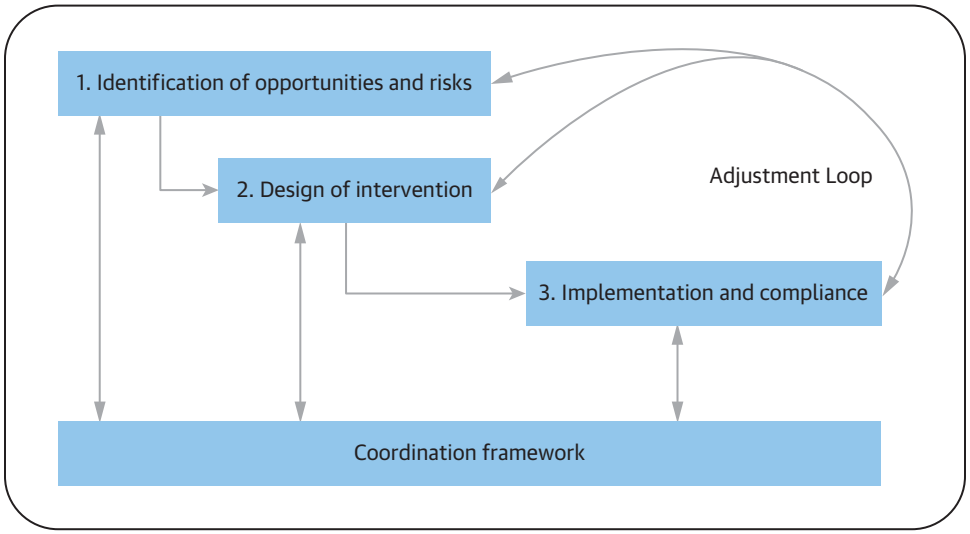
The current transboundary cooperation for identified mutual benefits between Portugal and Spain is based on the following:

- ***International Treaty*** **(T44):** The 1927, 1964, and 1968 Agreements between the two riparians focused on hydropower generation and flow regulation. Currently, the 1998 Albufeira Convention establishes an annual flow regime for all major rivers, as well as priorities among

economic activities, the setting up of information exchange channels, water transfers, and sustainable use of water.

- ***River Basin Organizations, Authorities or Commissions* (T59)**: the established Commission for the Application and Development of the Albufeira Convention (CADC) is the primary arrangement for implementing the Convention.

FIGURE 5.1. Three-Stage Process of Coordinated Basin Development



Design of Intervention

The exploitation and management of the large dams and reservoirs for hydropower generation on the Douro have in most cases been granted to the previously public (and over the last two decades gradually privatized) electricity companies in both countries.

Coordination Framework (Stage 2)

- ***International Treaties* (T44)**: under Article 2 of the 1927 Agreement, which specifically addresses the Douro, about 50 percent of hydropower generation capacity is allocated to each country. In addition, the 1964 Agreement introduced strict limits on withdrawals and flow diversions in both the Douro and its main tributaries.
- ***Public-Private Partnerships (P3)* (T86)**: the concession contracts between the riparians and electric companies extend for several decades, entail a financial compensation from the company to the public water domain, rely on the existing legal framework (both national and international), and are grounded in the historical flow record across the whole river basin.

Implementation and Compliance

For regulation of flows and hydropower production on the Douro, the two countries use the following tools:

- ***Single-Sector Operational or Implementation Plans* (T39)** and ***Technical Operators* (T35)**: the two hydropower concessionaires (the *Energias de Portugal* [National Electric Company of Portugal] [EDP] in Portugal, and Iberdrola in Spain) ensure the operational and daily management of the dams and reservoirs as well as the permanent monitoring of stream flows and discharges, and communicate the information according to procedure to the respective water authorities.

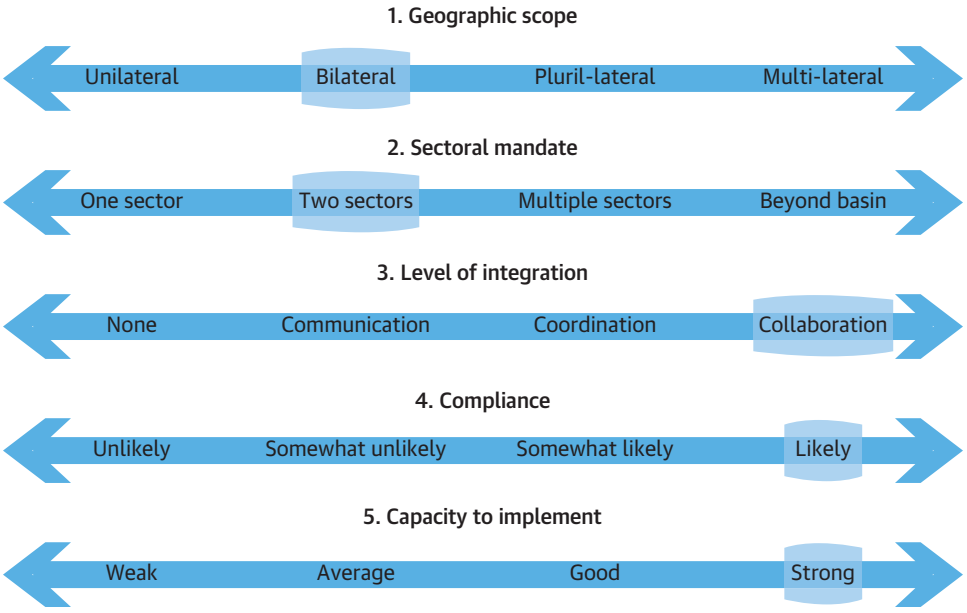
- ***Procedures for Data Sharing and Exchange* (T21)**: the two riparians gather data from their respective river basin organizations, the hydropower concessionary companies that operate the reservoirs and dams, and other stakeholders whenever relevant. Reports based on these data are only exchanged, validated, and published (as part of annual reports) once the respective CADC delegations have approved them.
- ***Annual and Sustainability Reports* (T25)**: the CADC delegations exchange informal monitoring reports on a quarterly basis, which form the basis for the annual reports that are approved in plenary sessions.
- ***Provisions for Extreme Events and Uncertainty* (T41)**: in emergency situations such as flood risk, the operational commands of the two hydropower companies engage in direct communications by phone to inform each other on river flows and dam discharges.
- ***Compensation for Harm* (T37)**: Spain has compensated Portugal for hydropower losses due to flow reductions. The Convention favors informal compensation mechanisms to allow for bilateral negotiations.
- ***Negotiations* (T66)**: in all cases of noncompliance, the riparians have reached an agreement through direct bilateral negotiations, formally foreseen by the CADC as the primary dispute settlement mechanism.

Coordination Framework (Stage 3)

- ***International Treaties* (T44)**: the 1927, 1964, and 1998 Agreements provide the framework for implementing the regulation of transboundary waters between Spain and Portugal generally, and the Douro specifically.
- ***River Basin Organizations, Authorities or Commission* (T59)**: the CADC is responsible for monitoring compliance with the Convention, including its flow regime, requested exemptions, and any eventual compensation, to be negotiated on a case-by-case basis.
- ***Amendments and Supplementary Agreements* (T46)**: the Convention was revised in 2008 as per Article 31, and a quarterly and weekly flow regime was added to the annual flow regime previously established.
- ***Minutes of Joint Management Mechanisms or Decision of Parties to an Agreement* (T43)**: most of the CADC's decisions are adopted by agreement of the two delegations meeting in plenary sessions and considered binding if, after two months from the date of their adoption, neither state formally asks for a revision or referral.
- ***Agreements of Private Law Character* (T45)**: the 1927 and 1964 Agreements largely delegate hydropower production and flow management to hydropower companies. Also, the private sector representatives from hydropower companies that operate the dams have consultative status at CADC meetings.

- ***Technical Entities* (T36)**: the CADC is composed of two separate national Technical Secretariats—whose members are appointed by the respective governments— including comprising political and technical experts as well as representatives from the key Ministries involved (Foreign Affairs, Environment, Agriculture, and Energy).

FIGURE 5.2. Application of the Five Dimensions to the Douro Basin Operations Case



Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention— to the Vuoksi flow regulation and hydropower operations case is depicted in figure 5.2 and detailed below.

1. The basin is shared by two countries and is therefore managed on a bilateral basis.
2. The sectoral mandates of these agreements cover flow regulation and hydropower.
3. The countries collaborate in the management of flow regulation and hydropower production on the Douro.
4. Both countries were expected to comply with the provisions of the agreements at the time they were negotiated; these mechanisms have so far been successful.
5. The capacity to implement the tools and design the coordination frameworks was probably strong because both Parties have well developed mechanisms to implement the agreements.

Case Study Description

Introduction

Portugal and Spain share the Iberian Peninsula territory and one of the oldest borders in the world (mostly unchanged since the 13th century). The Peninsula has five major river basins, three of which are shared between the two countries: the Douro, the Tejo, and the Guadiana (map 5.1). Altogether, shared river basins represent up to 45 percent of the Iberian Peninsula territory and, more importantly, about 46 percent of its surface and groundwater resources

MAP 5.1. Major Shared River Basins between Portugal and Spain

Source: Commission for the Implementation and Development of the Albufeira Convention, European Union.
Note: Douro [Duero] is the largest shared basin; Portugal area of the basin in yellow; Spain area of the basin in orange.

(Moral and Do Ó 2014). In all three shared basins, Spain is the upstream country and Portugal the downstream country. Thus, the shared Iberian river basins are a crucial factor in both Portuguese and Spanish social, economic, and political livelihoods, and have played a key role in their long-lasting bilateral relations.

Cooperation between Spain and Portugal on international watercourses is regulated by a series of legal instruments dating back to the end of the 19th century. These agreements have focused narrowly on economic use, particularly for hydropower generation on the river with the highest potential. The Douro, which runs from the Spanish high plains to the lower valley in Portugal, is the largest Iberian river basin, one of the richest in water resources (located in the wetter northwest) and marked by a steeper gradient than other transboundary basins.

The 1927, 1964, and 1968 water agreements between the two riparians established the principle of allocating about 50 percent of hydropower generation potential to each country by earmarking particular stretches and height differences for hydropower use. During this period in which the agreements were established, both States built numerous dams on the Douro, mainly to generate hydropower and regulate water flow, but also for the purpose of irrigation and urban supply, and to allow navigation through locks. As table 5.1 shows, the importance of hydropower production on the Douro is huge for both countries (representing 21% of Spain's and 40% of Portugal's total electricity production, MMA 2015) and likely to continue growing, particularly in Portugal, where the untapped hydropower potential is still large.

In the context of both countries' accession to the European Union (EU) in 1986, and of new EU legislation on water policy and management, the 1998 Albufeira Convention was signed between the two riparian countries, establishing minimum periodic flows for all five shared river basins. River flows are guaranteed on an annual and quarterly basis, and in most cases minimum weekly and even daily river flows are also set, in order to preserve environmental flows and related ecosystem functions.

TABLE 5.1. Main Features of the International Douro River Basin

	Portugal	Spain
Population (x 1,000 inhabitants)	1,969 (47%)	2,205 (53%)
Surface (km^2)	18,854 (19%)	78,859 (81%)
Water resources (hm^3/yr)	10,000 (37%)	16,700 (63%)
Hydropower dams (#)	67 (28%)	171 (72%)
Reservoir capacity (hm^3)	1,594 (17%)	7,874 (83%)
Production capacity (MW)	2,129 (39%)	3,370 (61%)
Gross production (GWh/yr)	7,632 (43%)	10,000 (57%)

Garrido Colmenero, A. 2010. Cuencas Hidrográficas Hispano-Portuguesas: Gestión en un horizonte de riesgos climáticos y ambientales, edited by Fundacion Canal de, I.

- The recent economic crisis that affected both countries—which imposed a reduction in the States' role and intervention capacity combined with the implementation of a common Iberian Electricity Market (MIBEL[1])—has reinforced the power and role of energy production and distribution companies, and significantly changed the framework for players and arrangements for the management of the basin's water resources, beyond the scope of the intergovernmental agreements.

Regulatory Framework

Tools that are Part of the Regulatory Framework and Operate at Different Levels

The long established hydrodiplomacy and cooperation over shared water resources between Portugal and Spain, particularly concerning quantitative management, is framed by a set of policy tools implemented at different levels and with a variable degree of legal enforceability. The next sections discuss the main tools of the Regulatory Framework and analyze them in terms of their relevance and effectiveness for the operational management of shared water resources in the Douro River Basin.

Internationally Enforced Regulations (Global and EU)

Both countries are signatory parties to the two major UN agreements on water (United Nations [UN] Watercourses Convention and UNECE Water Convention[2]). Although these international agreements are not particularly relevant to the operational management of shared Iberian waters, they establish an internationally recognized legal framework that provides a common framework of concepts, principles, and guidelines, which has set the stage for EU and bilateral agreements on shared water resources. Furthermore, they can serve as a reference during potential legal conflicts between both riparian countries.

At the EU level, the Water Framework Directive (WFD), a binding Act approved by the Member States in 2001, created a common umbrella of water policies in both countries, enforcing parallel endeavors to protect the condition of both surface and groundwater bodies. The legal obligation to use identical monitoring indicators, follow similar planning

structures, and ensure a shared participatory approach have greatly facilitated communication between both countries and key stakeholders.

A key aspect of the WFD was the consideration of entire river basins as the core water planning unit, regardless of political boundaries, thereby pushing Member States to agree on a common umbrella for each national part of a River Basin Management Plan (RBMP), if not a shared, joint RBMP. Another crucial aspect brought by the WFD to national water policies across the EU was to prioritize the *ecological* functions of water in relation to its *economic* uses, forcing compliance with basic qualitative and (to a lesser extent) quantitative levels prior to the fulfillment of human demands.

These international tools have already proven their usefulness when disputes arise between Portugal and Spain (and/or between stakeholders with conflicting interests), as in most cases the threat of legal action against the other Party (which has never happened since the entry into force of the Convention) on the basis of noncompliance with the WFD has encouraged both parties to negotiate directly and avoid a European Court arbitration.

Bilateral Treaties on Water Resources

Cooperation between Spain and Portugal on international watercourses is regulated by a series of legal instruments dating back to the end of the 19th century. The earlier agreements (1864 and 1912) focused on the border delimitation and on exploring the navigational conditions of the main rivers. Under Article 2 of the 1927 Agreement,[3] which specifically addresses the Douro, about 50 percent of hydropower generation capacity is allocated to both countries by earmarking particular substretches and height difference for hydropower use.

The 1964 Agreement[4] introduced strict limits on withdrawals and flow diversions in both the Douro and its main tributaries. If Spain decided on a new technical scheme involving a change in the heads to be used by Portugal, the established commission would determine the indemnity or compensation to Portugal (something that has never happened), with a view to ensuring equitable shares of the basin's available water resources.

The 1968 Agreement[5] expanded cooperation to all five major shared rivers between the countries. In addition to hydropower, it considered other economic uses. It referenced the maintenance of minimum flows during drought periods, and specified an obligation of prior notification for any new water uses.

In the early 1990s, a few years after Portugal and Spain had joined what was then still the European Economic Community (today's EU), Spain launched a mega water diversion plan,[6] intended to transfer large volumes from the heads of the Douro and Tejo River Basins to the drier southeastern Spanish river basins (mainly Júcar and Segura).

