

WBI Case Studies on Integrated Water Resources Management (IWRM)

Brazil River Basin Experience

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Background information on national and state levels

1 The Brazilian territory has a surface area of 8,533,000 km², and total average availability of water of 179,000 m³/s, which, for a current estimated population around 170,000,000 inhabitants, represents an average *per capita* availability around 33,400 m³/inhab.year. Taking into account the waters that enter the country from the neighbor countries, the average supply reaches 266,000 m³/s. The groundwater reservoirs are estimated around 112,000 km³, which, in the same way as the surface waters, show unequal distribution along the territory.¹

2 The total demand for consumptive uses reach around 1,592 m³/s, distributed as follow: 69% for irrigation; 13% for human supply (urban and rural), 7% for industrial use and 11% for animal use, which represents less than 1% of the average flowrate.

3 On the other hand, the disparities in the availability-demand balance are notable. One can verify great availability in the North region and scarcity in the Northeastern Semi-Arid region, where is located the so called “Drought Polygon”: for instance, the average *per capita* availability in the state of Roraima, in the Northern Amazon, is over 1,000,000 m³/inhab.year in a condition of extraordinary abundance, a value that contrasts with less than 500 m³/inhab.year in basins located within the “Drought Polygon”.

4 It must be mentioned that in the 1980-2002 period, the urban population growth from 67.7% to 81.2% of the overall population, which resulted in worsening of the water resources problem in the great centers. Concerning the sanitation indicators, the water supply services provided reach 90% of the urban population, whereas this index falls to 18% of the population in the rural areas (IBGE, 2002). As far as urban wastewater collection is concerned, the coverage is 56% of the urban population and 3% in the rural zones, whereas the treatment level is 20% only, which in reality results in around 90% of untreated wastewater discharged directly into the water bodies.

5 These characteristics lead to a mosaic of water resources problems that demand the action of the government in its three levels: federal, state and municipal, in order to solve them, particularly the following ones: - the water quality deterioration in the great urban centers, due to uncontrolled outskirts occupation and the low wastewater treatment level; - the water sustainability of the northeastern semi-arid, which is used to periods of natural scarcity worsening, causing serious economic and social problems to the country.

Water management policy framework

6 The Federal Constitution of Brazil, approved in 1988, defines water as a public good with **domain** (Federal or State domain), meaning that the water is administrated either by the Federal Government or the State Governments, and assigns the responsibility to administrate water uses in water bodies and not in water basins.

7 The Federal Government administrates the lakes, rivers and any water streams that are located in more than one State, that serve as border with other countries, or that extend to a foreign territory or come from it. The State Governments administer the flowing waters located entirely within the State borders, as well as groundwater emerging water or deposited water

¹ Federal Government of Brazil. Ministry of Environment. National Water Resources Plan. Brasília, 2006.

located entirely within State borders. Nevertheless, state waters collected or regulated by federal structures are under federal jurisdiction.

8 This existence of a double domain of demands articulated and harmonic actions between the Federal and States Governments, which represents a great challenge in the Brazilian context.

9 The Federal Constitution establishes private competence to the Federal Government to legislate on waters, also attributing its administrative competence of instituting the National Water Resources Management System and defining criteria of rights of use. (FC, art. 21, XIX).

10 The Federal Constitution, however, defines as common competence of the Union, the States and Municipalities, the environmental protection and the pollution control in any of its forms, and as competence of the three levels of the public administration to legislate concurrently about nature conservation, soil and natural resources defense, environmental protection and pollution control. The above mentioned competence allowed all the 1989 State Constitutions, and the laws that regulated them, to define criteria on the water resources within their domain, treating their respective management systems and policies, subordinated to the federal rules on environment and water resources.

11 The National Water Act of 1997 (Law 9433) defines de National Water Resources Policy (NWRP) and the National Water Resources Management System (NWRMS).

12 The NWRP shows the following principles: I – water is a public good; II – water is a limited natural resource and has economic value; III – in scarcity situations, the priority use of water resources is for human consumption and the watering of animals; IV – the water resources management must always allow for the multiple use of water; V – the water basin is the territorial unit for the implementation of the NWRP and the action of the NWRMS; VI – the water resources management should be decentralized and should involve the participation of the Government, the users and the communities.

