



ADB

Water

Vital for Viet Nam's Future

Asian Development Bank

CONTENTS

FOREWORD	1
THE VIET NAM CONTEXT	2
ASSESSMENT OF WATER SECTOR IN VIET NAM	7
1 - Ensuring adequate water supply and sanitation	7
2 - Managing floods and natural hazards	9
3 - Providing for economic development	11
4 - Sustaining agriculture and aquaculture	17
SECTOR MANAGEMENT – ADOPTING AN IWRM APPROACH	19
ISSUES AND OPTIONS FOR THE FUTURE	21
THE WAY AHEAD	25
APPENDIX - RIVER BASIN SUMMARIES	29

FOREWORD

We all depend on water - life is impossible without it. Water maintains the integrity and sustainability of the environment within which we all live. We need clean water for drinking and cooking, for sustaining our health and for sanitation. Water is arguably the most precious natural resource to support our growth and development. It supports our agriculture, aquaculture, industry and other sectors of the economy. It supports hydropower and waterway transportation. Water is precious but limited and highly variable in time and place. It is also highly vulnerable to degradation. Water, in its extremes, can also present major hazards for human existence.

Water resources have long been recognized as a key resource for the development of Viet Nam. Over many years the Government has undertaken considerable work to provide infrastructure to both develop water for settlements and food security, and to protect communities from flooding and other natural disasters. However, during this development period, the crucial role of water in the Nation's sustainable development, human health and life has not always been fully appreciated. Its value as a scarce natural resource and economic good has not always been recognized. As a result, insufficient attention has been paid to the need to protect and manage water resources, and today there are numerous examples of serious degradation in the quality and quantity of our national water resources, and of shortages of water in many regions.

In 2006, the Prime Minister signed the decision 81/2006/QĐ-TTg promulgating the National Water Resources Strategy Towards the Year 2020. This aims to strengthen the protection, exploitation, use and development of water resources, as well as the prevention and mitigation of adverse impacts caused by water.

In order to support the aims of the National Strategy, and to provide a platform for its implementation, the Water Sector Review (WSR) was undertaken as a joint project of the Government of Viet Nam and its international development partners. The objective of the project was to review the state of the Viet Nam water sector, to establish a common framework to guide development decisions in the sector and to support Integrated Water Resources Management (IWRM) initiatives to underpin the Government's achievement of the National Strategy over the forthcoming 10 years.

The water sector review was prepared on the basis of the best information available at the time, and was generally reviewed by the Government Task Force set up to guide the Review. However, the detailed results that have been produced cannot be taken to be absolutely accurate. They are used in the Review to illustrate the main issues facing Viet Nam, and over time more definitive data can verify the accuracy of the results. In that context, readers should not focus on the veracity of the data; rather they should take the main messages presented and work with the concerned Ministries and the international development partners on the various measures that will lead Viet Nam towards a better IWRM approach.

This publication presents the main findings of the Review, particularly in relation to the status of water resources and water-related environments, including water quality; the status of the main sub-sectors – water supply and sanitation, natural hazards, navigation, industry and craft villages, hydropower, irrigation and fisheries and aquaculture; the main issues facing the sector; and the main measures that Viet Nam could adopt to ensure a sustainable water future.

This publication is presented as a reference document for Government agencies and organisations at all levels, the international development partners, academics, as well as for a broader audience of individuals and organisations interested in issues related to the management of water in Viet Nam. Its findings are important to us all and the information stemming from the Review will influence key decision makers at all levels and potential investors in water sector reform.

In response to the Review, the Government is preparing a National Target Program to provide a concentrated focus and drive to deal with the critical challenges facing the sector and to focus on the sustainable protection and exploitation of water resources.

Hanoi, November 2009



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THE VIET NAM CONTEXT

16 Major River Basins

There are as many as 2,360 perennial rivers over 10 km in length in Viet Nam, and these naturally form 15 major river basins spanning the country – see map (Page 28). The project has also included the South East Rivers Cluster (SERC). This is the group of rivers in a comparatively dry part of the country where lack of water could prove a major constraint to poverty reduction and development. It consists of the provinces of Khanh Hoa, Ninh Thuan and Binh Thuan. These 16 basins were used as a platform for the analysis under the project. Most of the analysis is based on 2006 data.

The Water Sector Review (WSR) has shown that Viet Nam's water sector is facing a wide range of major issues, as outlined below. As a result, tremendous challenges face Viet Nam's proposed programme to implement the National Water Resources Strategy.

A rising population

Viet Nam is currently the 13th most populous country in the world, and its population is projected to reach 100 million in the next 25 years. Almost two-thirds of the current population live in the three main river basins (Red – Thai Binh, Mekong Delta and Dong Nai). This, combined with the shift in population distribution from rural to urban areas, is placing a particular strain on financing infrastructure, as well as resulting in ever increasing problems of water supply and environmental pollution.

Within 25 years the population in urban areas will require a daily water supply capacity twice that of the current level and will also generate considerable wastewater, all requiring significant investment. In the recent past, such investment, particularly in the urban areas, has come predominantly from official development assistance (ODA). Looking to the future, investment in both rural and urban water and sanitation will have to quadruple if the Viet Nam Millennium Development Goals (MDGs) are to be met.

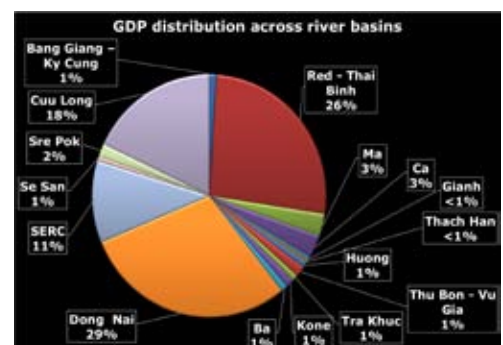
Economic development

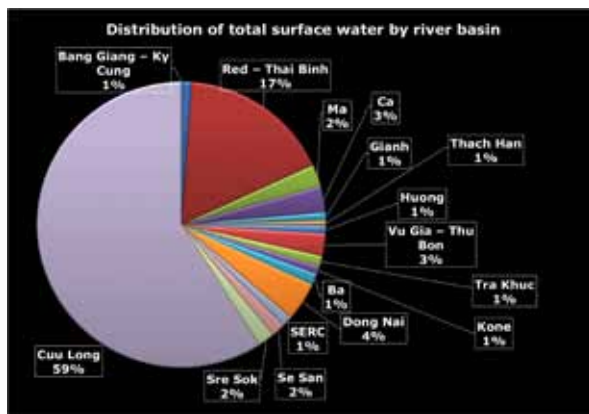
Undoubtedly, one of the greatest pressures on water resources and the water sector comes from the strong economic development and the changing structure of the economy. This growth increasingly consumes natural resources, requiring a reliable water source, and generates considerable volumes of polluted wastewater affecting water sources.