Portugal presented a formal complaint to the relevant European authorities, and was aided in its efforts by intense domestic opposition to the plan in Spain, a high-impact drought event affecting both countries between 1991 and 1995, and the growing environmental concerns of both populations. Under the threat of litigation, Spain decided to negotiate with Portugal, resulting in a wider, more ambitious and updated agreement on shared river basins.

The Albufeira Convention[2] (approved in 1998) was drafted in parallel with the early negotiations on a common EU legal framework for water (the WFD, approved in 2000), and its scope and approach reflect some of the key elements and innovative aspects of the latter. The Convention establishes an annual flow regime for all major transboundary rivers (the Minho, Lima, Douro, Tejo, and Guadiana), defining mandatory flow volumes in sections upstream of the border for Spain, and on the respective estuaries or mouths for Portugal (only for the southern and more arid Tejo and Guadiana River Basins). The agreed flow regime was the object of an Additional Protocol to the Convention that defines the minimum volumes allocated to each river basin, as well as the conditions allowing an emergency regime, usually associated with drought periods, to be declared (Art 5). It also establishes:

- Priorities among economic activities (urban water supply, livestock, permanent crops, and ecologic functions);
- Bilateral compliance with European and international laws and regulations;
- A limit of water transfers to other river basins of 5 hm^3/year;
- The setting up of permanent information exchange channels;
- The promotion of sustainable and frugal use of water, as any significant increase in water consumption raises the risk of noncompliance with the flow regime defined;
- The need to inform the other Party and conduct a transboundary impact assessment (based on principles laid down in the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)) for any water abstraction above 40 hm^3/year.

The major drought that occurred in both countries in 2004-2006, which forced Spain to declare an emergency (regime) for the Douro River Basin and concentrated the mandatory flow discharges in short periods of time (of relative runoff abundance) reinforced the Portuguese claims to negotiate a more time-equitable flow agreement. After intense negotiations, the Convention was revised in 2008 as per Article 31, and a quarterly and weekly flow regime were added to the annual flows established previously. Once the thresholds defining the emergency period are crossed, the Parties may declare an emergency and are thereby no longer bound to any minimum flow. In the case of the Douro River Basin, and similar to the other major shared river basins, the Convention establishes the minimum flows and conditions presented in table 5.2. The numbers reflect the upstream-downstream relative location between control stations (higher minimum flows downstream), as well as the Mediterranean climate conditions, marked by a dry summer season.

To determine the exception period, a set of rain gauge stations (3 or 4) is used for each flow control station to verify whether the accumulated average rainfall is less than 65 percent of the historical average (measured from October 1 to June 1 for annual flows, and from the start of the previous quarter to the end of the current quarter for quarterly and weekly flows). When average rainfall is less that the historical average, Spain may declare an

TABLE 5.2. Minimum Flows (in hm³) and Emergency Regime Set by the Albufeira Convention for the Douro River Basin, as Approved in 2008

Control station	Annual flow	Trimestral flow	Trimester	Weekly flow
Miranda	3,500	510	Oct–Dec	10
		630	Jan–Mar	
		480	Apr–Jun	
		270	Jul–Sep	
Bemposta	3,500	510	Oct–Dec	10
		630	Jan–Mar	
		480	Apr–Jun	
		270	Jul–Sep	
Saucelle+Águeda	3,800	580	Oct–Dec	15
		720	Jan–Mar	
		520	Apr–Jun	
		300	Jul–Sep	
Crestuma	5,000	770	Oct–Dec	20
		950	Jan–Mar	
		690	Apr–Jun	
		400	Jul–Sep	
Emergency regime	R Oct–Jun < 65%	R in current and previous quarter < 65%		=

emergency (regime) and consequently not release the minimum flows agreed. The emergency regime ends as soon as the accumulated values (after December, for the annual flows) again exceed the historical average.

The revised flow regime has allowed for better compliance by both countries with the WFD environmental requirements, while ensuring a more equitable distribution over time of the water resources released (from Spain to Portugal) over the year.

Institutionally, the CADC is the principal body for implementing the Convention. It is composed of two separate national Technical Secretariats (see flowchart 5B.1), whose members are appointed by each government and represent political and technical experts as well as representatives from the key Ministries involved (Foreign Affairs, Environment, Agriculture, Energy). The Portuguese delegation is headed by a Ministry of Foreign Affairs representative, while the Spanish delegation is led by a representative of the Ministry of Environment and Agriculture (MAA). On relevant occasions, other key stakeholders may be invited (irrigation boards, hydroelectric companies, etc.), but almost exclusively officials from both countries' public administrations. Regular sessions, which should be held each year but have not always been convened annually, are summarized in the meeting's minutes and subsequently posted on the Commission's website.

The delegates are assigned to WGs that exchange data and work together on predefined subjects, be it on very loose timelines. This mainly derives from the lack of a common

Secretariat, with implementation powers, which had been provided for in the 2008 revision, but was never set up.

The Commission is responsible for monitoring compliance with the Convention, including its flow regime, requested exemptions, and any eventual compensation (to be negotiated on a case-by-case basis). In case of disagreements at the CADC level, a Conference of the Parties (CoP, the highest decision-making body under the Convention) is generally convened. This has happened three times– in 2005, 2008, and 2015–usually in response to a breach of the flow regime.

The CADC delegations exchange informal monitoring reports on a quarterly basis, which are the basis of the annual reports that are approved in plenary sessions. Most of the Commission's decisions are adopted by agreement of the two delegations during these plenary sessions, and considered binding if after two months from the date of their adoption, neither state formally asks for a revision or referral. The CADC has held 19 formal plenary sessions since its beginning in 2000, with long gaps over the last three years (e.g., the 18th plenary session was held in December 2014, the 19th in March 2017).

The Convention has provided the institutional and operational framework for both river basin administrations to cooperate in the identification, monitoring, and assessment of shared water bodies, and in the informal exchange of methods and know-how–thus fulfilling the requirements of the WFD regarding environmental objectives, including the programs developed to achieve these goals.

Notwithstanding this formal and objective legal framework, additional informal mechanisms are often set in motion to regulate and implement the Convention (as described below in the "Regulatory Framework on the Operation of Cascade and Water Quantity Management" section), partly compensating for the poor effectiveness and limited mandate of the CADC.

Operational Rules and Guidelines for the Management of Dams and Reservoirs

The hydropower potential of the Douro Basin was the main reason for the signing of the first water agreement between both Parties, in 1927. In the 20th Century, both countries made a big effort to support theirs relatively late industrialization process by building large dams and starting to tap the river basin's large hydropower potential –particularly on its 135 km stretch along the border, where the river's main canyons (from the Iberian high plateau to the lower valley in downstream Portugal) are located. This height difference was fairly shared and allocated to both countries, and a series of dams and reservoirs was built along most of the valley.

In Spain, one of the countries in the world with the highest rate of river regulation (Benito et al. 2015), the construction of dams has stretched over all major tributaries of the main river, ensuring almost full control of inflows and discharges. Portugal, on the other hand, has a much lower rate of regulation, almost limited to the main river channel, which is nevertheless fully regulated as it is in Spain–known as "the Douro Cascade," with one reservoir ending in another upstream dam.

Concessions for the exploitation and management of these large dams and reservoirs were in most cases granted to the formerly public (but over the last two decades gradually privatized) electricity companies in both countries—EDP in Portugal and Iberdrola in Spain. In both countries, the concession contracts between the states and these companies date back to the late 20th century, when states lost their majority capital share. Although these contracts are not public, they share a certain structure and core principles: the concessions extend for several decades, entail a financial compensation from the company to the public water domain, rely on the existing legal framework (both national and international), and are grounded in the historical flow record across the whole river basin. This last factor means that any significant change in water abstractions or uses in the basin are likely to affect the established concessions, as the latter are based on the *status quo*. It also exposes the concessionaires (as long as flow records reference periods are not updated) to the effects of climate change, including the predicted reductions in rainfall, runoff, and streamflow in the Douro River Basin (Cruz García 2015).

Specific operational rules regarding reservoir discharges, turbine flows, and risk management procedures are set by each company for each dam and reservoir, in order to ensure compliance with: (a) the concession agreement and enforcement legislation, including national RBMPs and international agreements such as the Albufeira Convention; and (b) the established operations management model, as reservoir inputs and outputs are strongly interdependent.

More recently, from 2007 to date, a common Iberian Electricity Market (MIBEL) was put in place, connecting the previously separated national distributional grids and allowing the electricity companies mentioned above and other companies (mainly from Spain) to compete with each other in open market conditions. Since 2014, the Iberian grid is connected and integrated with the Southwestern European Grid, enabling the full integration of the Iberian companies and infrastructures into the EU's internal energy market.

This has significantly changed the operational procedures for most dams and reservoirs, as turbinated flows are increasingly responding to daily market conditions, and therefore becoming more variable and unpredictable. Another important factor in this context is the increasing weight of eolian production in the energy mix of both countries, which have in recent years become two of the largest wind energy producers in Europe. The different production patterns have forced hydropower sources to adapt and complement eolian production in periods of reduced wind potential.

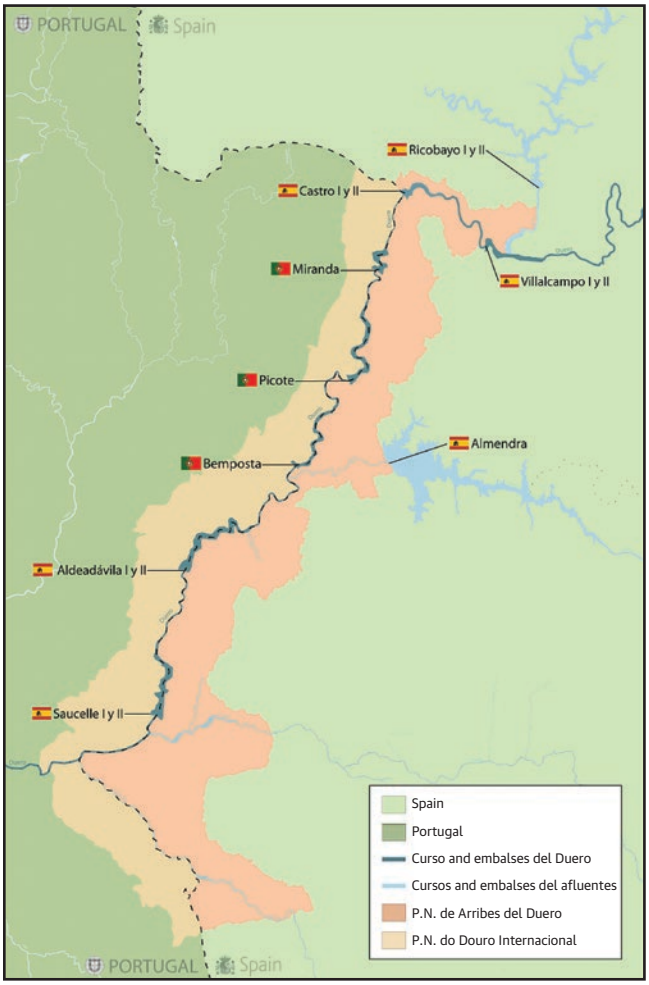
Conflict or Competing Demands That Were Addressed When Establishing the Framework

Several conflicts over shared water resources have arisen between Portugal and Spain over time, most of which have triggered the creation or use of the relevant tools previously discussed, embodying the overall regulatory framework guiding water quantity management in the Douro River Basin.

One major conflict arose from the Iberian rush to start tapping the hydropower potential of the Douro Basin, in support of the relatively late industrialization that both riparian countries pursued in the early 20th century. As the river stretch with the highest hydropower potential was the 135 km long border (map 5.2), the dispute triggered the negotiations leading to the 1927 Agreement, which was framed by the League of Nations Convention relating to the Development of Hydraulic Power Affecting More than One State (adopted December 9, 1923, entered into force June 30, 1925). The 1927 Agreement was meant specifically "to regulate the hydroelectric exploitation of the Douro international stretch," and to overcome the limitations imposed by the previous 1864 Agreement on borders and limits, which focused primarily on the border itself, and on navigational rights.

In the 1960s, as the industrialization process reached its height in both countries, Spain announced plans to divert water from the Tejo (the largest Iberian river) to the southeastern Segura, while water demand for irrigation and urban supply was rising exponentially all across the Iberian Peninsula. Once again, conflict over the seizure of shared water resources eventually led to negotiating another agreement in 1968. This Agreement expanded the scope of the 1927 Agreement to *all* shared river basins, and broadened its scope beyond the hydroelectric potential to *all water uses*, thus finally including the rivers' water flows and reflecting the first glimpse of environmental concerns.

MAP 5.2. International Stretch of the Douro River and its Major Dams (Flagged by Ruling Country)



Source: MMA 2015.

The 1968 Agreement was to be replaced only by the Albufeira Convention, signed in 1998 and presently in force. As had been the case previously, emerging conflicts between the two Parties on shared water resources had triggered the negotiations that led to this latest agreement. In this particular case, a combination of factors forced both Parties to the negotiation table:

- The increasing water scarcity in shared river basins, due to the exponential growth in water demand and the limited supply of water available;
- A period of extreme drought in most of the southern and western Peninsula during the early 1990s (heavily affecting both countries);
- Spain's 1993 plans to divert large river flows from the Douro to the southeastern basins (where water-intensive irrigation plots are concentrated);
- The growing environmental concerns of both populations, in the face of water quality problems, river degradation, pollution, and loss of biodiversity.

These factors were the main triggers for negotiating a new bilateral Agreement—the Albufeira Convention. For the first time, it included environmental concerns, fair sharing of all the water resources, and conflict-resolution mechanisms, among other innovative features—promoted by both countries' accession to the EU (in 1986) and the negotiations on a common EU legislative framework for water: the 2000 WFD.

Finally, the establishment of the MIBEL is the result of different actors competing for both energy sources and clients in the context of increasing EU market integration.

Institutional Arrangements

Stakeholders' Role, Scope of Action, and Liability

This section describes the regulatory framework outlined above and identifies the key institutions and their role and competences.

Central Administrations

The two central government institutions that are responsible in both countries for water management are legally liable, and act as the national public authority. They have a similar role and identical powers (including for transboundary relations), despite the quasi-federal structure of the Spanish administration and the centralized Portuguese model.

APA: Agência Portuguesa do Ambiente (Portuguese Environment Agency of the Ministry of Environment—Portugal)

The Agência Portuguesa do Ambiente (Portuguese Environment Agency; APA) acts as the national authority for water and dam safety issues. Two departments are involved in water management issues of transboundary river basins: the Departamento de Recursos Hídricos (Water Resources Department; DRH), and the International Affairs Department (DAI). Furthermore, APA has a separate Gabinete de Segurança de Barragens (Dam Safety Office; GSB), under the authority of the Vice-President, which is responsible for determining the technical requirements of new infrastructures; inspecting safety conditions in existing installations; and licensing dam operations, regardless of whether the infrastructure is run by public or private entities.

APA also presides over the national Comissão de Gestão de Albufeiras (Dam Management Commission; CGA), a multistakeholder operational forum where most decisions on multisectoral surface water uses are taken.

DGA: Dirección General del Agua del Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente (Water General Directorate of the Agriculture, Fisheries, Food and Environment Ministry—Spain)

The Spanish water authority is responsible for all water management issues in both internal and international river basins; its General Subdirectorate for Water Planning and

Sustainable Use (DGPUSA) is particularly important in this context. Furthermore, DGA regulates the activity of the *Confederaciones Hidrográficas* (River Basin Boards), which are technically and financially autonomous in their activity (contrary to their Portuguese counterparts), but subject to the national mandatory guidelines and rules for planning and water use.