13 The guidelines for the NWRP are the following: I – the systematic management of water resources, without dissociation of the qualitative and quantitative aspects; II – the water resources management adaptation to the physical, biotic, demographical, economical, social and cultural diversities of the regions of the country; III – the integration of the water resources management with the environmental management; IV – the articulation of the water resources planning with the user sectors and with the regional, state and national planning; V – the articulation of the water resources management with that of the land use; VI – the integration of the basin management with those of the estuarine systems and coastal zones.

14 The NWRP defines as its instruments: I – the water resources plans; II – the classification of the water bodies according to the preponderant uses of water; III – the concession of water use rights; IV – the charges for the use of water; V – the compensation to municipalities; VI – the information system on water resources.

15 The NWRMS was created with the following objectives: I – to coordinate the integrated water management; II – to arbitrate administratively the conflicts related to the water resources; III – to implement the NWRP; IV – to plan, regulate and control the water resources use, preservation and recovery; V – to promote the water charges.

16 The NWRMS is implemented under the Ministry of Environment and is integrated by: I – National Water Resources Council – NWRC; II – State Water Resources Councils; III – Basin Committees; IV – Federal, State and Municipal organisms whose competences relate to the water resources management; V – Basin Water Agencies.

17 The original conception of NWRMS contained a federal structure located in the Ministry of Environment, integrated by the NWRC and by its Executive Secretariat – the Secretariat of Water Resources; and also, ruled by federal legislation, the River Basin Committees of federal rivers and their respective Basin Water Agencies. In 2000, the original conception was enlarged with the creation of the National Water Agency – ANA (Law 9984), institution responsible for the implementation of the NWRP at the Federal Level, and coordinate the NWRMS.

18 Concerning the state structures, these have arrangements in accordance to the respective laws, but generally consist of: State Water Resources Council; a state water management organism; River Basin Committees for the state rivers, and their corresponding Basin Water Agencies.

19 The river basin committees have the following responsibilities in their respective areas of action: promoting the discussion of issues relating to water resources; arbitration of conflicts relating to water resources; approval of a basin's water resources plan; monitoring the execution of the water resources plan; proposition of water uses of minor importance that do not require a water permit; definition of pricing criteria and charges to submit to NWRC; and proposition of cost sharing criteria for multiple purpose improvements.

20 The water agencies will have the following responsibilities: keep the water budget in the basin updated; elaborate the basin's water resources plans and technical studies required for the management; perform the technical analysis of the investment proposed in the plan; monitor the implementation of the plan; manage the basin's water resources information system; submit water pricing criteria, actual charges and investment needs to the committee for approval; verify the application of the collected revenues; collect water charges; and secretariat the RBC.

The Paraiba do Sul River Basin Case Study

21 The Paraiba do Sul River Basin (PSRB) is located in Southeast region of Brazil and has a drainage area of 55.500 km²: 25.0 % in the state of São Paulo (SP); 37.3 % in the state of Minas Gerais (MG) and 37.7 % in the state of Rio de Janeiro (RJ). The basin has 179 Municipalities, and a population of 4,92 million inhabitants (year 2000).

22 One crucial aspect related with the water resources in the basin is that 160 m³/s of water is transposed from de Paraíba River to the basin of Guandu River, to supply the Rio de Janeiro metropolitan area, where 8,5 million inhabitants live.

23 The Paraíba do Sul River Basin (PSRB) is crucial in the Brazilian socio-economical context; about 8 % of the national GNP is produced there. The basin has been studied over the last decades, mainly in the last ten years. The first interstate initiative was the establishment of the Integrated Studies Executive Committee of the Paraíba do Sul River Basin, created by the Federal Government in 1978 and primarily integrated by state agencies. That Committee was responsible for the elaboration of several projects – the Managerial Projects, which suggested multisectorial actions in order to clean up the PSRB and improve its management. This effort ended up not producing the expected results due to lack of institutional and financial support to implement the Managerial Projects.

