Chapter 1

Why is financing water resources management an issue?

As societies made progress overtime in securing access to water, the subject progressively slipped away from the public agenda, at least in OECD countries. In the second half of the 20th century, rapid demographic and economic growth put increasing pressure on the water resource, both in terms of quantity and quality. As a response, many OECD countries have made significant efforts in the last three decades to clean up rivers – mostly by treating wastewater from urban and industrial centres. Water scarcity has always commanded attention in more arid countries, like Spain and Mexico, but countries that once perceived themselves as water-rich – such as Canada, New Zealand or the United Kingdom – are progressively realising their increasing vulnerability as population and economic growth takes place in areas with relatively low rainfall, where there is currently limited water storage capacity, and exposed to changing hydrological patterns. Managing "too much water" is also a major concern – indeed, flood management is highlighted in most recent Environmental Performance Reviews of OECD member countries.

Faced with the economic downturn, several OECD members consider water management as a potential new engine for growth. On the one hand, governments acknowledge that the costs of inadequate water management are becoming higher, from a financial perspective, but also in terms of lost development opportunities, compromised health and environmental damage. The recent US Intelligence Community Assessment on Global Water Security (National Intelligence Council, 2012) points out that water shortages and pollution from now through to 2040 are likely to harm the economic performance of important trading countries. Economic output will suffer if countries do not have sufficient clean water supplies to generate electrical power or to maintain and expand manufacturing and resource extraction. Water problems will also hinder the ability of countries to produce food. On the other hand, water plays a central role in OECD's Green Growth Strategy because well-managed water systems can generate huge benefits for our health and our economy (see OECD, *Water and Green Growth*, forthcoming, 2012).

Some countries have already shown the way forward. In 2008, several recovery packages included investment in water infrastructure. Korea's green growth strategy explicitly considers water as a driver for economic, social and environmental performance. Australia has increased its Growth Domestic Product (GDP) by around AUD 220 million in 2008-09 with ambitious reforms to establish a water trading system in the Murray-Darling basin and through reallocations of water used in agriculture – despite a severe drought.

The public debt crisis makes water financing an even more pressing issue: if water can drive growth, who should/can pay to make sure all water users (cities, farmers, but also energy suppliers, industry, and the environment) have access to the water they need, in terms of both quantity and quality?

This report aims to help water policymakers and water managers to strengthen the financial dimension of water resources management. There is a major shortage of policy analysis and guidance as regards sustainable financing of water resources management. *Water Financing and Governance* (Rees *et al*., 2008), published by the Global Water Partnership (GWP), is one of the few reports addressing this issue; it places particular emphasis on the links between multi-level governance and financing. In the context of the EU Water Framework Directive (WFD), the WATECO working group provided guidance on the use of economic analysis in the implementation of the WFD.

This report is another step in building knowledge and guidance on this policy area. The first section sets the scene, taking a medium term perspective on water management. The second section proposes a frame to consider financing water resources management. It identifies three principles and related issues, which policy makers might wish to assess the financial dimension of their water policies and to strengthen it. The next section compiles recent developments on the use and the relevance (and limitations) of economic instruments to lower the costs of water management and generate revenues to cover these costs. Finally, a set of related issues are explored, such as governance and the role of the private sector. The concluding section sketches a staged approach which can guide a review of the financial dimension of ongoing water management practices. It can inform a policy dialogue on financing water resources management, the ultimate way to manage reform in this area.

Future challenges regarding water resources management

The state of water systems is affected by both human activities and environmental change. Today the key human drivers include population, income growth and economic activities; urbanisation generates particular opportunities (lowering the per-capita cost of access to infrastructure) and

challenges (the sheer number of people without access to water supply and sanitation services; additional needs for infrastructure to control floods…).

To date, economic growth and population dynamics have affected water more than climate. But, in the second half of the century, the impacts of climate change are likely to compound water-related challenges. For instance, in the case of agriculture, the anticipated increased incidence and severity of flooding could mobilise sediment loads and associated contaminants and exacerbate impacts on water systems, while more severe droughts may reduce pollutant dilution, thereby increasing toxicity problems. Whatever the impacts on water systems, the task of achieving water quality objectives in agriculture will become more difficult in the coming years as a result of climate change (OECD, 2012b).