DGA also has a separate General Subdirectorate for Infrastructures and Technology (SGIT), which is in charge of dam safety issues, as is its Portuguese counterpart GSB.

River Basin Organizations

The River Basin Organizations (RBOs) described hereafter are the government institutions that directly control the Douro River Basin territory in their respective countries. They differ significantly in their roles and powers.

ARHN—Administração da Região Hidrográfica do Norte

ARHN is a decentralized body of APA in charge of monitoring and implementing water policies in the northern Portuguese river basins, including the transboundary Douro Basin. It has no technical, political, or economic autonomy, but plays a key role in linking with local and regional stakeholders, and in collecting, treating, and distributing hydrometeorological information.

It is bound to the administrative boundaries of the Northern Region (closely related but not overlapping those of the Douro plus neighboring river basins) and integrated in the regional CCDR-N services,[8] a decentralized government unit created for statistical and operational purposes, as required by EU governance criteria. In fact, administrations of hydrographic regions (ARHs) were only created in Portugal in 2009, in response to the WFD obligation to set up river basins as the basic water governance unit across the EU.

CHD—Confederación Hidrográfica del Duero

Contrary to its Portuguese counterparts, the Spanish river basin authorities such as CHD (i.e., those covering more than one region) have technical and economic autonomy in relation to the national DGA. They were created in the 1920s and rank among the earliest RBOs) in the world. Although subject to national guidelines and regulations that are binding and have been slightly reinforced over the last water planning cycle,[9] CHD remains responsible both for water planning and management in the basin, including the RBMP elaboration and implementation, monitoring, and stakeholder consultation.

Yet the national level of cooperation between both countries has found a minor *consultative* role for CHD, as direct interregional relations have always been limited, both because a legitimate Portuguese counterpart is missing (because of the limited autonomy of ARHN and the nonexistence of politically representative regions) and because of the national scope of diplomatic international relations.

Electrical Companies

Since the construction of the first dams along the Douro River valley (in the 1930s, following the 1927 Agreement between the two Iberian countries), the once public electrical companies have played a major role in building, managing, and operating the dams and reservoirs. After their privatization (gradually implemented since the late 1990s), they continued to hold the same powers through long-term concession contracts, extended to new dams as they develop.

EDP Produção

EDP has for decades been *the* Portuguese public electricity company, nowadays a large semi-privatized conglomerate with global activity in the energy sector. Although forced to compete for the national market with Spanish competitors in the framework of the MIBEL, it still holds a large share of energy consumers and an even larger share of energy production in Portugal. EDP Produção is one of the group's enterprises, responsible for all energy production in the country (mainly hydro and wind power), and holds the concession of all dams in the Portuguese part of the Douro River Basin, including the major ones in the international stretch.

Within the company, the Direção de Gestão e Segurança Hídrica (Water Management and Safety Board; DGSH), is responsible for monitoring, informing, and managing all reservoir and dam operations, including discharges and flow releases, in close (and restricted) operational cooperation with both its national public authority (APA) and its Spanish counterpart, Iberdrola.

Iberdrola Generación España, S.A.U.

Similarly to EDP, Iberdrola is an inheritor of the formerly public electricity sector, but in contrast to the Portuguese monopolistic context, the energy market in Spain is oligopolistic (only a few large companies affect but don't control the internal market). These companies have emerged from the previous regionalized public groups—presently the most relevant, besides Iberdrola, are ENDESA, FENOSA, VIESGO, and EDP España (which includes the Portuguese-based conglomerate).

Iberdrola holds the concession of all dams in the international stretch and vicinity of the Spanish part of the Douro River Basin, which is also the largest and most important section of the whole basin. Once again, similarly to the Portuguese situation, Iberdrola Generación España is the company responsible for all energy production in Spain within the Iberdrola conglomerate. Its operational control department is likewise responsible for monitoring, informing, and managing all reservoir and dam operations, in close (and restricted) operational cooperation with both its national public authority (DGA) and its Portuguese counterpart.

Other Stakeholders

Other stakeholders in addition to the above key actors on water and hydropower management in the basin play important roles. These range from national civil protection authorities, local and regional authorities (the latter only in Spain), and irrigation boards, to environmental groups.

Civil Protection Authorities: ANPC (Agência Nacional de Proteção Civil—Portugal) and DGPCE (Dirección General de Protección Civil y Emergencias—Spain)

In high-risk situations, such as those caused by floods and droughts, these authorities may take the lead role in all decisions on water management, according to the level of alert approved by each government. Even under the current management modality, regular communication of flow levels is mandatory between the reservoir management companies and these authorities through their regional operational centers (*Centros Distritais de Operações de Socorro* in Portugal, and *Delegaciones Autonómicas de Protección Civil* in Spain).

Local and Regional Authorities

Local and regional authorities play a significant role in the Spanish political landscape, which has a quasi-federal structure prone to significant unrest over the last decade. Among the conflicts that have emerged between the regions (*Comunidades Autónomas*) and the central administration, water has ranked high since the late 20th century, with both sides competing for more powers in water management and planning. The regions revised their statutory body, as in the case of Castilla y León in 2007, reclaiming authority over management of the river basins that are largely part of one single region (as is the case of the Douro Basin within Spanish territory). Eventually the central government reversed the situation for most interregional river basins (except for the Guadalquivir Basin, almost entirely located in Andalucía and therefore its regional government was granted a concession to manage the basin), water planning and management competences remaining with the *Confederaciones Hidrográficas* (such as CHD), directly dependent on the national authorities (DGA). Nevertheless, most regions (including Castilla y León regarding the Douro Basin) persist in their demands for greater control, fueling the ongoing conflict over water (and other) competences among different government levels.

On the other hand, the traditional centralism of the Portuguese state architecture continues to block any decentralization attempts, despite the mandate to implement the European WFD and its river basin approach. This institutional gap has proven to be one of the major obstacles to effective cooperation between both countries, and between the national parts of each river basin.[10]

Irrigation Boards

Irrigation accounts for most of the consumptive water use in the Douro River Basin (over 80% in the Portuguese part and over 90% in the Spanish part), similar to the pattern of other Iberian and Mediterranean river basins. Most of the irrigation plots are located in state-created perimeters connected to dam/reservoir systems. In recent years, these systems have increasingly shifted from irrigation and/or hydropower-only use to multipurpose uses, usually combining irrigation demand with urban supply, hydropower production, industrial, recreational, and other uses.

Irrigation farmers are often well organized at the system, regional, and national levels, particularly in Spain, where their lobby is quite strong and has significantly influenced water policy during the 20th century. These organizations remain well represented in consultation and decision-making boards on both sides of the border, most of which have been set up as a result of the participatory approach recommended by the EU Water Framework Directive (WFD).

Environmental Organizations

Public awareness of environmental issues has greatly increased in both Portugal and Spain since the late 20th century, water often topping common concerns, both due to issues related to qualitative (pollution, river degradation, loss of biodiversity) and quantitative (overexploitation, water scarcity, droughts) aspects. Some of these issues are largely responsible for triggering the negotiations that led to the bilateral agreement on water currently in force (the Albufeira Convention), as pointed out in section 1.3.

Although environmental organizations are not as well organized and have less lobbying capacity than irrigation farmers, they have also benefited from the participatory approach recommended by the EU WFD, implemented through several consultation and decision-making boards in which they participate. Partly due to their action, the International Douro Natural Park was created (in 1998 in Portugal, and in 2002 in Spain, and since 2015 a UNESCO transboundary biosphere reserve), encompassing the border river stretch where the basin's most important hydropower stations are located (pink-shaded area of map 5.2).

Inter-Relations, Level of Cooperation and Conflict Potential

Hydrodiplomatic relations between Portugal and Spain remain strongly focused on the national level, with little participation and inputs from other stakeholders. The governing structure is consistently top-to-bottom on both sides of the border, and joint decisions are only taken at the intergovernmental level (refer to flowchart 5B.2 throughout this section). RBOs either have limited legitimacy and autonomy (as is the case in Portugal, where they were created only recently in response to EU obligations), or face significant institutional conflicts between the different levels of public administration (as is the case in Spain, where they were subject to "enhanced control" by the central administration in interregional situations). In both cases, the recent trend toward further centralization seems to be related to the economic and public finance crisis that strongly affected both countries between 2011 and 2015, leaving limited resources at the central level for distribution to the regions.[11]

Other stakeholders are often consulted for policy purposes (i.e., regarding the design and approval of RBMPs), in the context of consultative river basin boards—led by APA (central administration) in the case of Portugal, and by CHD (river-basin level) in the case of Spanish. Nevertheless, although both public administrations comply with the public consultation procedures recommended by the WFD, most stakeholders remain excluded from the relevant decision-making processes, which are closely controlled by the respective governments.

Cooperation through the CADC

The lack of stakeholder engagement described above is particularly pronounced in the case of the Albufeira Convention, subject to strict foreign policy control by both countries. While major stakeholders such as Spanish regional administrations or the concessionary hydroelectrical companies are usually invited to attend CADC plenary sessions, they merely have a consultative role.

The verification and monitoring of the Albufeira Convention by the CADC is based on quarterly reports prepared separately by both sides, and subsequently exchanged between both national water authorities (APA and DGA). For this purpose, the two water authorities gather data from their respective RBOs (more relevant in the Spanish case, as CHD is the water authority); the hydropower concessionary companies that operate the reservoirs and dams; and other stakeholders whenever relevant. These reports are only exchanged, validated, and published (as part of annual reports) once the respective CADC delegations have approved them—thus avoiding any noncompliance, inconsistency, or dispute to become public before the two administrations are able to deal with them successfully.

RBOs from both sides (including ARHN and CHD for the Douro) participate in these plenary sessions and contribute to the monitoring and reporting under the Convention, despite the much larger role and powers of the Spanish RBOs. These organizations are subject to the authority and legal control of the central administration, and usually reflect common interests and concerns in bilateral meetings. The ongoing conflict over authority, both in water policy and many other domains, between the Spanish central and regional governments, has rarely directly affected the Convention and the works of the CADC. Nevertheless, it was a major cause for concern of the Portuguese authorities when the autonomic status of the Spanish regions was revised, implying a substantial increase of their mandates in water policy and management. To some extent, the Portuguese claims supported Madrid's intentions to retain control over its water resources, and the situation was eventually reverted (after protracted legal and political battles) for all river basins covering more than one Spanish region (thus including all the transboundary ones).

Cooperation with Hydropower Companies

More cooperative aspects of stakeholder relations can be found in the overall framework for managing the Douro transboundary water resources. The most evident is the established operational relationship between both central administrations and the two hydropower concessionaires (the energy companies EDP in Portugal and Iberdrola in Spain). These companies ensure the operational and daily management of the dams and reservoirs, ensure the permanent monitoring of stream flows and discharges, and communicate the information according to procedure to the respective water authorities. Although free to produce as much energy as the available resources allow, they are restricted in this activity by the requirements set by both States regarding environmental flows, flood control, transboundary agreements, and emergency situations. It is an interesting case of a win-win

relationship, set outside the Albufeira Convention or other major policy agreements, founded in the concessions granted by the state to the companies to explore the hydroelectric potential of the river basin.

The operational commands of the two companies communicate regularly, through direct and automatic data transmission on reservoir levels and observed and foreseen discharges. In emergency situations (most often involving flood risks), direct phone communication is also used. The level of cooperation has increased over the last few years as both companies (as well as other large hydroelectrical companies based in Spain) have penetrated the capital and managing structure of the other, leading to growing interrelations and crossed capital shareholdings, in the framework of the MIBEL.

Cooperation in Emergency Situations

For monitoring and disaster prevention purposes, semi-automatic communications are used by EDP and Iberdrola to inform the respective national water authorities—APA in the case of Portugal, DGA and the interregional river basin authority (CHD) in the case of Spain—about river flows and dam discharges (as required by concession contracts). But beyond this level, in case of an emergency or risk management need, and for verifying compliance with the existing agreements (including the flow regime of the Albufeira Convention), national water authorities, directly under the supervision of each government's foreign affairs office, remain the sole authorities and pivot players among all national stakeholders concerned.

Thus, in any emergency or risk management situation, APA and DGA are the only interlocutors besides each country's national Civil Protection Authority (ANPC in Portugal and DGPCE in Spain) that centralize operational and response procedures at the national level with all other relevant actors (meteorology services, irrigation boards, urban supply facilities, other public administration services, environmental organizations, etc.). In the case of drought, given its slow onset and creeping pace, most of the stakeholders (except those related to the pure emergency response, such as medical and fire brigade services) have been grouped in consultative boards that were created specifically for managing the multipurpose reservoirs—this is both the case of the CGA (Reservoir Management Commission) and of the Spanish Comisión de Desembalse (CD, Commission on Dam Water Releases). When an emergency arises, both these boards become "permanent" for as long as the alert remains active, with all members reporting and actively participating in the discussion and approval of any response measures.

Actual Implementation of the Framework

The scope and effectiveness of the regulatory framework described above is analyzed next, based on the actual outcomes and results of each of its main tools. Particular attention is given to assessing: (i) the informal arrangements guiding implementation that are not captured in formal agreements; (ii) the success in terms of achieving the goals laid out in the

agreements currently in force; and (iii) the obstacles to implementation and what needs to be done to reach the framework objectives.

Informal Arrangements Guiding Implementation Not Captured in Formal Agreements

Even where international legal agreements exist, informal arrangements often play a key role in implementing effective cooperation mechanisms between the Parties.

Two significant examples can be found in the hydrodiplomatic relations between Portugal and Spain on shared river basins. One concerns the institutional nature of governing bodies within the public administration of both countries, the other the voluntary agreements reached in the context of the Albufeira Convention to solve disputes.

In the first example, the quasi-federal organization of the Spanish state has granted broad competences and liabilities to the "autonomous regional communities" in terms of water governance; nevertheless, largely because of the *international* scope of some of its major river basins, the central administration has regained authority over much of its shared basins, at the cost of a long-lasting conflict with the affected regional governments. By contrast, Portugal evolved from an opposite starting point, with a fully centralized water administration moving toward decentralized boards at the basin level, to meet the requirements of the WFD; yet soon after they had been established (between 2009 and 2011), the competences of these regional governing bodies were given back to the central government, keeping the boars as mere implementing agencies for the policies formulated at the central level.

In the second example, the Albufeira Convention considers the possibility of both Parties agreeing to declare an emergency regime for the minimum periodic flows, when monitoring suggests drought conditions have been recorded. Although this has occurred only once, when Spain declared an emergency in 2005 for the Douro River Basin during a major drought, four other periods of noncompliance have been recorded[12] (one of which was also in the Douro) since the Convention was ratified, without the Parties having the possibility of declaring an emergency. In all cases, both Parties reached an agreement through direct bilateral negotiations, formally viewed by the Convention as the primary dispute settlement mechanism. In parallel, an informal compensation mechanism was agreed, with Spain partly compensating Portugal at a later stage for the flow reductions registered.

The structure of the Albufeira Convention favors such informal compensation mechanisms, not only by prioritizing direct and open bilateral negotiations, but also by not defining the terms and conditions for such compensations in operational terms. Hence, in situations of potential conflict, both countries have preferred direct negotiations (albeit on the sidelines and usually secretive), avoiding other conflict-resolution mechanisms foreseen in the Convention, such as appealing to the national and/or European courts of justice. As seen in other cross-border disputes,[13] both Parties clearly wish to contain any diplomatic conflicts and avoid the use of other conflict-resolution tools and mechanisms included in bilateral agreements and European legislation, such as those foreseen in the Albufeira Convention and other related international agreements.