Over the last ten years, GDP has nearly tripled and the growth in the industry, construction and service sectors has been dramatic. At the current growth rate (7.5%), Viet Nam's economic output is projected to double every 10 years. The Red – Thai Binh, Mekong Delta and Dong Nai river basins account for over 70% of Viet Nam's GDP, indicating that the pattern of economic growth is highly uneven, with the rest of the Country contributing less than 30% of GDP. Under the Socio-Economic Development Plan (SEDP) to 2010, the Government clearly expects the pace of economic reform to be maintained into the future, leading to even greater pressure on already stretched water resources



The water sector is extremely complex. It cuts across many Ministries and organisations and all levels of government, and covers many aspects of daily life for communities and businesses. It spans the entire country and its interests can range from a small household taking living water from a creek, or groundwater or a lake; to a farming community using a water supply system; to a large privately owned hydropower station – all are part of the water sector.





Dependence on international rivers

Viet Nam is heavily dependant on international rivers. More than 60% of the total average yearly surface water discharge is generated outside the country. Six river basins depend on water inflows from other countries – Red-Thai Binh, Ma, Ca, Dong Nai, Bang Giang - Ky Cung, and Cuu Long (Mekong Delta). In the Cuu Long, almost 95% of the average yearly surface water flows are generated in the upstream Mekong River countries, whilst in the Red River - Thai Binh basin almost 40% of the surface water originates in China.

Other countries also depend on inflows from rivers that originate in Viet Nam. Surface waters in the Se San and Sre Pok basins generated in Viet Nam account for 75% and 50% of the total water in those respective basins, and about 2% of the total flow in the Mekong River. The Bang Giang - Ky Cung flows from China through Viet Nam, and back to China.

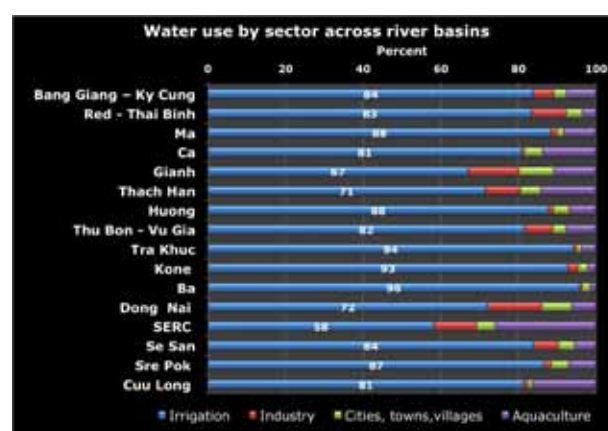
Available surface water

At first glance, Viet Nam has an apparently abundant water resource. Viet Nam's total surface water discharge of 9,856m³ per person a year compares favourably with the international standard for having adequate water of 1,700m³ per person a year. However, this varies greatly between river basins and is significantly different between the wet and dry seasons, which

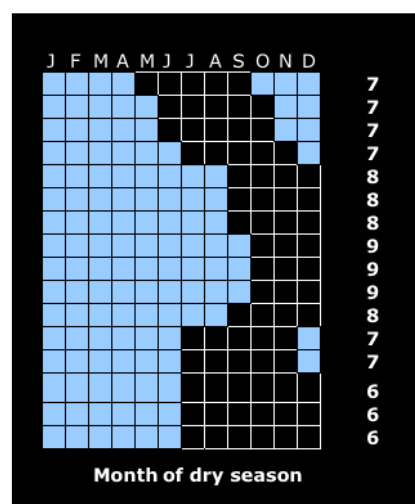
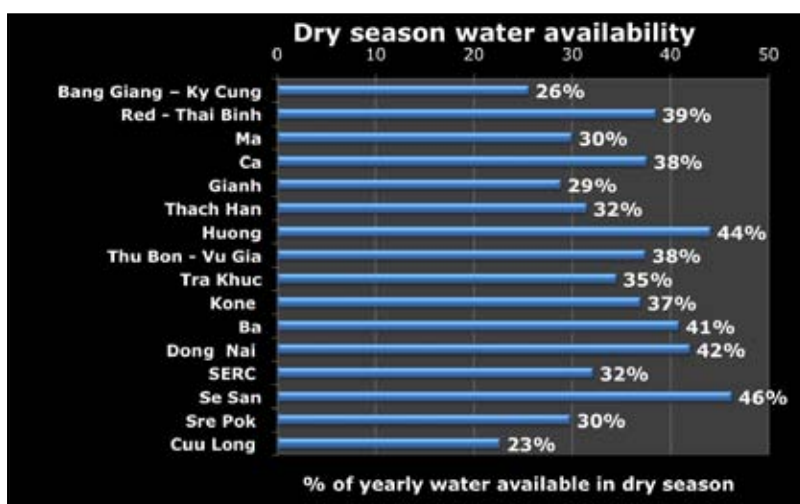
can range in length from six to nine months and are longest in the central Viet Nam basins. Under existing population and development levels, during the dry season the Dong Nai and the SERC basins run the risk of irregular or local water shortages, often due to unsustainably high levels of water extraction. Other rivers are approaching this level.

Competing water uses

At present, nationally, nearly 82% of the total current surface water use is for irrigation, 11% is for aquaculture, 5% for industry and 3% for urban use. By 2020, water use is expected to increase by 48% - irrigation water by about 30%, industry by almost 190%, urban by 150% and aquaculture by 90%. These changes will place a heavy burden on Viet Nam's water resources.



The WSR shows the serious lack of water availability in Viet Nam in terms of meeting future projected water uses, particularly in the dry season, and the stress that this will put on rivers, with a number of basins being particularly badly affected. This is likely to induce a focus on groundwater use to support more of the projected socio-economic growth. However, groundwater resources are poorly assessed and understood.



Groundwater potential

Groundwater provides the domestic water supply for more than half of Viet Nam's population. More than one-third of the urban population is dependent on groundwater, and almost two-thirds of the rural population. Whilst Viet Nam has an estimated total 'groundwater potential' of almost 63,000 million m³ per year, in some areas concentrated groundwater extractions are causing concern.

In Hanoi, water levels are falling by more than 1 m per year in some areas. In parts of Ho Chi Minh City, the drop in water level is as much as 30 m, and in other parts of the Mekong, water level declines are also significant. There are particular over-exploitation issues in parts of the coffee growing areas of the Central Highlands, with water levels dropping by over 2.5 m per year.

Water storage

The total current reservoir active storage volume is about 4.5% of the total average annual surface water discharge. Of this, over 45% is located in the Red – Thai Binh basin, and almost 22% in the Dong Nai. Viet Nam has an active storage of about 440 m³ per person, which is low in comparison with the United States and Australia (at over 5,000 m³ per person), and China (2,200 m³ per person). Only three river basins have reservoirs with a flood mitigation component.