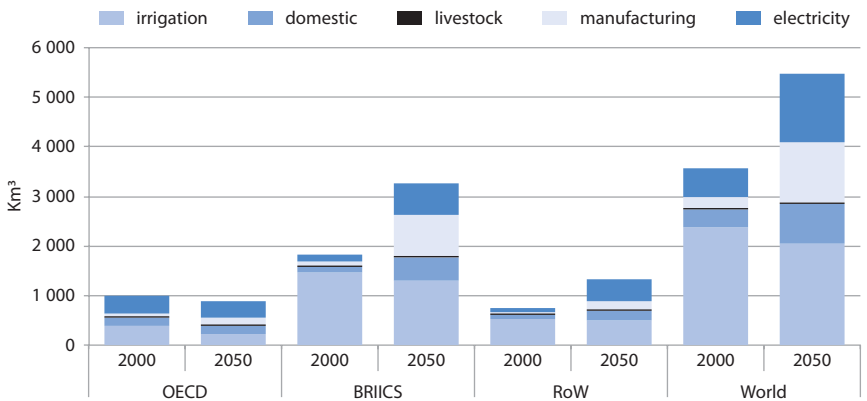
The *OECD Environmental Outlook to 2050* (OECD, 2012a) identifies four sets of interconnected challenges related to water management.

Water quantity

The Outlook Baseline scenario projects that by 2050, 3.9 billion people, over 40% of the world's population, are likely to be living in river basins under severe water stress. These people will have very little room of manoeuvre to adjust to uncertain water availability.

Figure 1.1. **Global water demand**

Baseline scenario, 2000 and 2050



Note: This graph only measures "blue" water demand and does not consider rainfed agriculture. The country groupings BRIICS and RoW are explained in OECD (2012a), Table 1.3.

Source: Environmental Outlook Baseline; output from IMAGE. OECD (2012a), *Environmental Outlook to 2050*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264122246-en*.

Water demand is projected to increase by 55% globally between 2000 and 2050. The increase in demand will come mainly from manufacturing, electricity and domestic, leaving little scope for increasing water for irrigation. Water resources management will need to manage this increasing competition between water users.

In many regions of the world, groundwater is being exploited faster than it can be replenished and is also becoming increasingly polluted. The rate of groundwater depletion more than doubled between 1960 and 2000, reaching over 280 km^3 per year. In places, this situation places cities and agriculture at risk. More sustainable approaches need to be implemented, from water savings to augmenting security and tapping alternative sources of water.

Water quality

Continued efficiency improvements in agriculture and investments in wastewater treatment in developed countries are expected to stabilise and restore surface water and groundwater quality in most OECD countries by 2050.

The quality of surface water outside the OECD is expected to deteriorate in the coming decades, through nutrient flows from agriculture and poor wastewater treatment. The consequences will be increased eutrophication, biodiversity loss and disease. For example, the number of lakes at risk of harmful algal blooms will increase by 20% in the first half of this century.

Micro-pollutants (medicines, cosmetics, cleaning agents, and biocide residues) are an emerging concern in many countries.

Access to water supply and sanitations services

The number of people with access to an improved water source increased by 1.8 billion between 1990 and 2008, mostly in the BRIICS group (Brazil, Russia, India, Indonesia, China and South Africa), and especially in China. However, globally, more city dwellers did not have access to an improved water source in 2008 than in 1990, as urbanisation is currently outpacing connections to water infrastructure.

More than 240 million people (most of them in rural areas) are expected to be without access to an improved water source by 2050. The Millennium Development Goal for improved water supply is unlikely to be met in Sub-Saharan Africa. The situation is even more daunting given that access to an improved water source does not always mean access to safe water.

Almost 1.4 billion people are projected to still be without access to basic sanitation in 2050, mostly in developing countries. The Millennium Development Goal on sanitation will not be met.

Water related disasters

Today, 100-200 million people per year are victims of floods, droughts and other water-related disasters (affected or killed); almost two thirds are attributed to floods. The number of people at risk from floods is projected to rise from 1.2 billion today to around 1.6 billion in 2050 (nearly 20% of the world's population). The economic value of assets at risk is expected to be around USD 45 trillion by 2050, a growth of over 340% from 2010.

Financing WRM: Expenditures and sources of finance

There are many responses to the challenges mentioned above, depending on local conditions. However, the appropriate responses will share several features: more attention will be paid to (ecologically sensitive) water storage, investment in water supply and sanitation, pollution control, and allocation issues.

This generates costs. These costs are not well known, as information is scarce and patchy. Partial information is available on infrastructure needs and on the costs of water resources management. OECD projections for annual investment in water supply and sanitation systems through to 2025 point to significantly high levels of investment requirements. In the OECD and Big 5 economies annual expenditures in the range of USD 770 billion are projected up to 2015 and over USD 1 trillion by 2025 (see OECD, 2006)[1].