The one time Spain declared an emergency (flow regime) as enshrined in the Albufeira Convention Agreement (in 2005-06), it largely did so because the flow reduction downstream was causing a loss in hydropower production, later estimated by the Portuguese EDP at €6 million. The Portuguese government announced it would claim that amount as economic compensation unless Spain could prove it had grounds for declaring the emergency regime, which it did in late July 2005 (a situation that prevailed until March 2006). In all other situations of noncompliance with the agreed flow regime, neither country took any legal action, and compensations for flow reductions were agreed, and apologies accepted (Sereno 2011).

The economic crisis of 2011-14 compelled both governments to recentralize many of the powers that had been transferred to the regions (in Spain) and municipalities (in Portugal), while reducing the state's capacity to intervene directly in public policy issues, such as those related to water management and cooperation. There were strong signs of both states' "demobilization" in respect of the Albufeira Convention: the CADC held no meetings in 2011, 2015, and 2016; its website was deactivated for a long time; none of the joint WGs produced any significant output, and the recommendations endorsed at the highest political level by the CoP were only implemented for a very brief period.

Contrary to these trends, private stakeholders have intensified their role and scope of action in the management of shared water resources, although no major formal changes have been made to the governance framework. Along with the implementation of MIBEL, both energy companies that hold a concession for operating the transboundary Douro dams (EDP and Iberdrola), together with the other large energy players based in Spain, have intensified their interlinkages and scope of cooperation.

Illustrative of these changes is the fact that while both countries receded in their capacity to maintain and support an adequate water monitoring network, both energy companies made the necessary investments and now monitor and supply much of the information needed to verify compliance with the Albufeira Agreement and prevent major risks (notably flooding in the low-lying Portuguese valley).

Overall, although the legal cooperative framework remains very much the same as it was in 2008, the main actors and stakes at play seem to have changed, and new arrangements are being worked out to manage water resources in the Douro River Basin (and in other shared basins).

Implementation Success in Achieving the Goals Laid out in Ruling Agreements

Over time, significant challenges have been overcome with respect to the management of shared water resources between Portugal and Spain in general, and of the Douro River Basin in particular.

Early agreements in the late 19th century were designed to clarify borders and avoid territorial conflicts, while establishing the first transboundary cooperative framework over shared water resources between the two riparian countries. Similarly, the 1927 Douro

Agreement ensured the shared exploitation of the great untapped hydropower potential of the river valley, and provided for much of the electricity the countries needed for their industrialization. The new agreements of the 1960s tackled the multiple use of reservoir waters and incorporated information and environmental concerns, in the face of increasing water pollution, river degradation, and water scarcity. Finally, the Albufeira Convention currently in force (1998) was a response to rising competition over increasingly scarce resources, in an environmental context of climate change and higher drought vulnerability, and a new political context marked by democratization and further EU integration.

Overall, it is clear that all these agreements have largely been beneficial for both Parties, not only by preventing conflicts that could have threatened the cooperative and peaceful neighborly relations that the countries have enjoyed for centuries now, but also by enabling optimized hydroelectricity production; flood prevention through flow regulation; a shared consideration of environmental issues and needs; and an integrated and systemic approach to the river basin territory and its water resources.

Yet the analysis also shows that this cooperation framework has been strongly state-centralized and reactive to the challenges that arose over the course of time. In a world marked by increasing globalization and multilateralism, including a growing role for non-state stakeholders, the top-down and poorly coordinated (rather than shared) structure of the CADC (see flowchart 5B.1) has serious drawback. More specifically, it has little adaptive capacity, and it somehow limits the capacity to take advantage of the synergy potential that a more flexible cooperative framework would offer—for instance, a more comprehensive and systemic consultative board, the establishment of a permanent Technical Secretariat (planned since 2008), and developing a more consistent and time-sensitive activity plan, to be reflected in the shared river basin management and planning tools.

The Convention flow regime, for example, has been largely praised as a diplomatic success that has proven realistic and effective over the years (Bukowsky 2011). However, the emergency regime, which was a key factor for the Convention to be approved by both Parties, means that when cooperation is even more necessary, the Convention actually loses its most significant tool. In fact, in a drought situation, competition between countries and stakeholders naturally increases as resources grow scarcer. But if the emergency regime is declared, neither country has to comply with the flows agreed in the Convention; they instead temporarily resort to managing the available water resources in a way that is best from a *national* (and necessarily partial) perspective, thereby reducing the cooperative scope of the Convention.

The emergency regime has only been declared once (between July 2005 and March 2006) since the Convention's approval, but in future an emergency regime is expected to be marked by longer and/or more severe drought periods (as predicted by most regional climate change scenarios), thereby possibly raising tensions between the two riparian countries over increasing demands for water resources in the basin. Overall, the existent cooperative framework does not yet embody the integrated transboundary management structure

foreseen and recommended by European regulations. Effective, coordinated planning seems unlikely to be implemented anytime soon, but the necessary tools are in place. The relevant experience is growing, and a small measure of political will and economic and technical resources could make the difference when an opportunity for closer cooperation arises.

Finally, the key role of the energy companies in charge of operating the reservoirs and dams of the international river basin pose a challenge for the current formal cooperative framework, as their responsibilities and liabilities are not clearly specified. While the existing informal arrangements have been able to deal effectively with some of the framework's shortcomings (such as the public monitoring system), situations of potential conflict (such as intensified droughts or increasing water scarcity) could undermine the existing cooperative framework. Clearly, the current system functions smoothly thanks to *informal* working arrangements between players, which entails a certain sustainability risk if the relationships between the countries and/or players were to change.

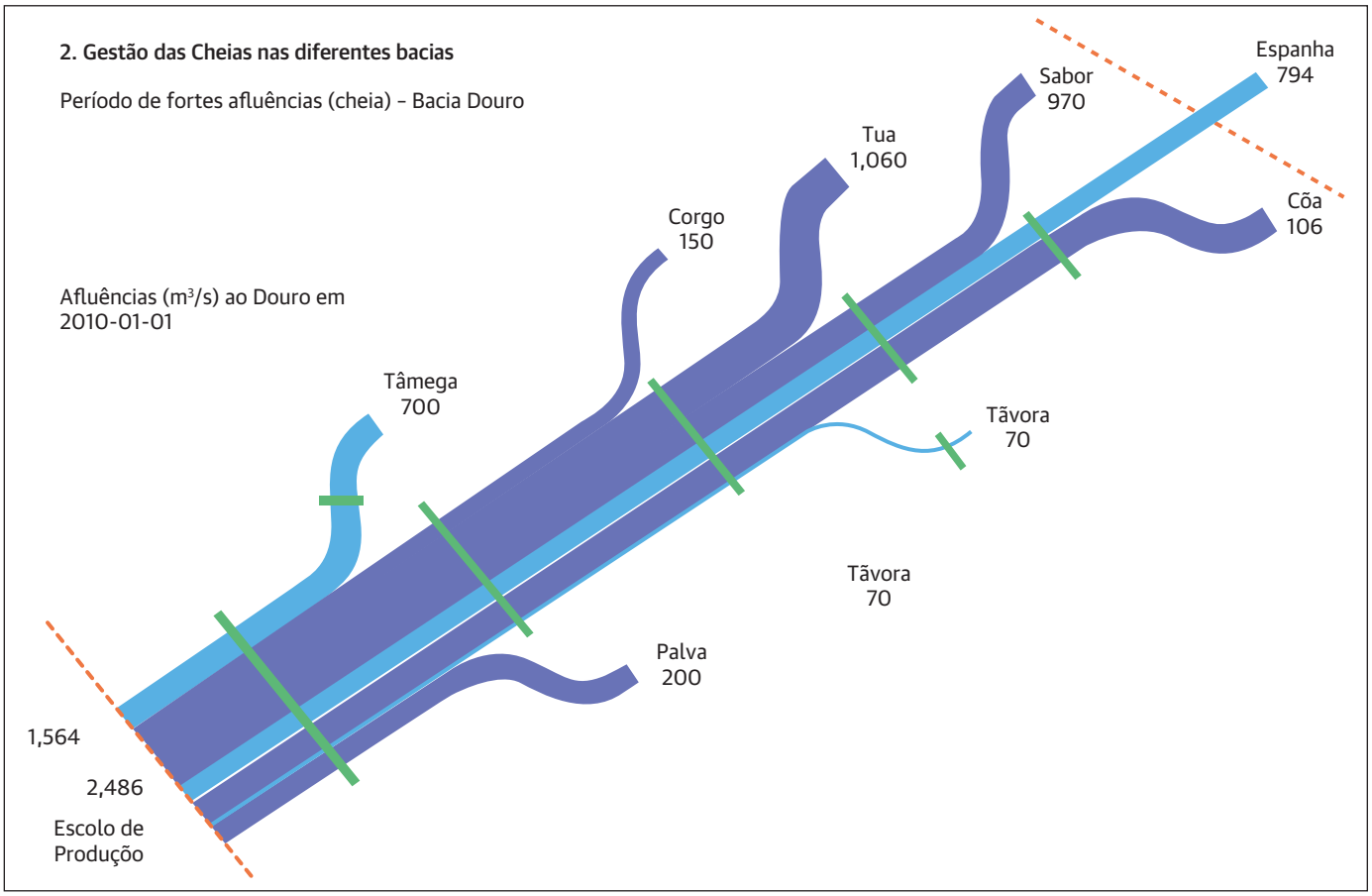
Hindrances and What Would Need to Be Done to Achieve Framework Objectives

Several hindrances remain on the path to a fully effective transboundary cooperation framework between Portugal and Spain, notwithstanding the formal policy guidance provided by the Albufeira Convention, supported by the international integration of both countries—in the framework of their EU integration, and as formal Parties to the UN and UNECE water conventions.

As is the case of most shared river basins, the Douro also faces a few conflicts, mainly over technical issues of its water management. One issue in particular issue remains central to flood risk management in the lower part of the basin—the final stretch of the river (between Régua and the Metropolitan Area of Oporto), which is relatively vulnerable to urban flooding. When reservoirs are close to their maximum capacity, the hydroelectric companies tend to discharge large amounts of water to make room for further reservoir inflows, thereby increasing the flood risk along the lower riverbanks. For safety reasons, this discharge is done at the reservoir operation level, even if the generated benefits (particularly for EDP, on the Portuguese side of the basin) are relatively low. This is due to the cascade of dams built along the main river, because the height difference diminishes from one reservoir to the next and thus creates less value added. This situation reflects a technical limitation rather than something that could lead to conflict, as the Spanish contribution to the overall runoff and flow in the lower basin is relatively small during high rainfall events, due to the extremely high regulatory capacity of the Spanish part of the basin (figure 5.3).

The large water contributions from the downstream tributaries of the Douro (subject to a humid Atlantic climate) that remain untapped tend to aggravate the flooding risk in the final Portuguese stretch and reduce EDP's ability to manage the stored resources. This has pushed key stakeholders (including the hydropower companies and national authorities of both countries) to support the building of new dams along these tributaries (the Tâmega, Tua and Sabor). Despite resistance and opposition from environmental organizations and sections of

FIGURE 5.3. Inflows from Spain and Major Douro Tributaries into Portugal during a High-Risk Flooding Event



Source: University of Algarve.

the local population, two new dams were built and have recently started operations (Baixo Sabor and Foz Tua), and another one is being planned (Fridão). These measures will strengthen both flood risk and drought risk management in the lower basin and significantly increase the potential for hydropower generation on the Portuguese side. However, this comes at a high environmental cost, particularly when considering that these river systems were almost pristine and untouched (particularly in the case of the Sabor).

Another potential conflict relates to environmental conditions and minimum ecological flows. Portugal has repeatedly called for an increase in these flows during the annual dry season and during periods of drought. Spain has repeatedly rejected these demands, arguing that natural flows have historically been close to zero for much of the summer, and that Portugal's demands hide economic interests downstream—reflected by large industrial and urban demands of the Oporto area, including a large thermo-electric plant that serves much of the metropolitan area, and needs significant flows for cooling purposes. This is one of the sources of recurring conflicts that has to do with the very nature of the Mediterranean

climate that most of central and southern Iberia has, characterized by a pronounced dry summer season—that is, water is scarce when it is needed most, and countries demand their share with increasing insistence during this extremely dry season.

In the long term, one key challenge may derive from the expected reduction in hydropower production (estimated by some authors at about 7 percent until 2020) (Garrido et al. 2010), mainly because of increasing irrigation demands, and reduced rainfall and runoff (caused by long-term changes to both climate and land use). This factor may not only increase the potential for conflict between the two countries, but also domestically between different water users, in particular during periods of extreme drought, such as occurred in 2005-06. Significantly, and taking these scenarios into account, both EDP and Iberdrola (as well as other companies active in Iberia) have diversified their energy production sources and portfolios, among others, by increasing their wind energy capacity. The latter has relevant technical complementarities with hydropower, in terms of response to demand peaks and distribution costs.

Conclusions

Partly because of the ability of both governments to overcome and prevent potential conflicts, the Albufeira Convention has been hailed as a major diplomatic success by the two Iberian countries (Moral and Do Ó 2014). It no doubt was an important factor in both bilateral relations and the management of transboundary river basins. However, its nature remains strictly governmental, lacking an effective multilayered governance system, participatory approach, and coordinated transboundary planning. To become a more action-oriented and less static tool, the Convention could incorporate scenarios of environmental and socioeconomic changes, and introduce a focus on shared development opportunities—for example, by assessing the viability of water intakes from infrastructures across the boundary or assessing the potential of river ecosystem services in boundary stretches. Currently, the Albufeira Convention lacks an adaptive and precautionary approach, and the Permanent Technical Secretariat foreseen as the operational body since 2008 has yet to be established.

The potential for cooperation between Portugal and Spain is higher than it is between most neighboring countries across the world, due to strong bonds and similarities in terms of:

- Culture, language, and history;
- General economic and social backgrounds;
- Environmental base conditions (including the north/south gap known as "wet/dry Iberia") and major environmental problems; and
- Increasing economic integration and legislative and juridical cohesion under the umbrella of the EU.

The similarity of the structure and hierarchy of the river basin management framework in both countries (as depicted in flowchart 5B.2) strongly facilitates cooperation over shared water

resources, despite the internal tensions in Spain related to the quasi-federal structure of its public administration and the autonomy of its RBOs, a context that is not mirrored in Portugal.

Making the most of this overall favorable political and institutional context, and implementing it further in more operational terms may enhance the effectiveness of transboundary cooperation between the two countries, the public recognition on both sides of the border, and the positive and proactive participation of all relevant stakeholders.