Potential water shortages and river basin stress

Water availability in the dry season is already a serious issue in many river basins or parts of basins. Conflict over access to water is increasing. As well, increasing population and water use projections will change the water availability in, and the stress on, river basins. While some basins will have sufficient water to support

the demands of their communities, a number of basins will suffer severe water shortages and be unable to meet growing demand for water resources, particularly in the dry season.

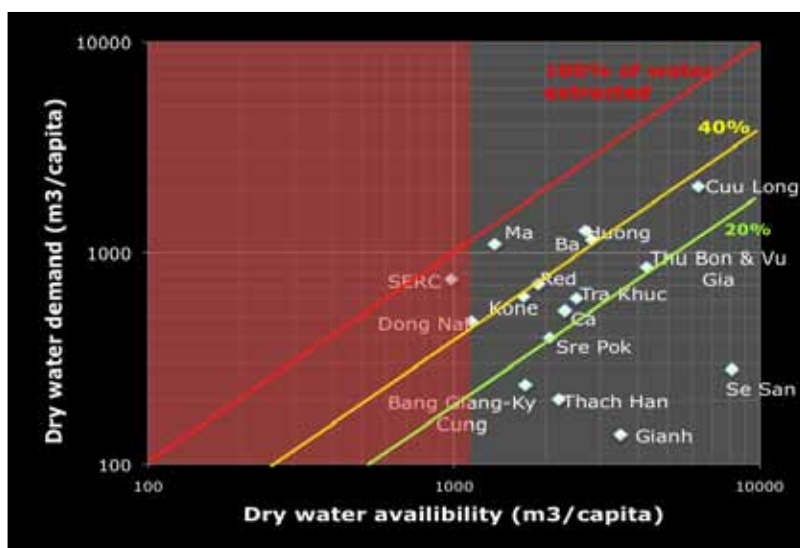
A measure of stress in a river basin is the percentage of the average annual discharge that is extracted from rivers. The international standard for water exploitation stress¹ is that moderate stress begins at a value of 20% extraction, and high water stress occurs for values above 40%. Stress mostly occurs during low flow times, during the dry season. Water extraction during these times results in less water for the river - less wetted area and reduced depth of water. In these conditions much of the native aquatic life struggle to survive. This is particularly important for Viet Nam as so many people, particularly the poor, rely on natural rivers for so much of their daily life.

Therefore, the surface water exploitation situation in the dry season is most critical. Under existing population and development levels, during the dry season six of the 16 basins are classified 'moderately stressed' (in the 20% to 40% zone), and a further four are classified as being 'highly stressed' (the Ma, SERC, Huong and Dong Nai). The Red River basin is almost at the high stress line. The most severely stressed systems are the SERC basins, with 75% of the dry season flows extracted, and the Ma basin with almost 80% extracted. These represent very high level of current water extraction.

Water quality

The WSR found it difficult to get meaningful water quality data and information. However, on the basis of what is available, it found that surface water does not meet the organic pollution standards for drinking water in the main parts of all river basins. Higher concentrations of organic matter are seen in a number of basins. There are also some hot spots for rivers running through residential areas. Organic pollution is generally within

1. Used by the OECD and European Environment Agency.



the B Class standard (except in hot spots). While there is limited data for determining pollution levels of heavy metals, the surface water in all river basins generally meets drinking requirements.

Protecting Ecosystems

Viet Nam's natural ecosystems support nearly 10% of the global total of mammal and bird species. However, Viet Nam's freshwater and marine biodiversity is being threatened by domestic and industrial water pollution, dam and infrastructure construction, dredging, destructive fisheries techniques, aquaculture and over-fishing. The SEDP noted that Viet Nam's Environment Sustainability Index (ESI) in 2005 was only eighth among ASEAN countries, and Viet Nam ranked 127th overall, well below some of its closest neighbours.

Viet Nam is rich in freshwater and marine wetlands, mostly in the Red River and the Mekong River Deltas and along the coastline. There are about 1 million hectares of wetlands in river mouths and around some island lagoons. The Directory of Asian Wetlands lists over 25 wetland sites in Viet Nam that meet the criteria of "Wetlands of International Importance". Despite this, only two wetlands are recognized as RAMSAR sites – the Xuan Thuy in the Red River Delta, and the newly established Bau Sau in Cat Tien National Park.

Healthy rivers, including their channels, beds, banks, and their habitats, support and maintain a mix of aquatic plant and animal life. The proportion of the flow that is extracted from a river is critical and indicates the stress level of a river. A number of basins are already 'stressed', particularly in the dry season, and this is likely to increase dramatically in the future.

Natural disasters

The location and topography of Viet Nam make it one of the most disaster-prone countries in the world. The fact that about 50% of its population lives on the

coast compounds the problem. More than 80% of the population live at risk of direct impacts from natural disasters. Floodplain flooding provides major difficulties in the Mekong Delta and the Central Region while the dike system in the Red River Delta provides some controls. Flash flooding occurs throughout the country. Typhoons regularly afflict the entire country but predominantly in the Central Region.

From 1997 to 2006, natural disasters caused over 5,000 deaths, and destroyed more than 6,000 fishing boats, nearly 300,000 houses, 4 million hectares of paddy rice, with a total damage cost of some VND50,000 billion. The average yearly natural disaster related damage cost in each basin is also dominated by the river basins in central Viet Nam, where economic losses are almost the same as the annual growth rates in GDP.

Climate change

Recent UNDP and World Bank reports indicate that Viet Nam is one of five countries world-wide most vulnerable to sea-level rise. In a scenario of a 1 m rise in sea level, assessments show that Viet Nam would lose 5% of its land, 11% of the population would be seriously affected, agricultural production would decrease by 7%, and the GDP would decrease by 10%. A 1m sea level rise would flood more than 38% of the land of the Mekong Delta Basin. Some provinces would lose nearly half of their land.²

In December 2008, the Government approved a National Target Program (NTP) on Climate Change Adaptation. Climate-change adaptation and mitigation projects will be piloted in provinces most at risk of sea-level rise over the next two years. From 2011–2015, the plan will be adopted nationwide.

2. Note that more recent information has been compiled for the NTP on climate change adaptation.





ASSESSMENT OF WATER SECTOR IN VIET NAM

1 – Ensuring adequate water supply and sanitation (urban and rural)

Current Status – Urban Water Supply & Sanitation

While over 14 million people (about 62% of the 22.5 million urban population) have access to clean water, around 8.5 million do not. For those that do have a clean water supply, the current standard of service is poor. The Government is trying to provide efficient water supply services to meet the needs of a booming urban population and industries; and have issued new decrees on urban water supply and drainage providing a strong platform for reform. However, problems remain, as sanitation services remain inadequate across the country, funding of major infrastructure projects is beyond Government capacity, and the Provincial Peoples Committees' often set water tariffs at rates that cannot sustain a viable business model and tie operations to decision making heavily burdened by government processes.