Much of this spending in Europe and North America will be on maintenance, repair and replacement rather than on additions to existing networks, since water systems in many of these countries are now very old and in poor condition. Not least in OECD countries, environmental pressures will continue to grow, as will the expectations of the general public with respect to environmental protection and natural resource management. These factors are expected to add significantly to the costs incurred in the supply of water services and wastewater treatment.

There are reasons to believe that a similar trend applies to other water infrastructure needs, for irrigation, flood control, or water storage (see Box 1.1, as an illustration).

Policy responses to water-related challenges do not only entail investment. They require strengthened water governance as well. In particular, coherence between policy areas which impinge on water availability and quality (such as agriculture and food, land use and city planning, energy and climate) need to be ensured. The multi-level dimension of water policies only adds to this

complexity: water has to be managed at local, basin, national and international levels; considerations and trade-offs will differ, depending on the level at which issues are addressed. Here again, various constituencies will be engaged in a complex architecture of water councils and related agencies. This complex web of decisions better relies on robust information, to monitor water use and consumption, water availability and status, the impact of climate change, and the financial flows related to water management.

It follows that water governance is costly. In addition to the political economy of collective action and transaction costs, Garrick and Hope (forthcoming, 2012) single out lock-in costs of path dependency and institutional capacities required for implementation as main drivers for these costs.

Box 1.1. **Benefits from investment in flood and coastal erosion risk management in England**

Floods have a devastating potential in England. Just in the summer of 2007, major floods caused damages estimated at GBP 3.2 billion, of which a significant share (especially for poor households) was uninsured. This estimate does not include stress on people and impacts on customers of infrastructure assets.

The government is devoting significant financial resources to decrease flood risks. Between 2003 and 2009, the government spent over GBP 900 million to reduce the risk of flooding for over 250 000 households. Most of the available funding was spent on improving existing flood defences or keeping them in good working order. But out of 29 million homes and other properties in England, 5.2 million remain at risk of flooding, with 490 000 properties at a significant risk of flooding from rivers or the sea. Infrastructure at risk includes critical national infrastructure assets, including 55% of pumping stations and treatment works, 28% of gas infrastructure, 20% of railways, 14% of electricity infrastructure and 10% of major roads. In 2035, under current trends there will be around 340 000 additional properties with a significant chance of flooding, mostly due to the increasing costs of managing risk in the face of climate change

The monetised benefits of recent expenditures in flood management show that on average, each pound spent generated eight pounds in long-term benefits. The ratio would be reduced only to 7:1 if expenditures were to increase at an annual average of GBP 20 million and would remain robust, at 4:1, even if expenditures were to increase at GBP 50 million per year. These benefit-cost ratios are considerably higher than those for other major (priority) public expenditures, especially for infrastructure investments such as transport and energy.

Source: Fisher, J., D. Johns (2010), *Funding Future Investment in Flood and Coastal Erosion Risk Management in England*, Background report for the OECD project on Financing Water Resources Management.

Because figures on costs are fragmented only, actual expenditures on water resources management give a sense of the financial challenge. Information from selected countries is compiled below, to illustrate how much is spent to manage water and how total expenditures break down for specific items. More detailed accounts of water management expenditures for Germany and Sweden are shared at the end of the chapter.

Expenditures on water management

Substantial financial resources are spent to pay for governance and management interventions, as well as for infrastructure interventions. This section compiles illustrations from selected OECD countries and BRICS (Brazil, Russia, India, China, South Africa), based on data collected for this project. More detailed information on Germany and Sweden are provided at the end of the section. The section gives a sense of the magnitude of water-related expenditures, of the share of some categories, and of the variety of national situations.

Table 1.1. **Main categories of water-related expenditures in selected countries**

	public sector expenditures for WRM	infrastructure-related	main infrastructure expenditures (as % of infrastructure-related expenditures)	governance-related	main governance functions
Brazil	2.2 billion	97%	pollution abatement (50%) storage and distribution of raw water (47%) ecosystem management (3%)	3%	research monitoring information management
China	10 billion	91%	water resources works flood control hydropower development soil and water conservation	9%	capacity development
Czech Republic	0.6 billion	80%	wastewater infrastructure flood protection environmental protection	20%	
France	29 billion	87%	sanitation (52%) drinking water supply (34%) soil and water conservation (7%) flood management (3%) miscellaneous, including scosystems (3%)	13%	general administration R&D basin authorities management

Note: Scope and definitions may vary across countries; see the text in this section for more precise information.