Annexes

ANNEX 5A

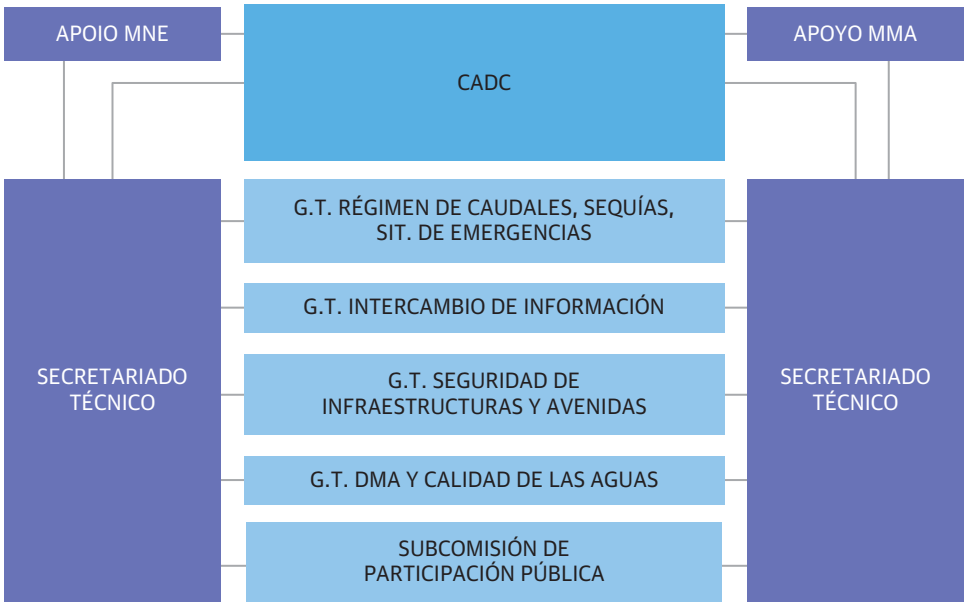
List of Interviewees

- **Víctor Arqued**—Subdirector General de Planificación y Uso Sostenible del Agua (General Deputy Director for Planning and Sustainable Use of Water), Dirección General del Agua
- **Vitor Silva**—Diretor da Área da Gestão de Operação Hídrica (Drector of the Department of Water Operations Management), EDP Produção
- **Felisbina Quadrado**—Diretora do Departamento de Recursos Hídricos (Director of the Water Resources Department), Agência Portuguesa do Ambiente

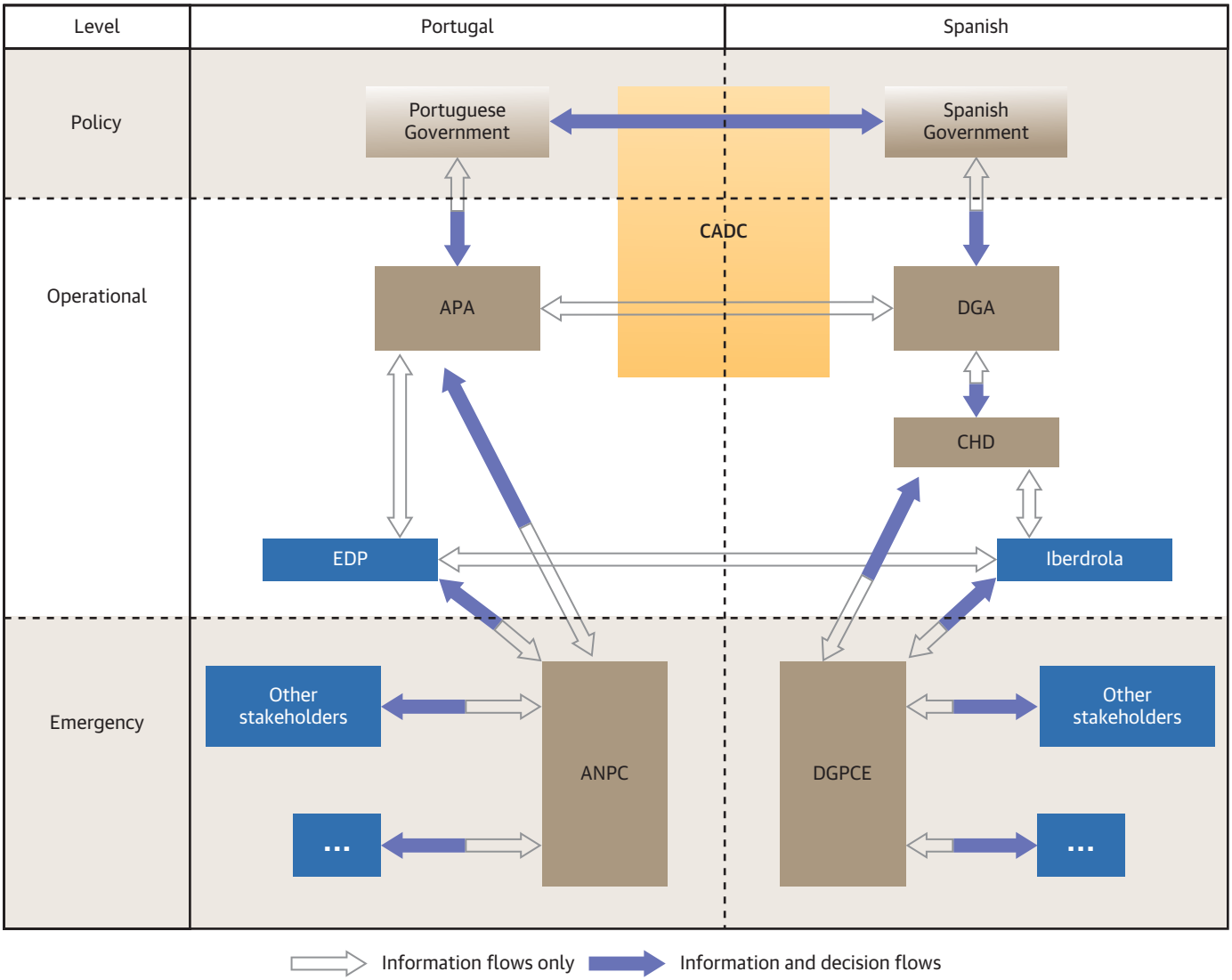
ANNEX 5B

Flowcharts

FLOWCHART 5B.1. Current Formal Structure of the CADC



FLOWCHART 5B.2. Institutional Structure Regulating Water Management in the Douro River Basin



Web Links

WFD (European Commission Water Framework Directive):

http://ec.europa.eu/environment/water/water-framework/index_en.html

CADC (Portuguese-Spanish Convention on Shared Water Resources):

http://www.cadc-albufeira.eu/pt/

APA (Portugal's ministerial water authority):

https://www.apambiente.pt/index.php?ref=16&subref=7

DGA (Spain's ministerial water authority):

http://www.mapama.gob.es/es/agua/temas/default.aspx

CHD (Spain's river basin board):

http://www.chduero.es/

Douro River Basin Management Plan (Portugal documentation):

https://www.apambiente.pt/index.php?ref=16&subref=7&sub2ref=9&sub3ref=848

Duero River Basin Management Plan (Spain documentation):

http://www.chduero.es/Inicio/Planificaci%C3%B3n/Planhidrol%C3%B3gico20152021/PlanHidrol%C3%B3gico/tabid/734/Default.aspx

EDP Produção (Portuguese hydropower concessionary company):

http://www.edp.pt/pt/aedp/unidadesdenegocio/producaodeeletricidade/Pages/ProducaoElectricidade.aspx

Iberdrola Generación España (Spanish hydropower concessionary company):

http://www.iberdrolageneracionespana.es/

MIBEL (common Iberian electricity market):

http://www.mibel.com/index.php?lang=en

Notes

1. In the context of EU energy market integration, Portuguese and Spanish authorities started talks and conducted research studies beginning in 1998 in order to increasingly dismantle the barriers and encourage the establishment of the Iberian Electricity Market, fully implemented since 2007 (check http://www.mibel.com/).
2. United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (1997), ratified by Portugal in 2005 and accessed by Spain in 2009; United Nations Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992), ratified by Portugal in 1994 and by Spain in 2000.
3. Convénio entre Portugal e Espanha para regular o aproveitamento hidroelétrico do troço internacional do Rio Douro (1927).
4. Convénio Luso-Espanhol para regular o aproveitamento hidroelétrico dos troços internacionais do Rio Douro e seus afluentes (1964).
5. Convénio entre Portugal e Espanha para regular o uso e o aproveitamento hidráulico dos troços internacionais dos rios Minho, Lima, Tejo, Guadiana, Chança e seus afluentes (1968).
6. Plan Hidrológico Nacional (1993).
7. Convenção sobre a Cooperação para a Proteção e o Aproveitamento sustentável das Águas das Bacias Hidrográficas Luso-Espanholas (1998).
8. Comissão de Coordenação e Desenvolvimento Regional do Norte.
9. Considered as a centralized response to regionalist pressures, and justified as a tool to ensure compliance with the WFD, contrary to what occurred in the previous cycles (with Spain being formally warned and admonished several times).

10. Significantly, in June 2009, the head of the Portuguese delegation to the CADC delivered a written complaint to the Spanish Administration in response to the 2007 revision of the autonomy statute for Castilla y León, asserting that management of the Douro river basin ought to be retained at the national level in order for Spain to comply with its treaty requirements specified in the Albufeira Convention.

11. http://www.sepg.pap.minhafp.gob.es/sitios/sepg/es-ES/Presupuestos/Estadisticas/Paginas/Estadisticas.aspx

12. By Spain in the Douro (2002), Guadiana (2006) and Tejo (2009) river basins, and by Portugal in the latter (2010).

13. As in the recent case of the project to build a new waste disposal site at the close to the border Almaraz nuclear plant in Spain (http://www.reuters.com/article/portugal-nuclearpower-spain-idUSL5N1F24MN), which was contested by Portugal in the European Court (on the grounds of not having been informed, and of the environmental impact not having been assessed), but withdrawn after direct bilateral negotiations were successfully conducted.

Emosson Dam. © Studiophotosite/iStock.

Chapter 6 Rhône Basin

Flow Regulation and Cascade Operation

By Christian Bréthaut

Summary: Three-Stage Process of Coordinated Basin Development

This case study provides an overview of the tools used by France and Switzerland at the transboundary level to coordinate on flow management for the production of hydroelectricity and other uses downstream of Lake Geneva.[1] The summary of the use of tools considers two areas of coordination between Switzerland and France: (i) Coordination for Hydropower Production; (ii) Sediment Flushing at Verbois Dam.

For reference, the three-stage process of coordinated basin development is presented in figure 6.1.

Part A: Coordination for Hydropower Production

Identification of Opportunities and Risks

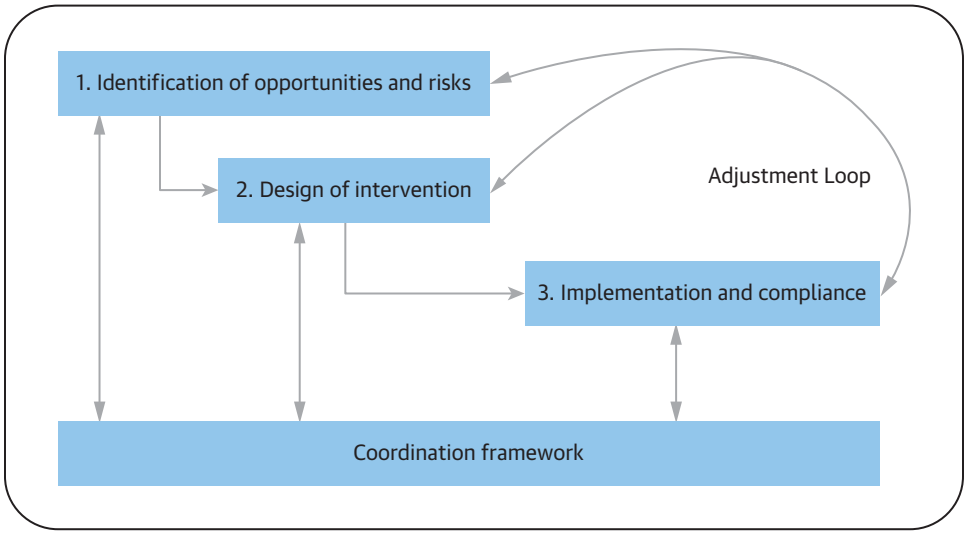
Hydropower production has long been one of the main drivers for regulation of the Rhône River. The countries took a project-by-project approach for coordination on hydropower production and identification of projects and instances that required cooperation. The countries gave concessions to their respective electricity companies to identify and realize the hydropower generation benefits.

Coordination Framework (Stage 1)

The current transboundary cooperation for identified mutual benefits in the Rhône River Basin is based on the following:

- ***International Treaty*** **(T44):** national policies that are in line with the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, the Aarhus Convention, and the Espoo Convention govern the management of the Rhône, as these three treaties have all been ratified by Switzerland and France.

FIGURE 6.1. Three-Stage Process of Coordinated Basin Development



- ***River Basin Organizations, Authorities or Commissions*** **(T59):** the International Commission for the Protection of Lake Geneva is an intergovernmental body that monitors the lake's water quality, coordinates water policies between the Swiss and French, and keeps the resident population informed of relevant matters.

Design of Intervention

To manage water uses on the Rhône and regulate the production of hydropower and nuclear power, the countries have used the following tools:

- ***Joint Investment; Equal Cost Sharing*** **(T14):** was used for the construction, operation, and management of the Chancy-Pougny Dam, the third dam of the cascade downstream of Lake Geneva located at the border stretch of the river. A binational concession to the Société des Forces Motrices de Chancy-Pougny (SFMCP), a company co-owned in equal shares by the then two nationally owned power companies, was granted in 1915.
- ***Public-Private Partnerships (P3)*** **(T86):** the construction of the Seujet Dam, replacing previous infrastructure regulating the levels of Lake Geneva, was cofinanced by the dam's future operator, Industrial Services of Geneva (SIG), and the Swiss lake-riparian cantons.

Coordination Framework (Stage 2)

- ***International Treaty*** **(T44):** releases at the outlet of Lake Geneva are regulated, among others, by the Convention related to the Emosson Dam, agreed between the two countries. These treaties define the principle of restitution of waters from the Arve River, which

are diverted by Switzerland upstream of Lake Geneva, back to France. These restitutions are also determined by an agreement between the three Swiss lake-riparian countries, which is implemented by SIG.

Implementation and Compliance

- ***Procedures for Data and Information Exchange* (T21)**: enables the hydropower operators to optimize electricity production to satisfy base-load and peak demands.

Coordination Framework (Stage 3)

- ***International Treaty* (T44)**: the *Mésures d'execution* clarify how the Convention related to the Emosson Dam will be implemented. It defines how the waters from the Arve River are returned to France. Agreements between the Canton of Geneva and SIG delegate the operation of lake levels and flow regime downstream of Lake Geneva to SIG.
- ***Agreements of Private Law Character* (T45)**: private law agreements implemented by the electricity companies aim to optimize hydropower production in accordance with electricity consumption peaks while allowing the use of the Rhône for other purposes such as cooling of nuclear power plants.
- ***Dispute Settlement Procedures* (T66–69)** are included in the Convention relating to the Emosson Dam.

Part B: Sediment Flushing at Verbois Dam

Identification of Opportunities and Risks

Lake Geneva and the slowing down of water flows, as well as additional flows from the Arve contribute to the deposit of sediments behind the Verbois Dam. This makes regular sediment flushing necessary. Flushing used to be coordinated directly by the hydropower operators and authorities. Environmental concerns that arose after the 2003 flushing triggered a moratorium and review of the method used until then.

Design of Intervention

In 2010, the need to flush sediments from the reservoir behind the Verbois Dam became pressing. The following tools were used to design a new flushing method:

- ***Negotiations* (T66)** between France and Switzerland to define the design process
- ***Environmental Impact Assessment* (T11)** and ***Stakeholder Consultations* (T40)**, based on the Espoo Convention, to identify an adequate flushing method.

Coordination Framework (Stage 2)

- ***International Treaty* (T44)**: it was decided to activate the Espoo Convention to frame the process of intervention design.