In 2006, yearly urban population growth was 2.18% compared to 0.93% in rural areas, with the urban population being estimated to reach more than 30 million by 2010. In 2005, the average urban water supply was about 80-90 liters per person per day; and in large cities 120-130 liters per person per day. However, Government objectives are to ensure that 100% of the urban population has access to clean water of 120-150 liters per person per day by 2020, which will require billions of VND worth of investment.

Current Status – Rural Water Supply & Sanitation

Increased coverage of rural water supply and sanitation (RWSS) is a crucial part of the fight against poverty. Access to water and sanitation is mainly a problem of the rural poor in Viet Nam. In 2005, over 60 million people lived in rural areas. Of the poorest 20% of people, only 22% have access to clean water compared to 78% for the richest 20%. For sanitation, the poorest 20% only have 2% access compared to an access level for the rich of 20%.

In rural water supply and sanitation, 21 million people do not have access to a "hygienic" water supply, and 41 people million do not have a supply that meets "clean" water standards (MoH standards). Furthermore, the vast majority of rural people do not have access to a hygienic latrine. However, despite these stark challenges, RWSS National Target Program (NTP) II is now underway with strong international support. It reflects the need for a greater focus on sanitation and hygiene, the need for better targeting of subsidies for the poor, greater emphasis on sustainability, improved operation and maintenance and further decentralization of implementation. It is starting to deliver far better results, and a new more cooperative and integrated approach, increasingly "bottom up", is being developed. As a result, NTP II deserves far greater levels of support.

The following section summarises the status of the main sub-sectors – water supply and sanitation, natural hazards, navigation, industry and craft villages, hydropower, irrigation and fisheries and aquaculture. For each of these, the current status and the major issues are described. We then look at how the water sector is managed.



In Viet Nam, at this stage of its socio-economic development, water supply and sanitation have traditionally been seen as "social" issues. In developed countries, urban water supply and sanitation are more likely to be regarded in much the same way as other utility functions – gas, electricity, telecommunications, etc.

Current Status – Urban wastewater treatment

Eleven out of the 16 basins have no domestic wastewater treatment. Sixty percent of hospitals have wastewater treatment plants but only 18% are properly operated and most wastewater from hospitals is discharged directly into public sewerage systems. Factories in urban areas also do not treat wastewater and this is discharged directly into the public sewerage systems. Urban areas may impose water sanitation fees but historically these have been heavily constrained. A recent decree provides a strong basis for the comprehensive reform of the urban sanitation sub-sector on a sustainable basis.

Major issues

Major urban and rural water supply and sanitation issues are as follows. However, recent legal changes for urban water supply and sanitation (Decrees 117/2007 and 88/2007) should provide a basis to overcome a number of these:

- *How to achieve the NTP II targets by 2010, particularly ensuring that consumers can provide a greater proportion of the funding in a socially acceptable way.*
- *The poor standard of service of urban water supply companies and their efficiency.*
- *Urban water supply infrastructure is not keeping pace with economic development, and urban sewerage and drainage infrastructure seriously lags behind.*
- *Towns under district control appear to have much less access to basic water services.*
- *The urban water tariff has not been aligned to business needs and has not covered costs.*
- *Collected wastewater fees are not returned to the service provider.*
- *There have been no clear mechanisms for determining the price of assets, nor consistent regulations on asset management.*
- *Poor and inconsistent policies and unclear organisational arrangements.*
- *The over-exploitation and pollution of groundwater.*
- *Dealing with the disposal of solid wastes.*
- *Capacity building, particularly for sanitation service provision.*



2 - Managing floods and natural hazards

Current Status

In dealing with the effects of natural hazards and disasters two aspects need to be considered. One is the response when disasters happen, and the long history of dealing with devastating storms has created a strong network and culture of response at all levels. The second aspect is the work undertaken between disasters, in developing an approach to better deal with future natural hazards, i.e. how to stop them becoming disasters, and to protect communities from their effects.

However, to date in Viet Nam this second aspect has been based on a strong traditional structural approach to natural hazards, particularly through dyke construction, which cannot always be implemented comprehensively. Structural measures alone are not effective for some areas, such as Central Viet Nam, where many people die each year. For example, flash flooding, which kills nearly 50 people a year, is extremely difficult to deal with and depends more on land use management, warning and community preparedness, than on any possible structural measure.

Viet Nam needs to develop far stronger measures for the application of a wider range of non-structural options. An integrated approach to hazard risk management should involve both structural and non-structural measures across sectors, and, working closely with the provinces, planning for disasters using Community-Based Disaster Risk Management (CBDRM) approaches. One successful example is a recent project in disaster-prone Quang Ngai Province (Tra Khuc Basin) which has demonstrated the benefits of this approach. Furthermore, there is now an urgent need to ensure sufficient resources are dedicated to dealing with natural hazards.

As economic development progresses, greater attention must be paid to the long-term stability of coastal areas subjected to natural disasters. The impact of vegetation removal, in particular mangrove removal, is well known. Extensive river sand extraction to support economic development is also reducing the natural processes of sand supply to the coast and thereby decreasing the capacity of coastlines to resist erosion forces. Climate change will only intensify the impacts of natural disasters and focus more attention on the need for more non-structural solutions.



Viet Nam is one of the most hazard-prone countries in the world, as set out earlier in this report. Climate Change is set to make these problems even worse, with Viet Nam being one of the top five countries in the world most likely to be directly affected by changes to sea levels, more frequent and intense typhoons, plus increased flooding and storm surges.

Major Issues

Major natural hazard issues include:

- *Lack of dedicated resources.*
- *The importance of, and lack of progress with, non-structural responses .*
- *Greater levels of warning and community preparedness.*
- *Greater use of flood storage in reservoirs.*
- *The integrity and safety of structural works.*
- *Land use planning having a key role in disaster vulnerability.*
- *Better coastal zone management.*

- *The effects of extensive river sand extraction reducing the natural processes of sand supply to the coast.*
- *Preparedness for extreme risks.*
- *Difficulty in dealing with flash floods.*
- *Institutional modes for disaster management.*
- *Greater adoption of Community-Based Disaster Risk Management (CBDRM).*
- *Climate Change: managing the risks of hazards also helps to manage the worsening risks due to climate change.*



3 - Providing for economic development

Current status – industry

Industrial activities are expected to account for over 45% of national GDP by 2010. Indeed, industrial sector GDP doubled between 2002 and 2006, and manufacturing accounts for around 84% of industrial output value. By 2007, there were 154 industrial parks and export processing zones nationally, approximately two-thirds of which are located in the Red – Thai Binh, Dong Nai and SERC basins. By 2010, it is expected that 35% of all manufacturing enterprises will be located within industrial estates, mostly in Southern Viet Nam.

Industry generates significant demand for groundwater. By 2015, industrial water use will more than double with the greatest increases projected for the Red, the Dong Nai, SERC, Cuu Long, and Thu Bon & Vu Gia basins.