Source: Country case studies.

In Brazil, public sector expenditures for water management at federal level amounted to EUR 2.2 billion in 2009, with infrastructure-related expenditures representing 97% of those expenditures and governance-related expenditures only 3%. Since 2006, expenditures in water infrastructure have increased almost 8-fold, driven largely by the Economic Growth Acceleration Programme launched in January 2007. Since 2006, expenditures in water infrastructure have been almost equally divided between pollution abatement (50%) and storage and distribution of raw water (47%), with ecosystem management representing only about 3%. Expenditures in research monitoring and information management increased 20% between 2006 and 2007 and have since increased slowly, reaching EUR 26 million in 2009. Expenditures in other governance functions (such as co-ordination, planning, administration and enforcement) almost doubled between 2006 and 2007 but have since then decreased below the 2006 level, representing only EUR 15 million in 2009.

China spent around EUR 10 billion per year during the period 2004-08, for water resources works (40%), flood control (37%), hydropower development (7%), soil and water conservation (6%) and capacity development and other items (9%).

In the Czech Republic, total expenditures in water resources management exceed CZK 15 billion per year. A ballpark figure for governance expenditures can be estimated at 20% of the total, while wastewater infrastructure alone represents about 50%. Annual average operational expenditures of the river boards were CZK 3.7 billion for 2004-2008, with additional CZK 1.8 billion spent on investments. Administration costs for minor rivers was CZK 480 million in 2008, with investments amounting to an additional CZK 500-600 million per year. Repeated occurrence of catastrophic floods has prompted an increase in expenditures in flood protection expenditures, now reaching over CZK 1 billion per year, as well as in flood damage restoration (over CZK 800 million per year). Expenditures for navigation are about CZK 400 million per year. Investments for environmental protection are about CZK 0.5-1 billion per year. Around CZK 8 billion is spent every year on wastewater infrastructure to achieve EU targets – but this amount should drop after 2013.

In France, expenditures on water management amounted to EUR 29 billion in 2007. Most of this was for drinking water supply (30%; EUR 8.8 billion) and sanitation (45%; EUR 12.9 billion). Protection and cleaning of soils, ground and surface water accounted for 6% (EUR 1.8 billion), flood management for 3% (EUR 0.8 billion), and hydropower, waterways and aquatic ecosystems management together accounted for another 3% (EUR 0.8 billion). Governance-related expenditures can be estimated at around EUR 3.8 billion, or 13% of the total – with EUR 1.7 billion for general administration, EUR 1.2 billion for research and development, EUR 0.6 billion for local public basin authorities and EUR 0.3 billion for other management expenses. Public administrations spent EUR 5.4 billion in water management – representing 19% of total

expenditures in water management, 5% of total expenditures in drinking water supply, 13% of total expenditures in wastewater, and 67% of total expenditures in other areas of water management. The annual estimated expenditures of the 6 water agencies in 2007-2012 are EUR 1.9 billion. The governance-related expenditures (knowledge, planning and governance) represent on average 18% – varying across water agencies from 11-27%.

Similarly, South Africa has a large stock of water storage and distribution infrastructure that requires significant, although relatively stable, expenditures in operations and maintenance. New investment programmes are carried out, but their lumpy nature implies that the year-on-year evolution varies greatly. Perhaps the most significant trend is the increase in water governance expenditures necessary to match the increasing complexity of water management. At the same time, there has been progress in reducing costs via optimised infrastructure operations and expenditure co-ordination at regional level.

Table 1.2. **Public expenditures in water management in South Africa**

billion rand

	2000-01	2004-05	2008-09
Governance	0.63	0.92	1.42
Water supply infrastructure (on-going)	0.90	1.00	1.05
Water supply infrastructure (capital)	0.20	0.19	1.95

Source: adapted from Pegram, G., B. Schreiner (2010), *Financing Water resources management – South African Experience*, EU Water Initiative Finance Working Group and Global Water Partnership.

Water management expenditures evolve over time. For industrialised countries, water governance is likely to increase rapidly, as more efforts need to be paid to integrative tasks. For instance, in the Czech Republic, achieving the EU WFD objectives of good status will require more extensive monitoring, drafting of catchment area plans, and enhanced international co-operation for managing transboundary rivers. In the Netherlands, for the period 2007-27, the additional costs of measures for EU WFD implementation have been estimated at EUR 2.9 billion and the investments in the complete package of measures total around EUR 7.1`billion, with management and governance costs representing around 11% of total costs (PBL, 2008).