24 The Federal Decree 1.842/96 dated March 1996 created thr Paraíba do Sul River Basin Integration Committee - CEIVAP (<http://www.ceivap.org.br>). This was the first step for the implementation of a new management model in the PSRB. The Federal Law 9.433/97 and the water resources state laws of São Paulo, Rio de Janeiro and Minas Gerais consolidated the juridical framework for such a model.

25 The Water Quality and Pollution Control Project (PQA) was an important joint initiative of the Federal and São Paulo and Rio de Janeiro States Governments, taken in 1996, supported by the World Bank. PQA goal was the elaboration of investment programs for the cleanup of the PSRB. The project proposed infrastructure works and actions related to water resources management. The partnership of the Federal Government with the States of São Paulo and Rio de Janeiro to perform PQA took place from January 1997 to March 1999. The investment needs evaluated by PQA project amount US\$ 1,08 billion.

26 After the conclusion of PQA the Ministry of Environment's Water Resources Secretariat performed the Japanese-funded Preparation Project for the Water Resources Management of the Paraíba do Sul - PPP. The World Bank intermediate the Japanese Government grant for the development of the PPP. The main goal of PPP was the elaboration of an "initial project" that covered two aspects: the first one was a set of institutional actions addressed to the consolidation of Water Resources Management in the PSRB. The cost of the "initial project" was evaluated in US\$ 44 million.

27 The second aspect of PPP was to implement some structural actions suggested by the PQA, mainly in the environmental sanitation field. The investment program conceived in the PQA was eventually complemented, including the State of Minas Gerais. The outcome was a three-billion-dollar set of investments for the three States to be implemented in 20 years.

28 The 44-million-dollar "initial project" would be partially financed by the World Bank (50%), and the federal (20%), state and municipal (30%) governments. The "initial project" was approved by the CEIVAP in July 2000. Despite hardship in obtaining new

external funding, the “initial project” would be feasible with fund raising through water use billing and federal, state and municipal budgets.

29 The National Water Agency (ANA), gave priority to the PSRB. Consequently, the ongoing action in the CEIVAP was intensified, and approved the creation of the PSRB Water Agency in March 2001. ANA set a team to elaborate new technical studies for the water resources management of the PSRB. Some of them are noteworthy: the PSRB Water Resources Plan (2003-2007); development and implementation of the water resources information system; water quantity and quality monitoring in the PSRB; soil conservation program; and the flood control program. In addition, this team provided CEIVAP with technical consulting to develop the criteria for the water charges system.

30 CEIVAP approved, in December 2001, the implementation of the bulk water charging system for the Federal water resources in the PRB. Nevertheless, the implementation of the charging system was conditioned on meeting the legal requirements and preparatory measures. In addition, the following conditions had to be fulfilled:

31 I- Approval of the PSRB Water Resources Plan, formatted according to the State Investment Programs of the PQA and the “initial project” produced by PPP; II- Creation of the PSRB Water Agency; III- Definition of uses considered to be “non-significant” in the PSRB, as defined in NWRP; IV- Conclusion of the PSRB’s water resources use regulation process by ANA and the States of Rio de Janeiro, São Paulo and Minas Gerais, and V- Definition of the methodology for charging the uses of water in PSRB.

32 All the conditions established by CEIVAP to start up the water charges system were met in 2002/2003. The PSRB Water Resources Plan was eventually approved in November 2002 by the CEIVAP.

33 CEIVAP created the PSRB Water Resources Pro-Management Association, a civil society integrated by entity representatives who are CEIVAP’s board members, aiming that such civil association could be accepted as water agency. The National Water Resources Council (<http://www.cnrh-srh.gov.br>) authorized the creation of the PSRB Water Agency in November 2002, and it recognized the Pro-Management Association - AGEVAP, for performing the PSRB Water Agency duties.