Despite the relatively large and increasing number of industrial estates, there are only 43 centralised wastewater treatment plants. Almost half of the non-state owned enterprises are located outside of industrial zones, presumably with little or no wastewater treatment. It is estimated that in 2006 there were 2,803 industrial enterprises nationally, discharging about 155 million m³ a year of wastewater - or 850,000 m³ a day. This represents about 340 Olympic-sized swimming pools of untreated wastewater being discharged every day across Viet Nam, but in concentrated locations.

Many industrial establishments come under direct Government control. The state sector contributes approximately 40% of Viet Nam's GDP. Many line ministries are owners and managers of industries which are among the most polluting in the country. Technological renovation in Viet Nam is at a much slower pace than in many neighbouring countries.

Plans have been approved by the Prime Minister (Decision 64/2003) to tackle environmental pollution by industrial establishments. However, by the end of Stage 1 only around 63% of the listed black spots have been resolved. Prime Ministerial Decree No. 67/2003 seeks to use pollution charges to limit the environmental pollution caused by wastewater, to use clean water economically and to create a funding source for the Environmental Protection Fund. However, at present, fees are not being uniformly applied and not all provinces participate.

Current status – Craft villages

The craft village industry has witnessed phenomenal growth, especially in the Red – Thai Binh basin, where 60% of craft industries are located. Craft villages are seen as an important measure for promoting economic development in rural areas, where 75% of Viet Nam's population still reside. Average income per capita in craft villages is up to five times higher than in villages devoted to agriculture. By 2002, the number of craft villages was assessed at



Across the country, industrial expansion is providing major economic and social benefits to many. However, it is also having major impacts on the quality of people's living environment – water quality is polluted and wildlife and natural areas, such as wetlands, are being diminished or lost. The rapid development of craft villages has also contributed to this problem. Viet Nam has yet to fully reconcile the trade off between development that will yield short term benefits but at enormous long term costs, and more sustainable models of economic development. Some Government initiatives have been undertaken, but in many cases the impacts of industrial and craft village pollution are extreme and are only likely to get worse over the coming years.

over 2,000, providing more than 10 million jobs or 29% of the rural workforce. An estimated 40,500 enterprises are located in craft villages, around 80% of those being family businesses with 1 to 3 employees.

However, craft villages are seemingly victims of their own success, with high occupational health risk and exposure to pollution. Almost all village households use their houses and gardens as production sites, meaning that waste is discharged directly into the surrounding environment. This directly affects surface water and groundwater, impacting on the drinking water for the villages. Water pollution from craft villages is a serious and growing problem.

Major issues - industry and craft villages

Major industrial and craft village issues are as follows:

- *Industry is growing rapidly with major impacts on water.*
- *Industry is concentrated which creates environmental problems, but also opportunities in terms of a more focused management approach.*

- *Populations are growing and concentrating around industrial areas.*
- *Industrial pollution will continue to increase as industry grows.*
- *The toxicity and complexity of pollution will increase as industry grows.*
- *Incomplete application of Decision 64.*
- *The production at craft villages is causing serious environmental pollution.*
- *The environmental performance of State Enterprises is poor.*
- *Lack of water use and wastewater discharge monitoring.*
- *Environmental protection processes are inadequate to deal with the booming development.*
- *Poor application of the environmental protection fee.*
- *Lack of enforcement and inspectorate.*



Current status – Hydropower

The hydropower sub-sector is one which will have a major impact on water resources in many river basins. Over recent years the development of hydropower has been growing rapidly and this is set to continue to meet energy targets. The latest master plan for power, Master Plan VI, seeks to satisfy electricity demands from 2006–2015, with an outlook to 2025. It provides for the building of about 26 more reservoirs, some of which are under construction. The unit cost of hydropower is much less than other types of power generation in Viet Nam.

From 1995 to 2005, the capacity for electricity production almost tripled: however, this is still insufficient to meet demand. By 2010, hydropower will provide 42% of the nation's total power capacity. Hydropower in the Red-Thai Binh and Dong Nai systems accounts for more than 50% of the nation's internal hydropower capacity. Small hydropower generating facilities account for 11%. However, it should be noted that "small" hydropower does not imply that the impact on a river will be small – many of these schemes have large impacts.

Major increases in hydropower are planned for the future, mostly in the Red-Thai Binh basin, which will increase capacity more than fourfold. The SERC will contribute almost 16% of all internal hydropower capacity in the future, with an inter-basin transfer from the Dong Nai. By 2010, about 50% of the technical and economic potential hydropower capacity across the country will have been developed. By 2025, this is expected to increase to 83%, an extremely high proportion by international comparisons, particularly given Viet Nam's relatively small hydropower potential. This projected level of development will put great pressure on river basins.

Cooperation with other countries is essential for meeting energy demand forecasts, and hydropower developments in Lao, Cambodia and China are expected to contribute substantially. Viet Nam is expected to import almost 6,000 MW of hydropower by 2025.

The Government's energy reform agenda is slowly transforming the function of Government from one of an operator to that of a regulator, as the private sector increasingly becomes involved in energy supply. Because these reforms are predicated on market mechanisms, a strong regulatory framework needs to be created with clear, well communicated

processes and rules that apply to both government and non-government operators.

Unfortunately in Viet Nam, the nature of important parts of the water sector are not yet up to what will be required – EIA processes are weak, clear and unambiguous water rights are not established providing a poor basis for business investment, the water needs of all users have yet to be adequately considered, especially for the needs of lower river communities, environmental water requirements need to be established and put in place, etc. A cautious approach would appear to be advisable to avoid any potential compensatory claims in the future.

Major issues - Hydropower

Major hydropower issues are as follows:

- *Integrated management and coordination between the hydropower and other sectors.*
- *Multi-purpose use of reservoirs and regulatory controls.*
- *International cooperation.*
- *The need for full assessment of the ability of a river basin to provide the necessary water volumes with no or limited detriment to other water users and uses.*
- *Inter-basin water transfers, particularly out of the Dong Nai, which is already highly stressed.*
- *Lack of consideration of down river flows in reservoir design and operation.*
- *Regulatory environment, especially with more involvement of the private sector.*
- *Promotion of small hydropower projects with no, or limited, impact assessment.*
- *Social impacts and environmental impacts are not properly recognised.*
- *Benefit sharing recognized concepts need to be embraced.*
- *Participatory mechanisms.*
- *Awareness of the impacts of hydropower and the impact mitigation options.*



Current status – Waterway navigation

Waterway navigation is often the forgotten part of the water sector. Its needs are not considered in water decision-making and are often compromised by other decisions, such as bridge building. However, the future of the sub-sector should be determined by economics – to what extent can the sub-sector provide transport navigation services at cost recovery levels that are economically attractive to businesses.

In 2006, the transport of cargo on inland waterways accounted for almost 20% of the total cargo transported, and passenger transport was about 13% of the total. Inland waterway transport is low cost relative to other transport modes, and it can carry oversized cargo long distances; however, it is slower, weather-dependent and does not provide a door to door service.