At the same time, infrastructure costs are also likely to evolve, with some items increasing and others decreasing. In general, the share of operation, maintenance and renewal costs will likely increase (in relation to the share of new infrastructure). Climate change will also have an impact on water management expenditures.

Financing water management: Combining sources of finance

Some of the required policy responses make claims on public spending. This can be legitimate, when related to the provision of a public good, and/or in contexts where basic infrastructures need to be built (typically, in developing countries). In the current context of fiscal consolidation, the extent of such claims will only materialise when backed by robust valuation of benefits (see Box 1.2), the exploration of alternative financing schemes, and a search for low-cost options.

Box 1.2. **Multiple benefits of water management in France**

A partial picture offered by current estimates of the benefits of WRM in France illustrates that they take various forms. It suggests that they amount to several EUR billion per year.

A first order of magnitude is given by the annual turnover of commercial activities directly dependant on water resources, which are estimated to be EUR 9.6 billion – including EUR 3.5 billion related to natural mineral waters, EUR 2.8 billion to hydropower, EUR 2.2 billion related to fish and EUR 1 billion related to spas. Examples of more direct benefits are those of avoided flood damages in Paris through construction of lake-reservoirs (estimated to be EUR 300-700 million), and those of preserving bathing water quality in tourism resorts (estimated to be EUR 1 billion).

Estimates of future benefits from implementation of the EU WFD in France include those of reduced drinking water supply costs from avoided agricultural pollution (EUR 1.8 billion), with non-commercial impacts of achieving good quality status being estimated via contingent valuation surveys at EUR 1 billion.

Another example of (non-monetised) benefits is the increase in water quality in the river Seine generated by several decades of investments in wastewater treatment in the Paris agglomeration area, prompting significant reductions in concentrations of biochemical oxygen demand (BOD), ammonium and phosphorus and resulting in improved biodiversity (currently 32 fish species are listed, from 3 fish species in the 1960s). A final example is the potential of river navigation in the Nogent-Le Havre corridor to reduce CO_2 emissions from freight transport – the current configuration allows a reduction of 28% and an improved configuration would allow a further reduction of 55% of CO_2 emissions.

Source: Bommelaer, O., J. Devaux (2012), "Financing Water Resources Management in France", *Études & Documents* No. 62, January 2012, MEDDTL, Paris.

A variety of sources of finance are available. Bommelaer and Devaux (2012) inventory multiple financing bases used to meet targeted water policy goals in France:

- Billing drinking water, based on a fixed rate and the volume used; this combination supports the sustainable financing of the service and the amortisation of its investments, while being an incentive to use water efficiently. The water bill also supports urban sanitation, taxes on domestic pollution, basin governance, maintenance of the aquatic environments and the public waterways and production of knowledge.
- The electricity bill finances part of the storage infrastructure and its maintenance.
- The insurance policy for dwellings and vehicles is the main basis of the management and compensation for flood hazards.
- The tax on abstractions covers some expenses related to quantitative management.
- The national or local taxpayer contributes to the general administration of the system and to the public good dimension of water resources management, via public budgets (research, information systems, water policing, health, environment, risks, biodiversity conservation, etc.).

Table 1.3 identifies those who pay for water management in China.

Table 1.3. **Paying for water in China**

Variations by sub-sector

Sector of water management	Main institutions/groups involved in financing
Flood and drought control	Mainly by the government (including planning, investment and operations) *Flood control law* indicates combination of government funds and "rational payment by beneficiaries". Flood control in rivers and lakes and emergency responses funded by central government Flood protection in cities funded by city governments Flood protection of economic infrastructure (oilfields, railways, mines, telecommunications, …) funded by companies Drought control and disaster relief by government at different levels
Water supply and sanitation in cities	Water supply in urban areas self-financed by water operators (with some government subsidies) with pricing in form of cost plus and total cost accounting. Sewage treatment and pollution control mixed, combining "polluter pays" and government subsidies Water supply in rural areas jointly financed by farmers and government (central and local) – principle of "multi-level, multi-channel, diversified and multi-way financing". Several funds (poverty relief, welfare-to-work, small irrigation and water conservation, special fund for shortage). In the special fund, central government financing to poorer regions (west 60%, central 40%), in richer regions (east) only local government and farmers.