34 The definition of the billing criteria for charging all the water uses in the basin was widely debated in CEIVAP. The discussion outcome came in the form of the following water use billing equation :

$$35 \quad \text{Monthly billing} = Q_{\text{intake}} \left[K_0 + K_1 + (1 - K_1)(1 - K_2 K_3) \right] UPP$$

where:

Q_{intake} = bulk water intake during one month (m³/month)

K_0 = intake unitary price coefficient (decided to be equal to 0,4);

K_1 = consumption coefficient. That is, the ratio between water consumed and water abstracted.

K_2 = *domestic or industrial effluent treatment coverage index*, ratio between total effluent flow treated and total effluent flow produced.

K_3 = efficiency level of BOD (Biochemical Oxygen Demand) reduction in the wastewater treatment plant.

UPP = Unitary Public Price, which corresponds to the billing for intake, consumption and effluent dilution (equal to R\$ 0, 020 /m³ ~ US\$ 0,0083 R\$/m³)

36 The PSRB's water resources use regulation process aimed to register all water resources users, regardless of domain of the water body. All users were called upon to register, no matter whether they had already received permits in the past or had made uses considered as non-significant.

37 Such a process was lead by the ANA and counted on the collaboration of CEIVAP. It was also supported by the States (São Paulo, Rio de Janeiro and Minas Gerais), each of which helping out by involving its water resources management department and one NGO. The States promoted registration and explained the process by the means of seminars and lectures, which were widely advertised in the local media. A website containing all information was also conceived, also allowing for on-line registration service.

38 The registration period, which took place in 2002 from September 16 to December 16, led to surprising results. There were 3,809 users who registered, 75.6% out of which from the State of São Paulo. Rio de Janeiro residents accounted for 14.6% and Minas Gerais 9.8% of the total registrations. Concerning the registration means, 81.1% chose the on-line option and the remaining 19.8% opted for filling printed forms.

39 CEIVAP decided then start up the water charging system in March 2003, relying on ANA's competence to promote the necessary operational actions of it's own attribution, namely: to bill all the water users and collect the revenues). Besides, ANA agreed to apply the revenues only in the PSRB, according to the priorities defined in the PSRB plan and recommended by CEIVAP.

40 In August 2004 of the PSRB Water Agency – AGEVAP, was installed and its working program was defined in the Management Agreement signed with the ANA as required by Law 10.881/04. After August 2004, ANA transfer the revenue collected regularly to AGEVAP, for applications according to the investment priorities defined in the water resources plan and included in the Working Plan of the Management Agreement.

The Piracicaba River Basin Case Study

41 The Piraciba River Basin (12.600 km²), the Capivari River Basin (1.570 km²) and the Jundiá River Basin (1.150 km²) are contiguous basins hydraulically connected for water resources management purpose. Water is diverted from the Capivari river basin

to reinforce the water treatment system of the Metropolitan Area of Campinas, located on both Capivari and Piracicaba basins. Also, from the last seventies water has been diverted from the Atibaia River, a tributary of the Piracicaba River, to the Jundiá River, where it is used to reinforce the water supply system of Jundiá City. Therefore, the three basins: Piracicaba, Capivari and Jundiá conform what has been called Piracicaba-Capivari-Jundiá – PCH Basins, and treated as unit of planning.

42 In the PCJ Basins there are 64 Municipalities: 60 in the State of São Paulo and 4 in the State of Minas Gerais, with populations of 4.900.00 and 60.000 inhabitants (year 2005), respectively. Since early seventies 31 m³/s of water is diverted from the headwaters of the Piracicaba river to another basin – the Alto Tietê river basin, through the so called “Cantareira System”. In the Alto Tietê River Basin is located the Metropolitan Region of São Paulo City. As consequence, the average reference flow remaining in PCJ Basins is 36,1 m³/s, and the ratio water demand/water available is 114 % (year 2002). The remaining total BOD₅ load discharged into water bodies is: urban sewage, 157 t/day and industrial effluent, 83 t/day.

43 From the middle of the seventies water users and civil organizations of the Piracicaba river started a strong mobilization process, supported by scientific community and several municipal mayors, in order to revert the deterioration of the water quality of the Piracicaba river. This movement grew progressively and gained support of many political leaders at the State Government level. In the early eighties the so called “Piracicaba – Campaign Year 2000” was released and became one important factor for the creation of the Water Resources Council of the State of São Paulo - WRCSP, in November 1987.