There are many environmental impacts from navigation activities, such as oil spills. There were 223 accidents on inland waterways in 2006, mostly in the Red – Thai Binh basin, which resulted in the sinking of 195 vessels, 213 deaths, and 14 injuries.

Major issues - Waterway navigation

Major navigation issues are as follows:

- *Integrated management and coordination with other sub-sectors.*
- *Low level of awareness and investment from within Government and the community.*
- *International cooperation in shared rivers.*
- *Navigation obstacles and barriers on many rivers.*
- *Impacts of dredging and sand exploitation.*
- *Impacts of aquaculture developments.*
- *Environmental impacts of navigation activities.*
- *Management, capacity and financing shortcomings.*



4 - Sustaining agriculture and aquaculture

Current status - irrigation

Today, the irrigation supply is inefficient, its infrastructure is old and dilapidated, and it is totally reliant on state budgets and ODA to keep the systems going. At current funding levels, with irrigation water now being free of charge, and despite some ODA rehabilitation, all systems are progressively deteriorating and some will eventually be non-viable, either partially or fully. Despite some successes, farmers still have relatively little say in system management, and there is little incentive for them to get involved.

The irrigation systems are set up for paddy rice, with water supplied by the Irrigation Management Companies (IMCs) to meet these water requirements. As supply is top down for paddy rice rather than farmer driven, crop diversification is difficult. While irrigation reform will always prove a dilemma for the Government, given the rural poverty situation, hard decisions will need to be taken on the extent to which major reforms can be embraced over time to create an innovative and progressive irrigation sector.

The sector is projected to continue to grow at a modest rate. Irrigation remains the largest user of water and the Cuu Long and Red – Thai Binh basins account for almost 70% of the use. The Cuu Long has the greatest irrigation water use per capita at over 1,600 m³ per person per year. Most basins have a figure of much less than 1,000 m³ per person per year. Paddy field rice accounts for 82% of the irrigated area. The relatively strong growth in production over the past 14 years has resulted largely from a process of intensification - there has been little investment in new irrigation capacity or in the rehabilitation of facilities.

In most river basins, the agricultural sector's contribution to GDP has dropped from 80-90% to 30-50%, although it remains a significant economic activity, and is not declining.

Agricultural chemicals are used by a high proportion of the population and on extensive land areas. The WSR reported on a study on chemical use which found that most pesticides used were of high toxicity, levels of exposure were unnecessarily high, costs of chemical use were high, but their efficiency was low. Most farmers had little awareness of proper pesticide use and many were suffering from pesticide poisoning problems as a result.

Until very recently, individual farmers paid 'irrigation service fees' (ISF) to cover at least a proportion of the operation and maintenance costs associated with irrigation water delivery by both IMCs and Water User Associations (WUA). Although not adequate to meet operation and maintenance requirements, these fees provided a substantial proportion of the budget for IMCs. In 2008, this fee was essentially abolished.

Major issues - irrigation

Major irrigation issues are as follows:

- Efficiency of irrigation water supply and use.
- Old and deteriorating hydraulic works, on which irrigation depends.
- Lack of financing for irrigation management.



Strong irrigation development over many years has ensured food security and has turned Viet Nam into a major exporter of rice. Water supply for growing paddy rice is at the very core of most rural communities. As such, irrigation management is steeped in tradition and is now in effect a means of providing social services to most rural people.

- *Water quality in food production.*
- *Excessive use of fertilizers and pesticides.*
- *Multi-purpose use of irrigation reservoirs.*
- *Institutional, legal and policy frameworks.*
- *State management of irrigation.*
- *Irrigation scheme management.*
- *Irrigation management capacity.*

Current status - aquaculture

The fisheries sector provides about half of the supply of animal protein to the human diet. Total earnings make it the third most important export-oriented sector. More than three million people are directly employed and nearly 10% of the population derive its main income from fisheries.

Aquaculture has grown significantly in recent years, where the freshwater sub-sector remains dominant at approximately 65-70%. Most fishermen and those involved in aquaculture are small-scale producers – 77% of households conducting aquaculture have pond areas of under 0.1 ha. More recently some cooperatives have been established. The biggest source of fishing and aquaculture income is generated within the Mekong Delta, where between 60% and 70% of households are involved in some form of aquaculture, involving employment of over 600,000 workers. Shrimp aquaculture accounts for more than half of this.

The value of production of aquaculture in river basins varies considerably – from 15,300 VND/m³ of water used in the Kone basin, to a low of 3,800 VND/m³ of water used in the Cuu Long.

The number of State Fishery Enterprises (SFEs) in the sector has decreased steadily but remains significant. Most coastal provinces own one or more state enterprises in the fisheries sector. SFEs are characterised as having low efficiency and are often unprofitable. The emergence of food safety requirements as barriers to accessing international markets is significantly re-shaping the industry structure.

While there are many water related threats arising from activities within the fisheries sub-sector, it is aquaculture and the fisheries processing industries that contribute to significant water source degradation through water use and pollution.

Major issues

Major fisheries and aquaculture issues are as follows:

- *Water quality and pollution from fisheries processing.*
- *Water quality and pollution from aquaculture.*
- *Poor water quality poses a threat to aquaculture.*
- *Loss of mangrove forests.*
- *The performance of the State Fisheries Enterprises.*
- *Information, research and capacity building.*



SECTOR MANAGEMENT – ADOPTING AN IWRM APPROACH

There is often a perception that “water” is a vital public resource and an essential component of life for people, and therefore cannot be treated like other utilities such as electricity or gas. As a result, essential reforms required in the water sector often lag well behind those of other utility areas.

River basin planning is an example. The various plans so far prepared for the Dong Nai basin have not prevented this river, vital in providing water and electricity to Viet Nam’s economic hub, from becoming one of the most highly stressed and polluted in the country. The current demands placed on this river basin are already causing water shortages and stress; while future demands are likely to be even greater.

It is therefore apparent that past approaches to river basin planning in Viet Nam have not been effective, and that new IWRM planning approaches are urgently required. However, in terms of the effective adoption and implementation of IWRM approaches, a number of challenges are being faced:

- *Availability of reliable data and information is lacking. Whilst some initial steps have been taken to improve the situation, this is still one of the most serious issues hindering effective decision making.*
- *Rights to water are not defined and, although licensing is underway, it lacks focus and adequate resources.*
- *Water quality management efforts are not effective, with serious pollution increasing in many urban/industrial centres, posing a growing threat to human health. In the immediate future the pollution levels will only get worse.*
- *Environmental protection provisions are inadequate, and cannot keep pace with economic development.*
- *Policy positions are often unclear on a number of issues, which are necessary to ensure effective IWRM.*
- *Awareness of water issues throughout all levels of Government and within the broader community is poor, and capacity to take IWRM initiatives is poor.*

The Government of Viet Nam is supported in the planning and management of the water sector by its International Development Partners (IDPs), who provide enormous support to the water sector. However, it is clear that many IDPs, a number of whom are significant donors, continue to act in isolation from one another, often leading to duplication and overlaps, whereas the adoption of a more common strategic approach by the IDPs - working together more regularly on projects to meet common objectives – would be much more beneficial.