Table 1.3. **Paying for water in China**
Variations by sub-sector *(continued)*

Sector of water management	Main institutions/groups involved in financing
Irrigation	Large and medium systems largely funded by the state, with some water fees from farmers Small systems largely funded by farmers, with some government subsidies Example: water saving initiative: central 33%, local 25%, 42% loans and farmers
Water and soil conservation	Mainly financed by the state. Enterprises must adopt water and soil conservation measures, or pay competent authorities to carry out works

Source: DRC (2010), *Study on Investment and Financing of Water Resources Management in China*, Development and Research Centre of the Ministry of Water Resources.

The next section sketches a framework to balance these different options and to select appropriate sources of finance for water management.

Illustration No. 1. Water Management expenditures in Germany

In Germany, the programmes of measures (PoMs) and river basin management plans (RBMPs) requested by the European Water Framework Directive can provide good insights in both the costs of sustainable water resources management (with the aim of reaching the good status of water bodies) and financing sources. In Germany, the RBMPs have been established at the level of the Länder. The task of the competent authorities was to estimate how much the different measures would cost, and to identify financing options. Furthermore, authorities had to assess whether costs are proportionate and whether they can be financed by the end of the first RBMP (*i.e.* 2015). Table 1.4 indicates the yearly financial requirements for the whole implementation period of the WFD, from 2010 to 2027, for the German land Hesse. The average financial needs amount to EUR 130.5 million per year. The Baden-Württemberg land has differentiated the financing needs of the PoM according to point sources, agriculture related measures and hydro-morphology. As can be seen in Table 1.5, different financing sources exist for the different types of pressures. Total investment costs have been estimated at EUR 780 million, whereas ongoing costs amount to EUR 1.7 billion per year.

Illustration No. 2. Water Management expenditures in Sweden

In Sweden, there is a funding gap for water resources management. In the area of water governance, the programmes of measures published by the DWAs are very general, they do not identify specific actions for each water

Table 1.4. **Financing needs to reach good ecological status of water bodies in Hesse**
Yearly, for the period 2010-27 (in million EUR)

Position	Designation	2010-15	2016-27	Average financing needs per year
1	Groundwater	24.0	19.5	21.0
1.1	in water protection areas	1.2	4.3	3.3
1.2	outside water protection areas	22.8	15.2	17.7
2	Surface water bodies – Hydromorphology	65.3	35.1	45.2
2.1	Water bodies outside of federal waterways	59.6	30.7	40.4
2.2	Measures on federal waterways	5.7	4.4	4.8
3	Surface water bodies – Substances	122.0	35.1	45.2
3.1	Point sources	19.3	-	6.4
3.2	Diffuse sources (erosion of phosphorous)	16.0	35.5	29.0
3.3	Salty effluents	86.7	-	28.9
	Total costs	211.3	90.1	130.5

Source: Gräfe, A. (2009), *Finanzbedarf und Finanzierung*, Hessisches Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz (Financing needs and financing sources, Ministry of the Environment, Energy, Agriculture, and Consumer Protection, Hesse). PowerPoint presentation available at *www2.hmuelv.hessen.de/imperia/md/content/internet/wrrl/ 4_oeffentlichkeitsbeteiligung/offenlegung2008_bwpl_mp/informationsveranstaltungen/finanzbedarf_neu090324.pdf.*

body as required by the EU WFD due to lack of financial resources. In the last few years financial resources for fighting euthrophication have increased, but three of the six national environmental goals related to water will not be achieved until 2020, suggesting a gap for financing specific interventions. Information on expenditures and costs estimates has improved thanks to demands from the EU WFD.

The largest expenditure on water resources management corresponds to wastewater treatment – some SEK 7 billion. Total costs of water supply and wastewater treatment activities were SEK 14.3 billion in 2003 (including 25% VAT). Of the total 40% for drinking water supply and distribution and 60% for sewage systems and wastewater treatment – with capital costs accounting for 26% of the total. While there are not reliable estimates of overall expenditures in water governance in Sweden, estimates are available for some items. Co-ordination costs for SEPA were about EUR 25 million in 2008. In nominal terms, the expenditures of the national monitoring programme on inland waters have tripled between 1996-2008, from SEK 7 million to SEK 21 million. Sub-national authorities (such as county boards, water councils and municipalities) finance regional and local monitoring programmes which for all subjects (air, water and land) may add to SEK 130 million. Estimates of public funding for research in WRM are not available. Most of such funding is made available

by 4 research councils with a combined budget of about SEK 7 600 million for different subjects. National research funds from SEPA for water were SEK 23 million in 2008. SEPA's expenditures to support law, economy and co-ordination work amounted to SEK 3.3 million and those central guidance on water regulations to SEK 4.2 million. Expenditures on the flood warning system operated by the Swedish Meteorological and Hydrological Institute are not available.