Implementation and Compliance

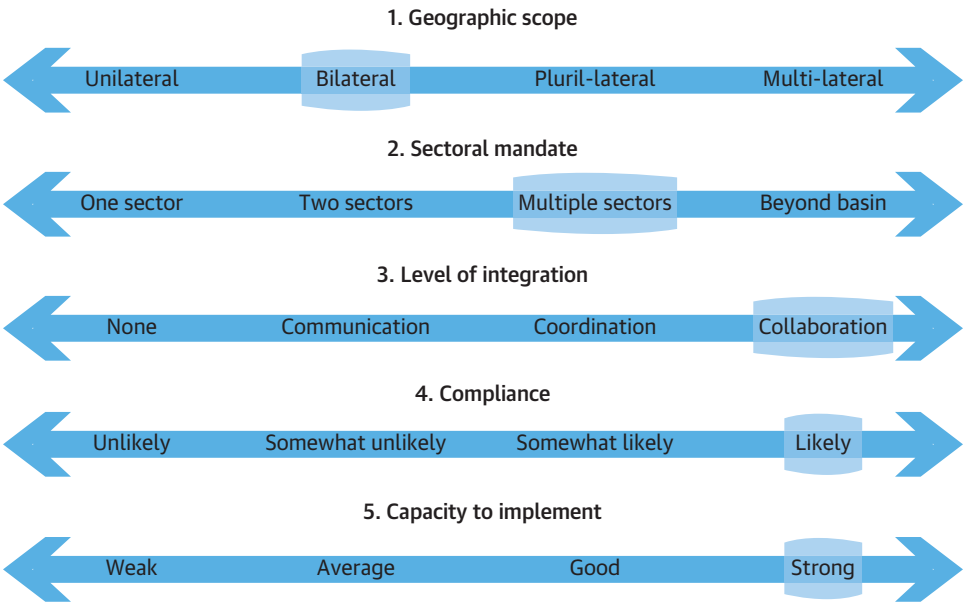
- An ***Implementation Plan*** **(T39)** determined the coordination of water releases from the different reservoirs operated by the French and Swiss hydropower operators.

Adjustment Loop Back to Design of Intervention (Stage 2)

The combination of bad weather and construction at the Verbois Dam led to the loss of control over the amount and concentration of suspended sediment in the river as result of the flushing. Sediment concentration reached a level higher than allowed under French legislation, and caused environmental damage. To prevent similar incidents in the future, the countries adjusted the design of the flushing method.

- Using ***Ad-Hoc Mechanisms*** **(T54)**, including a ***Joint Technical Committee*** **(T55)**, the countries agreed on a revised sediment flushing methodology for future application.

FIGURE 6.2. Application of the Five Dimensions to the Rhône Flow Regulation and Cascade Operation Case



Application of the Five Dimensions

The application of the five dimensions—which should be considered when defining the characteristics and content of the tools chosen for a respective intervention—to the Rhône flow regulation and cascade operation case is depicted in figure 6.2 and detailed below.

1. The basin is shared by two countries and is therefore managed on a bilateral basis.
2. The sectoral mandates of these agreements cover nuclear power and hydropower production, flow regulation, and management of Lake Geneva's water levels.
3. The two countries have delegated coordination for the optimization of hydropower production and flow management to public/private power companies.
4. When the agreements were negotiated, it was considered very likely that both countries would comply with the provisions of the agreements; mechanisms have so far been successful.
5. The capacity to implement is strong because both parties have well-developed mechanisms to implement the agreed coordination.

Case Study Description

Introduction

The Rhône is one of Europe's major rivers. It is an international river shared between Switzerland and France that flows from the Swiss Alps to the Mediterranean Sea. The river is a particularly interesting example of transboundary river governance for a number of reasons:

(a) Absence of an International Organization

The management of the Rhône River does not depend on an organization responsible for ensuring coordination among the different water uses or for developing specific action plans (Bréthaut 2016). In the basin, the International Commission for the Protection of Lake Geneva (CIPEL)—an intergovernmental body bringing together senior officials and scientists—is active (since 1963) but only addresses the Lake Geneva Basin. Its objectives are to monitor the evolution of the lake's water quality, to coordinate water policies at the lake basin level and to keep the resident population informed about water quality. CIPEL's work is therefore not dedicated to the transboundary management of the river and no organization focuses on *quantitative* issues of the Rhône.

(b) Institutional Fragmentation

The governance system of the Rhône is characterized by a great number of actors and a multiplicity of management mechanisms and legal provisions. Very few discussion arenas exist that enable the different actors to interact in a structured manner. This institutional fragmentation coupled with the existence of many private law agreements do not facilitate the understanding of how the river is managed. CIPEL allows actors to meet and exchange on both a formal and informal basis, facilitating transboundary cooperation. However, while this transboundary framework exists for the lake, there is no similar institutional framework to support the transboundary management of the Rhône River.

(c) Outsourcing to the Private Sector

The Rhône has long been considered a source for energy production. However, over time, perceptions of the river have changed. While initially viewed as a natural hydrosystem, the river is now seen as an industrial tool facilitating the production of hydropower, the development of irrigation, and the exploitation of new cultivated areas thanks to canalization. As a result, populations living along the Rhône have turned away from the river. This evolution has had a significant impact on governance mechanisms (Bréthaut and Pflieger 2015). Nowadays, private and semi-private hydropower operators dominate the Rhône River governance structure. Operators hold long-term concession contracts that have been granted for periods ranging between 60 and 90 years. Specifically, the regulation of the river's flow between Geneva and the Mediterranean Sea depends chiefly on two hydropower operators. The SIG is in charge of managing several dams located downstream from Lake Geneva to the Swiss border. The Compagnie Nationale du Rhône (CNR) is responsible for the management of the river in

France, from the border to the sea. CNR is a company whose capital is predominantly public, as local authorities and public investment funds hold 50.03 percent of shared capital. The remaining capital belongs to the private group ENGIE (49.97%). In France, the river's water flow management is steered by concession contracts granted by public actors in 1934 for an initial period of 99 years. Nevertheless, from an operational perspective, an important part of the management of the river depends on private law agreements between private actors. These agreements aim to optimize the production of hydropower in accordance with electricity consumption peaks. The governance structure of the river is single-sectoral, with a bias toward energy production, and it is heavily outsourced to private operators.

(d) Involvement of Different Regulatory Frameworks

Multiple regulatory frameworks guide the Rhône's governance system. At the subnational level, management of the French portion of the river is significantly influenced by the legal framework of the EU. In this context, environmental objectives are defined in the European Water Framework Directive (WFD) (2000/60/CE). As Switzerland is not part of the EU, it is not subject to EU legislation. At the national level, the Swiss political system is organized around the principle of subsidiarity. According to this principle, "nothing that can be done at a lower political level should be done at a higher political level." The management of the Rhône consequently involves the Swiss Confederation at the national level and the riparian cantons of Valais, Vaud, and Geneva at the regional level. In France, management of the Rhône is based on a concession granted by the central government as the main supervisor of the system.

This case study provides a broad overview of the Rhône's governance mechanisms with a specific focus on the transboundary level. Section 2 describes the river's hydrological profile. Section 3 presents a brief history of the Rhône's transboundary cooperation. Section 4 focuses on existing institutions that are active in Switzerland and France, and on implementation of cooperative measures at the transboundary level. And Section 5 focuses on the sediment flushing of the Verbois Dam, illustrating transboundary cooperation in practice.

MAP 6.1. The Rhône River Basin

Source: UNEP-DEWA-GRID 2003. Available at http://www.grid.unep.ch/index.php?option=com_content&view=article&id=73&Itemid=400&lang=en&project_id=25FE9290.

The Rhône's Hydrological Profile

The Rhône is 812 kilometers long. Along its journey, the river's hydrological profile is characterized by great diversity. This ranges from the alpine torrent to the wide Camargue delta (map 6.1). The river is heavily channeled and almost the entire river course is regulated.

Three main sections can be identified:

From the Source to Lake Geneva

The upper Rhône Basin is situated in the Canton of Valais and Vaud. Here, the runoff regime is characterized as nivo-glacial, marked by lower river flows in winter than in summer. Precipitation in this part of the basin is variable, with relatively dry inner valleys that have less than 600 mm of precipitation per year to very wet mountains with more than 2,500 mm per year (Clarvis et al. 2014). In the Canton of Valais, the river flows through the Rhône valley and is almost entirely channeled. In the wake of several flooding events, a Third Rhône Correction is currently underway in this portion of the river. This correction should improve flood defense capacities by giving more space to the river (Hill 2013).

Lake Geneva to Geneva

After flowing through the Rhône Valley, the river enters Lake Geneva. The lake occupies an area of 582 km^2, representing a freshwater reservoir of 89 billion m^3 that supports notably the production of drinking water. The lake is divided between France and Switzerland. Although the south shore of the lake is French, the regulation of lake levels depends on an agreement signed by Swiss parties only. The Seujet Dam in the city of Geneva regulates the levels of Lake Geneva and the discharge at its outlet. The lake's levels are accurately managed, with a maximum level (372.3 meters above sea level (MASL)) reached in the summer and a minimum level (371.70 MASL) in the spring, allowing water from snowmelt to be stored. In addition, once every four years, the lake level is lowered to 371.50 MASL to allow for maintenance and rehabilitation of structures located at the edge of the lake. At the outlet of Lake Geneva, the Rhône passes through the city of Geneva. After Geneva, different infrastructures regulate the flow of the river. The management of the river from Geneva to the Swiss border depends on SIG. Lake regulation and hydropower operations at the outlet of Lake Geneva cause a change in the regime of the Rhône River, moving from an ice- and snow-fed regime toward a smoothed seasonal variability (Ruiz et al. 2015). The impact of lake regulation and hydropower at the outlet of the lake is compensated by the glacio-nival regime of the Arve River, which joins the Rhône immediately downstream from Lake Geneva. The regime of the Rhône downstream of Lake Geneva depends on the regulation of the lake at the outlet and water flows in the downstream tributaries.

Geneva to the Mediterranean Sea

After the Swiss border, the Rhône flows south to the Mediterranean Sea. On its course, the river caters to a range of water uses including hydropower production, nuclear energy production, irrigation, fishing, production of drinking water, tourism, and ecosystems needs. The river passes through several urbanized areas, such as the city of Lyon (about 2.2 million inhabitants). The French part of the Rhône basin experienced several flooding events between 2000 and 2003, which led to the implementation of the *Plan Rhône,* a policy instrument aimed at managing the river in a coordinated manner and

avoiding flood risks in the French part of the basin (Guerrin, Bouleau, and Grelot 2014). From the city of Arles, the river splits into two branches, creating the delta of the Camargue.

A Brief History of the Rhône's Transboundary Cooperation

The evolution of the Rhône's transboundary management can be divided into three distinct time periods: 1870–1970, 1970–2006, and 2006 to the present day (Bréthaut and Pflieger 2015; Bréthaut 2017). These phases reflect the changing perception of the river's collective action problem. They illustrate the various configurations of actors and the increasing number of uses that are formally recognized by the regulatory frameworks. These phases also show an evolution in the way central governments consider river governance in relation to the delegation of powers.

Phase 1: Mono-Functionality (1870–1970)

In this first phase, the Rhône was essentially dedicated to the production of hydropower. The river was massively channeled on both sides of the border. The population was protected from flooding and, as a result, the perception of the river as a natural hydrosystem gradually changed. The management of infrastructures and subsequently of the flow of the river was delegated to a small number of stakeholders who were the operators of the river. In France, as illustrated by Pritchard (2004, 2011), the river was considered a production tool dedicated to ensuring the autonomy of the country's energy economy. With this objective in mind, the construction of hydraulic infrastructures became an important symbol of the rebuilding of the French Nation after the destruction suffered during the Second World War. The system was characterized by a mono-functional vision of the river primarily dedicated to the production of electricity through hydropower (Pritchard 2011). This situation allowed hydropower producers to operate independently and to coordinate directly with other users such as for irrigation. In fact, at that time, neither the French or Swiss states nor the operators considered the transboundary coordination highly significant. Both countries delegated operational power to a select number of concession holders. They defined technical specifications as a framework, but gave autonomy to the operators regarding the daily management of the river and, subsequently, regarding the strategy for the production of electricity.

Phase 2: The End of the Hydropower Monopoly (1970–2000)

This second phase was characterized by reinforced self-organization among energy operators. Private law agreements were defined to regulate water transfers and to coordinate uses for efficient energy production. Simultaneously, this second phase saw the emergence of a new arrangement. Firstly, the rise and continuous strengthening of environmental policies characterized this period. This trend was seen at the national level (Switzerland and France) as well as the supranational level (European Union [EU]) (Varone et al. 2002; Bressers and Kuks 2004). For example, the European WFD targets river basin management and the definition of objectives regarding water bodies. In France, this legislation has been embodied in a master plan established for the French part of the Rhône River Basin. This master

plan includes actions regarding the management of water quality, ecological continuity, and water quantity. This policy and contextual change facilitated the return to the perception of the river as a natural ecosystem; the vision of the Rhône uniquely as a means for production became less dominant. This evolution forced hydropower companies to consider the environmental impact of the way they managed the river. For example, one of the objectives of the 2006 French water law is to ensure a balanced management of aquatic systems. In practice, the law redefines and increases the obligation to maintain environmental flows. Likewise, since 2004, CNR has implemented an action plan dedicated to the general interest (*Plan de missions d'intérêt general*). This action plan allowed significant funding of actions related to the environment. However, hydropower operators still had some scope to implement their own production strategies in response to electricity consumption peaks.

Additionally, during this period, new types of uses started to become officially recognized. By means of illustration, several nuclear power plants were built along the French Rhône during the seventies. Here, the Rhône, as a source of cooling, played an important role in ensuring nuclear safety on both the French and Swiss territories. The French state granted new water rights specifically dedicated to the cooling of nuclear power plants. The end of the hydropower monopoly led to an increased need for coordination between hydropower and nuclear power plant operators. The hydropower sector was then confronted with increasing complexity, necessitating negotiations with new types of river uses. New negotiations began on how to use the river, and different private law agreements were implemented between the different operators (SIG, CNR, Électricité de France [EDF].

Phase 3: Toward Increased Integration (2000–Present Day)

This last period witnesses the continuous proliferation of activities along the river. The Rhône is now viewed not only as a source of energy production but also as a means for irrigation, the production of drinking water, tourism, and the maintenance of ecosystem services.