44 One of the first resolutions of the WRCSP was to declare the Piracicaba river basin as critical, with respect to water resources, and determine the elaboration of a priority program in order to start reverse the existing water pollution problems of the Piracicaba River. In June 1988 the Government of the State of São Paulo recognized the critical condition of the basin, declared the Piracicaba Basin as the basic model for water resources management in the State, and urged the WRCSP to propose the priority programs to be developed by the State of São Paulo institutions related with the solution of the problems. The priority programs for the Piracicaba river basin were developed, but it was realized that its implementation would require new management instruments as well as improvement in the administration structures in order to be successful. At that time had been started the elaboration of the Water Resource Plan, and the proposed programs were integrated to the process of the new coming plan.

45 Relevant initiative was taken in October 1989, with the creation of the “Piracicaba and Capivari River Basin Municipalities Partnership”, a technical and financial autonomous civil organization with the objective of collect funds to apply in environmental programs and actions in both basins. In 2000 the municipalities of the Jundiá river basin joined the partnership. From then on the partnership held the name of the three basins: Piracicaba, Capivari and Jundiá Municipal Partnership – PCJ Partnership. This institutional arrangement was successful, was subsidized by international collaboration program, developed several projects, one of them noteworthy: the investment program “R\$ 0,01/m³ water consumed” in which the water users of PCJ

basins voluntarily pay 1 cent of Real for m³ of bulk water consumed, in order to raise funds for the clean up of the basins' waters.

46 In 1993 the State of São Paulo Water Resources Policy law was edited, and created the new instruments and institutions for water resources management, such as water charges, basin committees and water agencies. Based on this law, it was created the state water basin committee for the Piracicaba, Capivari and Jundiá rivers – State PCJ Committee, with jurisdiction over the Capivari and Jundiá basins (both state river basins), but only over the São Paulo's State territory of the Piracicaba River basin. The State PCJ Committee has a composition defined according to São Paulo State's water resources law, and its working program was independent of the PCJ Partnership's. This arrangement of two basin wide water resources management organisms was unique in Brazil.

47 From 1997 to 1999 a PQA program was developed for the PCJ Basins, in a very similar way as the one developed for the Paraíba do Sul River Basin. The Water Quality and Pollution Control Project (PQA) for the PCJ basins, was a joint initiative of the Federal and São Paulo States Governments, taken in 1996, supported by the World Bank. The program elaborated a very consistent program of investment for the cleanup of the PCJ .

48 From 2002 to 2003 the so called HIDROPLAN was developed, a report on the present situation of the water resources in the PCJ basins, with support of the State of São Paulo Water Resources Fund – FEHIDRO.

49 The National Water Agency – ANA, is installing Federal Committees in priority basins in Brazil, and decided, in 2002, to create the Federal Committee of the Piracicaba River. The negotiation with the States of São Paulo and Minas Gerais resulted not in the creation of the Piracicaba Federal Committee, but in the creation of the PCJ Federal Committee, that is: the Federal committee of the Piracicaba River was supposed to be created for the total basin area of the Piracicaba River (Piracicaba basin's territory in São Paulo and Minas Gerais States). Nevertheless, the negotiations resulted including the São Paulo States Rivers Basins Capaviri and Jundiá in the jurisdiction area of the Piracicaba Federal Committee, so it became the PCJ Federal Committee. This arrangement shows how flexible and really adapted to local conditions NWRP is in Brazil. In practice the PCJ State Committee (Piracicaba without Minas Gerais state territory + Capivari + Jundiá) and the PCJ Federal Committee (Piracicaba total + Capivari + Jundiá) coexist, they have common agendas, and work integrated.

50 In December 2005, the Water Agency of the PCJ Federal Committee was installed, with the same legal support given to the Paraíba do Sul Water Agency (based on Law 10.881 and Management Agreement with ANA). The important arrangement is that the PCJ Partnership was indicated by the Piracicaba Federal Committee, and approved by the National Water Council, as the Federal PCJ Water Agency.