Additional expenditures exceed SEK 0.5 billion. Expenditures in liming lakes and water courses to reduce the effects of acidification were

Table 1.5. **Cost and financing information in Baden-Württemberg**

Type of pressure	Point sources	Agriculture	Hydromorphology (structure, continuity, minimal flow)
Cost information	– Municipal point sources: Yearly costs for sewage disposal: EUR 1.6 billion Total investment costs: EUR 400 million (EUR 200 million for wastewater treatment plants, EUR 200 million for treatment of rainwater) – Industrial point sources: little need for action, individual cases	EUR 97 million/year – composed of: – Compensation for market relief and cultural landscape (MEKA) – EUR 75 million/year – Regulation on protected areas and compensation (SchALVO) – EUR 22 million/year	Total investment costs: EUR 380 billion, composed of: – EUR 320 million (Land (35%) – EUR 111 million; Municipalities (27%) – EUR 85 million; Private (operator of hydropower plants) (38%) – EUR 122 million) – EUR 60 million for federal water ways
Potential financing sources	Sewage charges, support through the subsidy guidelines for water management, Municipal Environmental Fund → 40 million/year	Existing programmes are used for financing agricultural measures, complemented by specific advice: MEKA and SchALVO → EUR 97 million/year	– Structure: EAFRD, European Fisheries Fund, Municipal Environmental Fund, lottery funds, Ecological accounts → EUR 8 million/year – Continuity of hydropower plants: Application of the Renewable Energy Law – Federal water ways → EUR 10 million The rest will depend on negotiations between national ministries and the Land.

Source: adapted from Bley J. (2009), *Maßnahmenprogramm Wasserrahmenrichtlinie – Vorgehensweise in Baden-Württemberg*, Umweltministerium Baden-Württemberg (The Water Framework Directive programme of measures – methods in Baden-Württemberg, Ministry of the Environment, Baden-Württemberg), PowerPoint presentation available at *www.netzwerk-laendlicher-raum.de/fileadmin/sites/ELER/Dateien/05_Service/Veranstaltungen/2009/WRRL/Bley_TagungLandwirtschaftundWRRL_03_2009.pdf*.

SEK 209 million in 2008. Expenditures to reduce nutrient loads from agricultural land amount to about SEK 320 million per year. SEK 288 million per year correspond to EU CAP funding for creating buffer zones, applying catch crops and changing agricultural practices (such as manure handling). About SEK 30 million correspond to the "focus on nutrients" programme centred on on-farm advisory services.

Estimates of costs to achieve water policy goals related to the EU WFD suggest the need for additional expenditures in the order of SEK 4-5 billion. Under current patterns, this would be covered by a combination of 45% public budgets (mostly for governance costs), 45% users (mostly for wastewater treatment) and 10% EU transfers (agricultural measures).

A ballpark figure for additional water governance costs may be SEK 1.5-2 billion per year. This is a significant figure, which would probably mean more than doubling current expenditure levels. It is dominated by the administrative costs by sub-national agencies to implement the EU WFD. Just in the Skagerrak and Kattegat DWA district, total costs of administrative activities called for by the EU WFD, such as control and renewal of permissions, have been estimated to be SEK 2.1 billion in 2010-2015 – of which SEK 1 billion correspond to the municipalities. The Swedish Environmental Protection Agency expects to increase expenditures for water management associated with the WFD during the years 2010-2012 due to needs to update regulations and guidance documents, to co-ordinate the programme of measures, and to implement proposed measures. The central budget related to implementation of the EU WFD was SEK 148 million for 2008 and expected to grow to SEK 173 million in 2010, with management expenditures of the District Water Authorities and supportive staff at the county boards representing over 80% of the total. These expenditures relate only to "governance" aspects, such as mapping and co-operation (SEK 48 billion and 25 billion respectively in 2008) by the centrally-supported agencies. It is expected that monitoring costs will increase substantially – this might be funded by a combination of higher water prices and reallocation of environmental monitoring budgets by sub-national authorities. Costs of extended evaluation and improved sampling and analysis have been estimated at SEK 50-100 million.

Ecosystem management costs are SEK 320-350 million. Cost related to improved water source protection has been evaluated at SEK 70-100 million per year – these costs are currently co-funded by government budgets and a fee on drinking water. Costs of liming are estimated at SEK 150 million per year – to be covered by the national budget. SEK 100 million per year are needed for the restoration of 1 000 lakes.