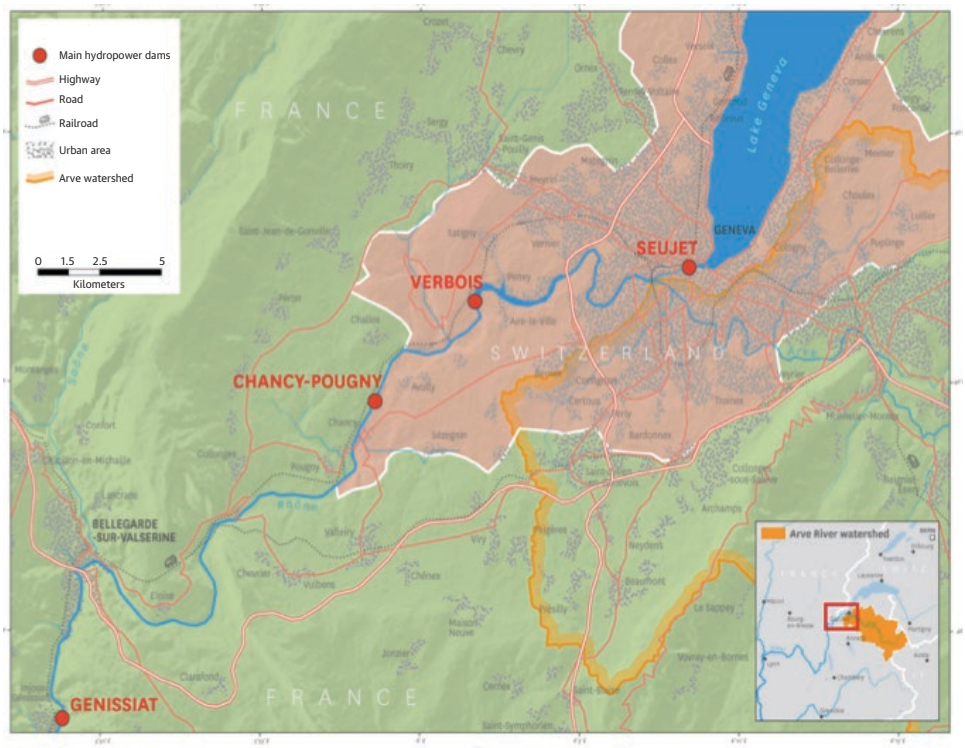
Central governments begin returning to the center stage motivated by the desire to strengthen their competences regarding the regulation of the system. This return can be explained by various factors such as the recurring droughts of the last 10 years. Also, issues such as the decrease of mean flows, extreme events, and upstream-downstream coordination have ensured that transboundary coordination is placed firmly on the agenda. Further, as an extension of the trend described in phase 2, the regulatory framework continues to be strengthened in terms of environmental policies. At the EU level, this shift includes the reporting obligation (Albrecht 2013) and the calling for reinforced supervision and control of the system by the French central government.

Regulatory Framework for the Transboundary Management of the Rhône: Analysis of Existing Institutions

This section analyzes the institutional frameworks that regulate the transboundary management of the Rhône, focused on the operational aspects and legal provisions that affect the management of water flows, water intakes, and water transfers by the different dams (map 6.2).

The analysis starts with the international conventions. Next, it focuses on Swiss regulations regarding the frameworks developed within and between the Swiss cantons. Finally, it focuses on the concession used on the French side. Annex 6A and 6B of this case study captures a list of the mentioned provisions.

MAP 6.2. Transboundary Management of the Rhône and Related Infrastructures



Source: Stéphane Kluser, Geneva Water Hub 2016.

International Conventions

Several international conventions are applicable regarding the management of transboundary rivers, including the Convention on the Law of the Non-Navigational Uses of International Watercourses, adopted May 21, 1997, and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes from March 17, 1992. Only the latter convention has been ratified by both Switzerland and France. The Aarhus Convention (Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, June 25, 1998) and the Espoo Convention (Convention on Environmental Impact Assessment in a Transboundary Context, June 15, 1998) can also be cited. The Espoo Convention has recently been activated to guide the sediment flushing operation of the Verbois Dam (see section "Transboundary Cooperation in Practice: the Sediment Flushing of Verbois Dam"). Based on the Espoo Convention, a participatory process took place at the transboundary level.

In addition to these agreements, the management of the Rhône is partly regulated by the Convention related to the hydropower infrastructures of Emosson (*Convention entre la Confédération suisse et la République française au sujet de l'aménagement hydroélectrique d'Emosson*, August 23, 1963).

The Emosson Dam is located upstream from Lake Geneva. The reservoir is partly fed with water diverted from the French Arve River Basin. As this amount of water no longer flows naturally in the Arve River, the Convention stipulates that a similar amount of resources should be stored in Lake Geneva and be available at the outlet of the lake, if France requests it. This annual volume of water is equivalent to about 85 million m^3.

France has recognized the right of Switzerland to freely use this amount of water in the Emosson Dam, which is stipulated in article 20 of the Convention.

While this first Convention defines the principle of return of water derived from the Arve River Basin, another agreement ensures the implementation of this decision: *Mesures d'exécution 2000*—signed on March 27, 2000, by France, and on April 5, 2000, by Switzerland. This second document clarifies how this stock of water should be managed. Paragraph 2 defines the minimal amount that should be available for France during the whole year (29 hm^3), with the exception of bissextile years, where the lake is lowered to carry out maintenance work on its shores and infrastructures. Finally, the provision stipulates how the parties commit to the exchange of information. Swiss authorities are responsible for sharing information regarding the lake's levels such as any modification in the operation of the Seujet Dam. On the French side, EDF is responsible for calculating the amount of water from the Arve available in Lake Geneva (paragraph 6). This provision relies on transparency and the effective sharing of information between the different operators. These *Mesures d'exécution 2000* have been ratified for a period of five years. They have been renewed three times (in 2005, 2010, and 2015).

Swiss Intercantonal Agreement

The management of the level of Lake Geneva and Rhône River flows at the outlet of the lake depend on an agreement signed between the Swiss riparian cantons (Valais, Vaud, and Geneva) under the auspices of the Swiss Confederation: the *Acte intercantonal concernant la correction et la régularisation de l'écoulement des eaux du Léman* (11 September 1984). This agreement, following a first legal provision signed in 1884, allows the replacement of previous infrastructures regulating the lake's levels. It allowed the construction of the Seujet Dam (Art 1§2, Art 2) and consecutively the modernization of lake level management. The dam's future operator (SIG) financed this construction, and the Swiss cantons contributed toward the operation costs. France was not involved in the construction of the dam. Article 5§2 of the agreement specifies that the levels of the lake must remain between a minimum altitude of 371.70 MASL and a maximum altitude of 372.30 MASL (see also section "The Rhône's Hydrological Profile"). As indicated in §5 of the same article, the agreement is subject to revision every five years if one of the parties wants to change it.

Legal Provision from the Canton of Geneva

At the level of the Canton of Geneva, the inter-cantonal agreement details a series of provisions refining the operation of the Seujet Dam. The first provision is the *Règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève* (September 17, 1997). This provision defines monthly levels and the specific functioning of the dam in times of flood or if there is a need to reduce the levels of the lake. This regulation also recalls the need to record the flows and the lake levels and to share this information with the cantonal authorities.

This first provision is completed by a disposition ratified by the canton of Geneva and SIG: the *Modalités d'application du règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève* (December 1, 1997). The latter delegates the implementation of the *Règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève* to SIG. It also recalls the main mission of the Seujet Dam, which is the management of Lake Geneva's levels rather than the production of hydropower, and the obligation to transfer water rightsbelonging to France—the water (a maximum amount of 85 million m^3 per year) derived from the Arve River Basin (see Art 20 of the Convention of Emosson). Thirdly, this agreement defines specific river flows such as minimum flow rates downstream of the dam and the value of peak flows.

Finally, two agreements frame the collaboration between the Canton of Geneva and SIG: the *Convention entre la République et canton de Genève et les SIG* (12 November 1984) and the *Loi 5570 sur la concession aux SIG de la force motrice hydraulique du Rhône pour l'exploitation d'une usine hydroélectrique dite du Seujet, située entre les ponts de la Coulouvrenière et de Sous-terre* (September 12, 1984, and implemented on 1 July 1, 1997, when the Seujet dam started operating). The first agreement recalls the need to respect the rules defined by the intercantonal agreement. The second agreement defines the terms of the concession for the operation of the Seujet dam itself. The provision defines the length of the river subject to the concession, the maximum water flows to be used (360 m^3/sec), the nature of the infrastructures and related rights and obligations. It includes specifications regarding the regulation of the lake levels and the operation of hydropower infrastructures.

Binational Concessions

The Chancy-Pougny Dam is framed by a concession granted in 1915. The dam is both French and Swiss, and therefore the two countries jointly granted the concession. The operator is the SFMCP, a company shared between SIG and CNR, and closely interlinked with SIG. The latter holds 72.24 percent of SFMCP's share capital, while CNR holds the remaining 27.76 percent.

French Concessions for the Rhône River

The management of the French portion of the Rhône is also framed by a concession contract. On May 27, 1921, the Rhône Law was adopted in France. This law aimed to implement a planning program for the entire French portion of the river. As a result, the CNR was founded and became the river's operator—based on a concession contract granted on December 20, 1933, for a period of 90 years. As recalled by decree n°2003-513 of June 16, 2003 (which is also the eighth amendment of the concession contract of 1933), the concession defined three main missions for the operator: (i) to produce electricity from the management of 19 hydropower production plants located along the French part of the river; (ii) to ensure navigation on the river; and (iii) to allow the use of the river for irrigation.

The concession was accompanied by a bill of specification and a master plan. The master plan depends on the concession and evolves with amendments to the concession.

Through these two documents, the operator commits to an action plan and is able to develop projects on the river. Today's master plan covers the period 2003-023 and results from the eighth amendment made to the general concession of 1933. The action plan focuses on the main areas of the concession contract (hydropower production, navigation, agriculture). It also includes obligations regarding management of the environment, which refer to aspects such as the balanced management of water resources and aquatic systems in line with the French environmental code, the prevention and correction of any damage to the environment, and the sustainable development of spaces, resources, and the natural system. Besides the bill of specification and the master plan, CNR every five years prepares a "*plan de missions d'intérêt general*" (an action plan for public interest) to specify the different measures to be taken. This action plan allows the funding of specific development plans such as economic and tourism development along the river or the development of actions in line with French national environmental policies. Funded actions aim to ensure the ecological integrity of the river, the transit of the fish population, or the implementation of restoration programs for specific portions of the river.

Upstream-Downstream Coordination and Formalized Procedures between Hydropower Operators

Previous sections presented the different legal provisions that frame the management of the Rhône. This section focuses on interactions that exist between the different producers of electricity using the Rhône, including agreements made between hydropower producers and agreements between hydropower and nuclear power plant operators. Between Geneva and Lyon, one nuclear power plant is in operation. It is called the plant of Bugey, and is located downstream from Geneva (about 150 kilometers away) and 50 kilometers upstream from Lyon.

The previous section on the existing legal frameworks demonstrates their complexity and the extent to which transboundary governance is disjointed. This section focuses on how energy producers interact and on how private law agreements ensure coordination among the different operators. We have seen how these different agreements encourage three types of collaboration. The first is information exchange, which is key to anticipating the fluctuation of water flows and defining production programs. Secondly, beyond the international convention obligations, operators can also negotiate and define water transfers that allow a better coordination and an improvement of production capacities. Finally, CNR and SIG are also collaborating in projects related to the building of additional, jointly owned hydropower plants. They are simultaneously competitors (in the energy market) and partners (in the construction and management of hydropower infrastructures).

Private law agreement: Industrial Services of Geneva—Compagnie Nationale du Rhône

The key areas of interaction between SIG and CNR are focused around three formal procedures: the exchange of information, collaboration on different hydropower projects, and the management of sediment flushing.

1. Exchange of information: A coordination mechanism defines the type of information that is communicated by the operators. This includes aspects such as the frequency and timing of transmission. For example, SIG communicates its production program to CNR. The latter then has the possibility to anticipate the flow of the river and define the hydropower production programs of the different infrastructures located downstream from Geneva accordingly.
2. Collaboration on hydropower projects: Whenever there is shared ownership of the hydropower infrastructures, interaction between the two operators is essential. Interaction between the two operators manifests itself in the collaboration within the SFMCP company. In addition, the operators share the energy produced by the Chancy-Pougny Dam. SFMCP sells the produced energy to both operators. SIG subsequently buys the portion of energy belonging to CNR and as such becomes owner of all the electricity produced by the dam. The "Conflan" dam project proposed to be located downstream from Chancy-Pougny would also see the owners work together. This collaborative model attempts to establish an organizational structure similar to SFMCP's (the implementation of an independent company co-owned by the two operators). The feasibility of this project is currently being studied.
3. Sediment flushing management: The operators recently defined a formal agreement regarding procedures that will be adopted in the management of sediment flushing. This agreement clearly defines rights and obligations in addition to the responsibilities involved in the preparation and implementation of such an operation (see section "Transboundary Cooperation in Practice: the Sediment Flushing of Verbois Dam").

Private law agreement: Compagnie Nationale du Rhône—EDF

Further downstream, coordination is also needed between CNR (the concession holder for hydropower infrastructures along the Rhône) and EDF (the operator of the nuclear power plants situated along the Rhône). The two operators mainly coordinate the transfer of water. EDF needs a guaranteed water supply of 130 m^3/per second to ensure the cooling of the nuclear power plant of Bugey. To do so, EDF has the right to use the amount of Arve water (see *Mesures d'exécution 2000*) dedicated to France and available at the outlet of Lake Geneva.

This continuous supply is guaranteed through two formal agreements made between CNR and EDF. The first agreement is the *Convention pour la gestion des stocks d'eau d'Arve disponibles dans le Léman* (signed by CNR and EDF on June 5, 2002). This agreement highlights the priority granted to nuclear activity for the use of water in Article 2. Then, in order to facilitate the transfer of water, Article 3 indicates that CNR replaces EDF as the main interlocutor of SIG. This provision slightly modifies the *Mesures d'exécution 2000* agreement. When water is needed from the Arve, EDF makes a request to CNR, which transmits the request to SIG. As indicated in Article 4, if CNR has enough water at the time of the request, it can decide whether to delay the request or to directly ensure the water supply. By doing so, CNR has the possibility to use Arve water with optimal timing regarding its

hydropower production. From an economic perspective, it is more beneficial to produce hydropower in response to peaks in consumption. Finally, the agreement includes provisions for the transfer of information. This enables the operators to adapt infrastructure operations to hydrological variations. The second agreement allows EDF to purchase additional water quantities. In this case, CNR is compensated for the lack of optimization regarding its hydropower production program.

As illustrated, the transfer of water from the Arve River depends mainly on coordination mechanisms that have been formalized in private law agreements. While public authorities remain involved as supervisory authorities, they are not involved directly in the coordination mechanisms related to water transfers.

Main Characteristics of Rhône Transboundary Management

The management system of the river involves a large number of stakeholders as well as multiple management mechanisms and legal provisions. This fragmentation leads to a complex framework regarding how the water is transferred between the different operators. There is no official arena to allow stakeholders to interact regarding quantitative issues.

The Rhône is governed by a limited number of public policy instruments adapted to the management of the river. If the legal frameworks (Swiss and French) address similar objectives regarding water management, no institution exists to supervise a coordinated management of the river at the transboundary level. In this regard, the Rhône is considered unique at the regional level. Indeed, the region is well known for its successful transboundary cooperation regarding water. The canton of Geneva and France jointly manage the "Genevois Aquifer" and several river contracts have been signed to ensure coordination of the management of the region's subbasins.

Regarding the management of the Rhône, the two national frameworks are quite different. On the Swiss side, the management of the river depends on public stakeholders that are constrained by regulatory frameworks. On the French side, there is a prevalence of private actors that self-organize to implement coordination mechanisms and manage the flow of the river. This self-organization ensures a certain amount of flexibility, although it relies on the regulatory framework imposed by the state. Self-organization results from a competitive context where operators interact within different types of markets (CNR acts as a wholesaler, SIG as an electricity provider) or produce energy to meet different demands (base load versus peak load).