51 The charging system for PCJ Basins started up in January 2006. All the uses are charged annually, and invoiced monthly. There are no uses considered “non-significant” as in the PSRB charging system (31), but the charge is not applied when the annual value

is less than R\$ 20,00 (~US\$ 8,3). The PCJ charging system could benefit of the similar ongoing process in the PSRB, but the charge application criteria are different.

52 Four categories of charges are applied: I- water abstraction for use in the basin; II - water abstraction for transposition to other basins; III- water consumed, and IV – organic load released.

Conclusions

51 The IWRM is recommended widely as the best approach for basin water management. The experiences so far developed in Brazil, during the last 15 years, confirm this assertion. However, IWRM depends heavily on political will, particularly to set up the management system when technical and financial support of the Government is required to the elaboration of the basics management instruments (plans, cadastres, permits, charges, etc.). ANA has been pushing the IWRM process forward in Brazil.

52 The IWRM is the challenge of the NWRS: on one hand, the Government has a recent tradition of centralization and very often reacts to transfer decision power to collegiates, as Councils and Committees. For instance, the Brazilian NWRP included as one attribution of the basin agencies to collect fees for water uses, under authority delegated by ANA. During the transmittal process of PSRB Water Agency proposal, Sectors of Federal Government reacted against the application of such rule, and only when a new bill (Law 10.881) was issued, suspending that possibility, the creation of AGEVAP was authorized, under the Management Agreement condition.

53 On the other hand, users and civil society are still not well structured to participate objectively in IWRM, although some evolution can be detected in Brazil. ONGs play an important role in the political arena, but with little technical contribution to the process. Capacity building is a key factor to the development of IWRM. Skill upgrading and training policies are essential to change the decision capacity of the collegiates. In Brazil this is particularly true in BWC.

54 The PSRB Committee played a decisive role during the critical reservoir storage period (2001 to 2003): a task group was created for implanting and monitoring restricted operational criteria for the reservoirs, and the involvement of the Committee in was essential for the acceptance of the flow restriction by affected population. Hydrologic studies performed ex-post showed that if traditional operative rules had been maintained, the hydraulic system would have failed in providing the required flows in the basin.

55 The implementation of the charging system requires: - existence of BWC with participation of Government, Users and Civil Society, to push forward the process of IWRM in the basin; - elaboration of cadaster (who are the stakeholders? Where are they?); - negotiation of bulk water pricing in the BWC; - elaboration of basin's water plan (where the revenues will be applied?); - creation of the Basin Agency to collect and apply the revenues. Therefore, the implantation of the charge system is the last stage of a long process, and should be started the sooner the better.

56 The NWRP and NWRS have two really new challenges to Brazil: implant water charges and create water agencies. Nevertheless, there is no general rule to be applied nationwide, and a harmonic mosaic of solutions is being constructed under the framework of the NWRP. Water tariffs and agencies arrangements have varied case by case so far, and the key directive is that local solutions based on BWC decisions must prevail.

57 Strong WBC, like PSRB and PCJ have in common severe water allocation problems. In such cases there exist stakeholders mobilization and social pressure to assure participation, and the committee is the real parliament of water. The quality of the representation is very important, and care must be taken to avoid that more organized but less representative groups take command of the process. This undesirable condition often happens in BWC in Brazil.

58 The Management Agreement establishes performance criteria to be attained by water agencies. In the case of PSRB 50 performance indicators were set, which are monitored by ANA. The Management Agreement is an important control tool, but a fair negotiation of goals is always complex.

59 The water agencies in Brazil are limited to spend no more the 7,5% of the revenues with its administration costs. For the annual budgets of both PSRB Agency (R\$ 12 million ~US\$ 5 million) and PCJ Agency (R\$ 10 million ~ US\$ 4,17), the resources available to contract personnel are very restrictive. Even if the limit were raised to 10% of the water charges revenue, the current budget of the agencies would not be enough to contract the minimum required staff. Besides, the wages paid by the agencies presently are not attractive for skilled professionals.