Costs in wastewater treatment infrastructure are SEK 1.5-1.9 billion. Additional reductions in pollution loads from municipal wastewater treatment plants will increase costs by about 10% or SEK 800-1 000 million per year – to

be fully covered by water charges. The cost of additional reductions in pollution loads from industrial facilities is estimated at SEK 250-400 million per year – to be fully funded by industry via direct investments or water charges. The costs of additional reductions from currently unconnected households are estimated at SEK 400-500 million – so far covered by the households.

The costs of additional nutrient reductions from agricultural land have been estimated at SEK 500-1 000 SEK per year for the next 10-20 years – so far these costs have been covered both by EU funds and by farmers via compliance with regulations.

Note

1. Figures in this area are hugely uncertain. A more recent OECD survey, using a different method, anticipates significantly different needs. See Annex B for more information.

References

Bley, J. (2009), *Maßnahmenprogramm Wasserrahmenrichtlinie – Vorgehensweise in Baden-Württemberg*, Umweltministerium Baden-Württemberg (The Water Framework Directive programme of measures – methods in Baden-Württemberg, Ministry of the Environment, Baden-Württemberg), PowerPoint presentation available at *www.netzwerk-laendlicher-raum.de/fileadmin/sites/ELER/Dateien/05_Service/Veranstaltungen/2009/WRRL/Bley_TagungLandwirtschaftundWRRL_03_2009.pdf*.

Bommelaer, O., J. Devaux (2012), "Financing Water Resources Management in France", *Études & Documents* No. 62, January 2012, MEDDTL, Paris.

DRC (2010), *Study on Investment and Financing of Water resources management in China*, Development and Research Centre of the Ministry of Water Resources.

Fisher, J., D. Johns (2010), *Funding future investment in flood and coastal erosion risk management in England*, Background report for the OECD project on Financing Water Resources Management.

Garrick, D., R. Hope (forthcoming, 2012), *Economic Instruments to Manage Water Security Risks and Tradeoffs*, OECD Environment Working Papers, Paris.

Gräfe, A. (2009), *Finanzbedarf und Finanzierung*, Hessisches Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz (Financing needs and financing sources, Ministry of the Environment, Energy, Agriculture, and Consumer Protection, Hesse), PowerPoint presentation available at *www2.hmuelv.hessen.de/imperia/md/content/internet/wrrl/4_oeffentlichkeitsbeteiligung/offenlegung2008_bwpl_mp/informationsveranstaltungen/finanzbedarf _neu090324.pdf*.

OECD (1978), *Recommendation of the Council on Water Management Policies and Instruments*, 5 April 1978 - C(78)4/FINAL.

OECD (1989), *Recommendation of the Council on Water resources management Policies: Integration, Demand Management, and Groundwater Protection*, 31 March 1989 - C(89)12/FINAL.

OECD (1998), *Water Consumption and Sustainable Water Resources Management*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264162648-en*.

OECD (2006), *Infrastructure Needs to 2030. Telecom, Land Transport, Water and Electricity*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264023994-en*.

OECD (2008a), *OECD Environmental Performance Reviews: Denmark 2007*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264039582-en*.

OECD (2008b), *OECD Environmental Performance Reviews: Australia 2007*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264039612-en*.

OECD (2009), *Managing Water for All – An OECD Perspective on Water Pricing and Financing*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264059498-en*.

OECD (2010a), *Pricing Water Resources and Water and Sanitation Services*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264083608-en*.

OECD (2010b), *OECD Review of Agricultural Policies: Israel 2010*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264079397-en*.

OECD (2011), *Water Governance in OECD Countries: A Multi-level Approach*, OECD Studies on Water, OECD Publishing, Paris. DOI: *http://10.1787/9789264119284-en.*

OECD (2012a), *Environmental Outlook to 2050*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264122246-en*.

OECD (2012b), *Water Quality and Agriculture: Meeting the Policy Challenge*, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/9789264168060-en*.

OECD (forthcoming, 2012), *Water and Green Growth*, OECD Publishing, Paris.

OECD (forthcoming, 2013), *Water Security: Managing Risks and Tradeoffs*, OECD Publishing, Paris.

PBL (2008), *Evaluation of the Water Framework Directive in the Netherlands – costs and benefits*, Netherlands Environmental Assessment Agency (PBL), Bilthoven.

Pegram, G. and B. Schreiner (2010), *Financing Water resources management – South African Experience*, EU Water Initiative Finance Working Group and Global Water Partnership.