This self-organization has certain advantages. It allows the management of the river to be adapted according to the main users' needs. The users define agreements deemed suitable for the coordinated management of the river. This system of collaboration is relatively mature and has already shown resistance and resilience when faced with difficult or exceptional situations. In fact, public and private stakeholders have demonstrated their capacity to collaborate effectively in times of crisis. The serious droughts that happened in 2003 and 2011 were problematic for specific uses such as irrigation and the cooling of nuclear

power plants. These challenges were overcome thanks to the successful collaboration and flexibility among the different stakeholders. Self-organization meant that the operators were able to redefine coordination mechanisms according to needs. To do so, stakeholders agreed not to comply with formal agreements for a short period of time; this has been the case particularly for the management of the levels of Lake Geneva. Moreover, the implementation of private law agreements allows flexibility in regard to changes, adaptation, and possible renegotiations in the way the hydrosystem works.

Conversely, this flexibility can also be seen as an issue or constraint. The different mechanisms of river management depend mainly on a sectoral perspective linked to the production of electricity. Consequently, alternative uses of the river, such as ecosystem preservation, become a secondary consideration. Moreover, these different mechanisms, often negotiated bilaterally, depend on the stability of the relationship between the actors. In consequence, the liberalization of the European electricity market and the possible future renegotiation of concession contracts raise questions about the management of competition among the different actors and, in turn, about the functioning of the entire system. Thus, it is important to consider the impact of any major change on how the actors work together. Finally, the multiple existing agreements between the different operators create a complex system that entails multiple agreements founded both on public and private law.

Transboundary Cooperation in Practice: the Sediment Flushing of the Verbois Dam

This section focuses on the sediment flushing that took place on the Verbois Dam in 2012 under the responsibility of SIG. This operation was particularly complex. It allowed *in vivo* the study of the transboundary management of the Rhône River. The Verbois Dam is situated in Switzerland, downstream from Geneva and only five kilometers away from the French border (map 6.2). Upstream from the dam, Lake Geneva and the slowing down of water flows contribute to the deposit of sediments carried by the Rhône River. Just after Geneva, the junction with the Arve River brings additional sediments. These materials are carried along in the flow of the Rhône and get trapped in the dams. As a consequence, the dam operators need to undertake flushing to avoid the blocking of infrastructures and to maintain the hydropower production capacities. In the case of Verbois, by mitigating flood risks, the flushing also ensures the safety of riparian inhabitants who are located upstream of the dam.

Preparation of the Operation

Flushing had last taken place nine years earlier in 2003. Before 2003, flushing had taken place every three years. At that time, the procedure was quite simple as it involved only a limited number of stakeholders: mainly hydropower operators and authorities. The flushing of 2003 was the subject of much debate and followed by the organization of the "Rhône Congress" in 2006. This Congress gathered Swiss and French representatives from all the different

sectors concerned by such an operation (authorities, hydropower companies, fishers, protectors of the environment, scientists, etc.). After the Congress, the decision was taken to declare a moratorium and avoid further flushing. The aim was to better understand the effects of the procedure, to reflect globally on the necessity for such an operation, and to consider which specific procedures to adopt prior to any new attempt.

In 2010, it became clear that flushing needed to be carried out on the Verbois Dam. Once this had been established, a period of negotiation and preparation began that lasted until 2012. When the operation was undertaken in 2012, it was confronted with different challenges.

Firstly, after a nine-year long moratorium, there was a huge amount of sediment to evacuate. This raised concern on the French side. Previous operations had been criticized for causing biodiversity loss and for threatening other types of water uses such as the functioning of nuclear power plants and the production of drinking water in the city of Lyon.

In 2010, when the Swiss operator and the canton of Geneva signaled the necessity for sediment flushing, the procedure was much more complex than it had been up to 2003. Following Article L123-8 of the French Environmental Code, the French authorities asked for public consultations. The Swiss Confederation asked the canton of Geneva to grant specific authorization for the procedure, as it entailed possible consequences at the transboundary level. As a result, flushing was no longer a purely technical procedure but one that involved a much wider range of stakeholders in order to gain authorization.

The flushing of the Verbois Dam has a significant impact at the transboundary level. This situation presents a number of challenges because it involves two institutional frameworks but no specific guiding legal provisions exist. As a consequence, the Swiss and French authorities decided to activate the Espoo Convention to frame the process at the transboundary level. They launched a public consultation process using a formal framework supported by international law.

This public consultation attempted to ensure that public participation was considered and effectively applied. The need for sediment flushing was first raised in 2010, but the procedure delayed the launch of the operation. The flushing finally took place in spring 2012.

Implementation Timeline

- On June 6, 2012, the French operator (CNR) reduces water levels at the Génissiat Dam. By doing so, it anticipates the flow of additional sediments that will transit as a result of the flushing at Verbois.
- On June 9, 2012, the flushing begins with a reduction of water levels on the Verbois Dam.
- In the morning of June 10, the first sediments that have been flushed away from the dam arrive in France. Meteorological conditions are not favorable. High precipitation levels mean that the water level rises in the tributaries of the Rhône. Moreover, construction work on the Verbois Dam during the flushing causes some delay. The combination of these different factors greatly complicates the flushing process and leads to the loss of control over the amount and concentration of suspended sediment in the river.

- On June 11, 2012, the CNR announces sediment concentration peaks reaching 40 grams per liter in a section of the river between the Verbois Dam and the Génissiat Dam. This level is higher than allowed under French legislation. It has an impact on fish mortality levels in the river.
- On June 22, 2012, the operation ends. The flushing enabled the storage capacities of the Verbois Dam to be restored and, by doing so, ensured the safety of upstream riparian inhabitants. It also restored the hydropower production capacity of the dam.

Follow-Up

The complexity of the operation to flush the Verbois Dam (both in terms of preparation and implementation) was a catalyst for different initiatives—both public and private—to address procedures and to define new guidelines and methodologies. In this regard, French and Swiss authorities launched two steering groups: a political and a technical group. These groups encouraged dialogue between the authorities and the dam operators. As a result, different scenarios were considered. These ranged from the repetition of a similar process and the interruption of flushing to the adoption of mixed methods. This last option was chosen.

Mixed methods target the implementation of soft sediment flushing that happens every three to four years (or once the sediments stocked in the Verbois Dam reach about 5 million m^3). The concept aims to take advantage of the Arve River's period of natural high flow. In this period, coordinated measures are implemented between the different operators to release the trapped sediments. The water flows are increased at the outlet of Lake Geneva. On the other hand, operators of the other dams (Chancy-Pougny and Génissiat) anticipate the soft sediment flushing by decreasing the water levels of reservoirs. Dredging operations are also undertaken. Following the definition of a Memorandum of Understanding (MOU) between the canton of Geneva and the prefecture of the Ain department in September 2016 *(Protocole d'accord transfrontalier pour la gestion sédimentaire du Haut-Rhône)*, this mixed method was successfully implemented for the first time in May 2016. Four years of discussion resulted in the definition and assessment of different management scenarios. The mixed method has a number of advantages. It has less impact on the environment, guarantees a regular sediment transit, ensures an organized coordination between operators, and avoids having to implement a complex and time-consuming public consultation. SIG and CNR also implemented a private law agreement clearly defining the responsibilities and tasks during such a complex operation.

Conclusions

As described in this case study report, the transboundary governance of the Rhône River represents a complex system that comprises a multiplicity and a great diversity of stakeholders as well as numerous agreements that are founded both on private and public law. As shown by the historical analysis, this complexity was reinforced by the introduction of more severe environmental norms, growing uncertainties related to climate change, and an increasing number of river uses that are recognized by legal frameworks and considered by the

governance system. Having been operational for several decades, the governance system at the transboundary level has shown great resilience and capacity to react to crisis. Nevertheless, this case study report also shows the challenges related to fragmentation and notably the difficulties of reading and understanding the overall management of the river when the system relies on such a complex web of actors and numerous bilateral agreements. As illustrated by the flushing operation of the Verbois Dam, nowadays the system sees reinforcement of the role of central governments as a means to reinforce coordination and enhance the overall understanding of the system.

Annexes

ANNEX 6A

TABLE 6A.1. Table of Existing Legal Provisions in the Management of the Rhône

	Swiss Confederation (Federal Office for the Environment—OFEN)	France (Direction Régionale pour l'équipement, l'aménagement et le lodgement—DREAL)	Canton of Geneva	Canton of Vaud	Canton of Valais	SIG	CNR
Convention entre la Confédération suisse et la République française au sujet de l'aménagement hydroélectrique d'Emosson (23.8.1963)	X	X					
Mesures d'exécution 2000 (First signature: 27.3.2000 (France)/5.4.2000 (Switzerland)	X	X					
Acte intercantonal concernant la correction et la régularisation de l'écoulement des eaux du Léman (First signature: 17.12.1884, Second version: 11.9.1984)	X		X	X	X		
Règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève (17.9.1997)			X				
Modalités d'application du règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève (1.12.1997)			X			X	
Loi sur la Concession aux SIG de la force motrice hydraulique du Rhône pour l'exploitation d'une usine hydroélectrique dite du Seujet (12.9.1984, entry into force 1.7.1997)			X			X	
Loi sur la concession aux SIG de la force motrice hydraulique en aval de l'usine de la Coulouvrenière jusqu'à Vers-Cinge pour la production d'énergie électrique par l'usine hydroélectrique de Verbois (5.10.1973, modified on 13.9.1996, entry into force 9.10.1996)			X			X	
Concession de Chancy-Pougny (attributed in 1915, renewed on 12.5.2003 till 2061)	X	X				X	X

TABLE 6A.2. Table of Formalized Procedures

	France (Direction Régionale pour l'équipement, l'aménagement et le lodgement—DREAL)	CNR	EDF	SIG
Concession du Rhône (attributed in 1934)	X	X		
Exchange of information regarding water flows		X		X
Formalised cooperation within SFMCP		X		X
Formalised cooperation regarding the Conflan project		X		X
Formalised coordinated water management		X	X	
Formalised management of the amount of Arve water available in Lake Geneva	X	X	X	
Formalised coordinated water management			X	X

Overview of the Various Conventional Arrangements in Force for the Management of the Rhône

➢ **International Conventions**

Convention entre la Confédération suisse et la République française au sujet de l'aménagement hydroélectrique d'Emosson (23 août 1963)

Mesures d'exécution 2000 (27 mars 2000 (France)/5 avril 2000 (Switzerland))

Modification (5 mars 2002 (France)/25 avril 2002 (Switzerland))

➢ **Intercantonal Convention**

Intercantonal act concerning the correction and regularization of Lake Geneva water flows

→ As a result of this intercantonal act, the "Pont de la Machine" (a pedestrian bridge over the Rhône River) and the Coulouvrenière industrial area were constructed between 1883 and 1888.

La deuxième convention intercantonale date du 11 septembre 1984 et abroge la première version de 1884:

→ This second convention enabled the building of the Seujet Dam: Decision to construct: 1984; start of the work: 1987; work finished: 1995.

➢ **Cantonal Provisions**

Règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève (17 septembre 1997)

- Convention between the canton of Geneva and SIG

Modalités d'application du règlement sur la manœuvre de l'ouvrage de régularisation du niveau du lac Léman à Genève (1er décembre 1997)

Convention entre la République et canton de Genève et les SIG (12 novembre 1984)

Loi sur la concession aux SIG de la force motrice hydraulique du Rhône pour l'exploitation d'une usine hydroélectrique dite du Seujet (12 septembre 1984, entrée en vigueur le 1er juillet 1997 avec la mise en service du barrage du Seujet)

Loi sur la concession aux SIG de la force motrice hydraulique en aval de l'usine de la Coulouvrenière jusqu'à Vers-Cinge pour la production d'énergie électrique par l'usine hydroélectrique de Verbois (5 octobre 1973, modification le 13 septembre 1996 et entrée en vigueur le 9 novembre 1996)

➢ **Franco-Swiss concession granted for the management of the Chancy-Pougny Dam**

Concession de Chancy-Pougny (12 mai 2003)
French concession granted for the management of the Rhône

➢ **Convention between CNR and SIG**

- *Formalized procedures regarding:*
  - The transfer of data on water flows (time, frequency, type of information, etc.)
  - The transfer of real-time information regarding the Rhône River flows and hydropower production (SIG) but also regarding the Arve river (CNR)
- **Formalized collaboration within the SFMCP (CNR-SIG)**
  - SFMCP sells produced energy to SIG and CNR
  - SIG buys energy that CNR bought from SFMCP
- **Formalized collaboration within the Conflan project (SIG-CNR)**
  - Project management for the concession application
  - SIG and CNR are both project holders
  - SIG is the project leader for the concession application

➢ **Convention between CNR and EDF**

- *Coordinated water management*
  - Following fluctuations in water flows at the Seujet Dam, Électricité de France (EDF) must ensure additional amounts of water to secure the 130 m^3 water flow dedicated to the cooling of the Bugey nuclear power plant.
  - EDF is allowed to adapt the CNR's production program according to need.
  - CNR is compensated for this production alteration that results in a loss of benefits because of the change of the river's operation.

Convention pour la gestion des stocks d'eaux d'Arve disponibles dans le Léman (CNR-EDF) (5 juin 2002)

➢ **International cross-border management convention mobilized on an *ad hoc* basis**

- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)—the "Espoo (EIA) Convention"
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998)—the "Aarhus Convention"

➢ **Legal framework for the sediment flushing of Verbois**

- *European Union provisions*
  - Directive n°2000/60/CE du 23 octobre établissant un cadre pour une politique communautaire de l'eau
  - Directive n°92/43/CE du 22 juillet 1992 portant sur la conservation des habitats naturels ainsi que de la faune et de la flore sauvage
  - Directive n°85/337/CE du 27 juin 1985 concernant l'évaluation des incidences de certains projets publics et privés sur l'environnement
- *French provisions*
  - Code de l'environnement: Articles L122-1, R214-1, L214-6
  - Arrêté du 20 novembre 2009 portant approbation du schéma directeur d'aménagement et de gestion des eaux du bassin Rhône-Méditerranée et arrêtant le programme pluriannuel de mesure
  - Arrêté du 30 mai 2008 fixant les prescriptions générales applicables aux opérations d'entretien de cours d'eau ou canaux soumis à autorisation ou à déclaration en application des articles L214-1 à L214-6 du Code de l'environnement et relevant de la rubrique 3.2.1.0 de la nomenclature annexée au tableau de l'article R.214-1 du Code de l'environnement
  - Décret n°94-894 du 13 octobre 1994 relatif à la concession et à la déclaration d'utilité publique des ouvrages utilisant l'énergie hydraulique
- *French prefectural provisions*
  - Arrêté interpréfectoral modifiant l'Arrêté interpréfectoral du 21 décembre 2012 approuvant la consigne générale d'exploitation des ouvrages des opérations d'accompagnement des chasses suisses de Verbois pour la campagne 2012 sur les aménagements de la CNR sur le Haut Rhône
- *Swiss provisions*
  - Loi fédérale sur la protection des eaux du 24 janvier 1991 (RS 814.20)
  - Ordonnance sur la protection des eaux du 28 octobre 1998 (RS 814.201)
  - Loi fédérale sur l'utilisation des forces hydrauliques du 22 décembre 1916 (RS 721.80)
- *Provisions for the canton of Geneva*
  - Loi sur les Eaux du Canton de Genève du 5 juillet 1961 (L2 05)
  - Convention entre la République et canton de Genève et les SIG (12 novembre 1984)
- *International Conventions*
  - Convention on Environmental Impact Assessment in a Transboundary Context (Espoo 1991)—the "Espoo (EIA) Convention"

Note

1. The tools for water quality management with respect to Lake Geneva, which are referenced in the main text of the case study, are not considered in this summary on the application of tools.

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