Much ODA support remains focussed on the traditional water sector areas. Current international investments reflect a strong development focus with



Many of the issues currently facing the sector were identified in the first Water Sector Review carried out a decade ago. Current water sector management is dominated by traditional water management approaches, rather than more progressive Integrated Water Resources Management (IWRM) approaches, which are still very much in their infancy in Viet Nam.

an emphasis on infrastructure. Whilst the need for and level of support for these projects may be appropriate and necessary, many other equally important areas of water sector management receive negligible support, and the lack of investment in some of the necessary tools of IWRM is striking. Investment in these tools is essential if the water sector in Viet Nam is to operate on a sustainable basis.

Many of these IWRM issues, which have been apparent for some time, could be addressed through more proactive action and support on the part of the Government and IDPs.



ISSUES AND OPTIONS FOR THE FUTURE

Having examined the current status of the various sub-sectors together with some of the major issues facing each one, this section outlines some of the cross-cutting issues facing the Water Sector in Viet Nam as a whole.

Institutional and legal arrangements. There are a number of grey areas in terms of legal and institutional arrangements. At times, laws appear to conflict, and this needs to be addressed in the current review of the Law on Water Resources (LWR). The roles of different institutions are not clearly understood leading to confusion and at times conflicting messages to stakeholders. This applies generally to the relationship between Ministries and Departments and Provinces, as well as to the hierarchy of Laws governing the activities of both the public and private participants. There is also considerable work required to properly implement institutional arrangements based on the separation of resource manager/regulator from the operators.

International cooperation. More than 60% of surface water is generated outside the country. Nearly 57% of the total water is in the Cuu Long basin and of that 95% comes from the Mekong River. In this context, the intensive hydropower development that is occurring in other countries in the Mekong Region should be of major concern to Viet Nam. It is in Viet Nam's interest to ensure that the provisions of the Mekong River Commission's Procedures for Notification, Prior Consultation and Agreement under the 1996 Mekong Agreement are closely followed. A further 16% of Viet Nam's total water is found in the Red-Thai Binh basin and 40% of this comes from China. China is also planning many hydropower projects, but there is little consultation with Viet Nam on these proposals or their impacts on the country's water resources.

Conflicting/uncoordinated uses. There is little planning or coordination between the sectors, which leads to unintended, uncosted and unmitigated impacts of one sector on another.

Inter-reservoir operation rules. The NWRS found that many reservoirs have been designed without proper consideration of the adequacy of downstream flows, leading to severe depletion of flows and increasing salt intrusion, and reducing the access to good water for the residents living in the lower reaches of rivers. Most projects for water resources exploitation and use have been designed to serve one particular purpose, with combined uses, if any, not planned. For a number of river basins a complicated system of dams and reservoirs along rivers and tributaries have been developing making it very difficult to manage flows and ensure minimum flows are maintained. Presently, in some river basins, inter-reservoir operation rules have been developed for flood control only, with no rules developed to regulate flows in the dry season, resulting in inappropriate water use, conflicts, degraded and dried-up rivers.

In order to ensure minimum levels, flood protection and access to water during dry seasons, reservoir operation rules need to be urgently



A number of generic cross-cutting issues have been identified which are posing challenges across all of the water sub-sectors, as well as to the water sector itself. Unless there are moves to address some or all of these fundamental issues, it is unlikely that the myriad issues facing the water sector and its sub-sectors will be able to be speedily and easily resolved - to the detriment of the economic, environmental and social development of the country.

established. These will also be necessary in many cases to ensure water allocation and sharing plans are optimally implemented in many basins.

River Basin Coordination. Viet Nam has found it difficult to embrace this approach in a meaningful and practical way. As a result, Government implementation of the new river basin management decree (120/2008) is critical.

Water Sharing Policies. The lack of water sharing policies at a river basin scale is becoming increasingly problematic. There is serious competition between sectors for dry season flows in some areas, and for the competing environmental, social and economic values that rely on natural rivers. Limits to the amount of water that can be extracted have not been established and new extractions can take place at any time. Water rights are not defined and there is no certainty for the sectors, or for private investment, as a result, the risks to existing development are unknown. This in itself is likely to lead to inefficient and unsustainable investment and development.

Impact assessment of projects. Currently the assessment of the water resource and environmental impacts of projects is poor. Other sectoral interests, and the impacts on flows and other water uses, are not fully considered in the process from inception.

Regulatory environments. The private sector is becoming increasingly involved in all sectors, and the Government will slowly transform its functions from one of operator to that of regulator. To provide for this, a strong regulatory environment, with clear, well communicated processes and rules that apply to both government and non-government operators, is required. At this stage, this regulatory framework is not in place - roles and functions are often unclear and appear conflicting, there are few environmental safeguards built into sector policies, laws, and supporting documents, and monitoring and compliance activities are largely absent. Clear water rights are not in place.

Performance of the State Enterprises. The performance of the State Enterprises is a major issue. On the one hand, some SOEs need far greater autonomy from government interference to be provided with business flexibility within a regulatory framework that protects communities, customers and the environment. However, other SOEs are involved in production activities of a commercial nature generally undertaken by the private sector. Typically these SOEs are inefficient operators with a very poor environmental performance. Sadly, many of the worst polluters in the country are Government-owned.

Water licensing. There is little meaningful coverage of water licensing in accordance with the LWR. Currently licensing is seen as an end in itself, rather than a tool to achieve water resource management, sharing and protection objectives and outcomes. There is a lack of acceptance of the need for licensing by most sectors. It is not only the central and provincial governments, but also the IDPs, that are not aware of, or fail to recognize the importance of, licensing of water resource exploitation and use, and of wastewater discharge.

Participation. Viet Nam, aided by the international community, is only now tentatively testing participatory approaches. A significant cultural shift will be required, both within government and outside, if these approaches are to succeed and the benefits to the sectors and communities are to be realised.

Capacity and awareness. Awareness of water resource management issues, and water sub-sector issues, their interaction with other sub-sectors, and the regulatory environment, is deficient in the Government, Ministries, and provincial governments and departments. The agencies themselves have little understanding of, or practical training in, integrated approaches to resource allocation, development and protection. As the government role slowly changes to one of planner and regulator, a different skill set will be required within Government agencies, both centrally and at the provincial level. Capacity building is urgently required, and potentially a re-distribution of human resources.

Financing. Water and water services are currently well under-priced in Viet Nam and the water sector generally has survived on subsidies and ODA. Furthermore, the pricing policy is neither efficient nor equitable and has led to a dearth of financial resources for infrastructure management. Therefore, more investment in the water sector must recognize that water pricing is an essential instrument to enhance the sustainability of the resource, meet operation and maintenance costs, expand services, maintain water resources management functions, etc. Most improvements in the water related sectors will not occur if governments do not consider developing socially acceptable pricing and tariff policies. This issue must also recognize that in a number of situations, full cost recovery may not be achievable at all due to social considerations or because of previous inefficient decisions on capital infrastructure. However, such costs should be clearly agreed and disclosed as a transparent subsidy.

Improvement in basic survey and information. Good information, freely available and reliable, is paramount; yet it is probably one of the greatest problems for IWRM in the immediate future in Viet Nam. Currently, there is no accurate source of water resources data and information. Little data is available,

except perhaps for surface water quantity. The current observation network, mainly for surface water, has so far only been used for the construction of irrigation and other reservoirs and works, and flood protection works. There is no comprehensive inventory and assessment of water resources which all decision makers can use. Data and information, obtained with state funding, is often treated as an economic good. Tools for making decisions in a data-poor environment are urgently required.

Climate change. The projected impacts of climate change – more intensive rainfall runoff in the wet season, and sea level rise – are of grave concern and the Government has recently approved a NTP on this matter.



THE WAY AHEAD

Water Sector Reform and Priorities – a pathway to Integrated Water Resources Management (IWRM)

The WSR contains more than 150 detailed recommendations, which are grouped into five major outputs (see figure opposite), so that the structure of the sector and the range of outputs can be understood and assessed in a simple and logical way.

Together, the activities under these five output groups are intended to achieve the overall goal for the water sector:

To manage, use and protect the water resources of Viet Nam in an integrated and comprehensive manner to ensure that economic growth, poverty reduction, environmental health and the quality of life are sustainable in accordance with the goals of the Government.

The immediate priorities of the WSR are as follows.

- **Output Group 1:** *The system of legislation, policies, and strategies on water resources developed*

This Output Group is about setting the framework for IWRM at the national level. Within this framework, provinces and others (e.g. Ministries, provincial planners, river basin organisations) can make decisions at their regional or local level that are consistent with the key directions and policies of the Government. Without this framework, decisions and management will be ad-hoc with different ministries/provinces applying different policy positions to deal with the same issue.

The immediate priorities are: (i) revising the Law on Water Resources; (ii) establishing stronger arrangements for the operation of the National Water Resources Council; (iii) preparing the strategic plan to implement the Government's National Water Resources Strategy; (iv) developing a legal basis and implementation framework for river basin management to achieve IWRM; (v) developing processes and methodologies for determining the "real potential" of water sources as a basis for sustainable management; (vi) developing a water rights and sharing framework; (vii) developing an environmental flows framework and methodology; (viii) developing a national policy on water sector financing; (ix) strengthening institutional arrangements for urban water service delivery and natural disaster management; and (x) strengthening international relations for water management.



The Water Sector Review Project has set out a comprehensive programme of activities and actions for water sector reform. The overall aim has been to design a package of measures that would start Viet Nam on a pathway towards IWRM and make significant achievements over a 5 to 10 year timeframe.

- **Output Group 2:** *Improve the social environment and living conditions for vulnerable people, especially the poor (including social empowerment)*

This Output Group covers the fundamental Government initiative for improving health, living conditions and opportunities of the rural poor including ethnic minorities. It also covers activities that minimize the effects of natural hazards, and that share the benefits of major development with the people directly affected by those developments

The immediate priorities are: (i) preparing a strategic approach to selecting priorities for pro-poor rural development and irrigation diversification; (ii) preparing uniform and appropriate health standards for both water supply and sanitation (rural and urban); (iii) greatly strengthening the implementation of NPT II for rural water supply and sanitation; (iv) preparing natural hazard management plans for the highest priority river basins (Huong, Tra Khuc, Thu Bon & Vu Gia and Kone); and (v) implementing the concept of benefit sharing for hydropower plants.

- **Output Group 3:** *Effective management and sustainable use of water resources*

Activities under this Output Group will provide the framework within which decisions can be taken on how sectors, businesses, individuals, etc. can take and use water resources. These activities will work within the framework provided under Output Group 1. These activities are also about the sustainable use of water resources – so that while environmental considerations are factored in, environmental health itself is covered in Output Group 4.

The immediate priorities are: (i) development of inter-reservoir operation rules for priority river basins, starting with the Red River; (ii) preparing water sharing component plans for highest priority river basins (Dong Nai, Red, Thu Bon and Ma); (iii) preparing aquifer sharing plans for priority groundwater areas requiring the management of water extractions (Red River delta aquifer, aquifer around HCMC, central highlands); (iv) preparing rapid assessment framework level plans for areas with significant hydropower development; (v) reviewing all proposals for further reservoir/inter-basin diversion against agreed framework and water

sharing plans; (vi) urgently developing infrastructure for urban water supply; (vii) setting meaningful water prices and charges for water supply and other service provision; (viii) reforming water extraction licensing; (ix) undertaking a programme to reduce unaccounted for water in urban areas; and (x) undertaking a programme to increase water efficiency in irrigation areas.

- **Output Group 4:** *Water related biodiversity conserved, pollution prevented and environmental quality improved*

In practice, Output Groups 3 and 4 need to work together so that activities in one do not unnecessarily compromise activities in the other. The way to achieve this is through the various planning processes particularly river basin and land use planning.

The immediate priorities are: (i) preparing water source protection plans³ for the Dong Nai basin, including Ba Ria - Vung Tau, and Red River; (ii) urgently developing infrastructure for urban sanitation services; (iii) urgently developing infrastructure for the treatment of hospital waste; (iv) establishing community environmental values and objectives as a basis for water source protection; (v) developing further implementation guidelines for Decree 67/2003 and lead capacity building; (vi) reform of water extraction licensing; and (vii) provide incentives for the more effective implementation of Decision 64/2003.

- **Output Group 5:** *Institutional capacity strengthening*

This is the ‘enabling’ group of outputs that will provide the tools, skills and facilities to make the other outputs happen more effectively.

The immediate priorities are: (i) urgently implementing National water and related data and information management programmes for basic survey and inventory; (ii) developing a National water data and information programme for climate change; (iii) enhancing capacity at all levels (particularly for provinces) for the implementation of IWRM approaches; (iv) strengthening the involvement of farmers

³ Where component river basin plans are proposed for the same river basins under different output groups, they should be prepared together.

in irrigation scheme decision making; and (v) implementing water education programs carefully targeted to community behaviour.

Conclusions

The clear conclusion from this Water Sector Review is that fundamental changes are urgently required if Viet Nam is indeed to start to make meaningful progress towards IWRM, consistent with good international practice. A significant cultural shift will be required, both within and outside of government, if these approaches are to succeed and the benefits to the sectors, governments and communities are to be realized. Traditional thinking and practices must be transformed and new concepts embraced.

The recommendations and the activities program set out what is required not only to start Viet Nam on the pathway to IWRM, but also to take significant steps along the path. However, it is a very ambitious program and will require a number of essential prerequisites for it to succeed:

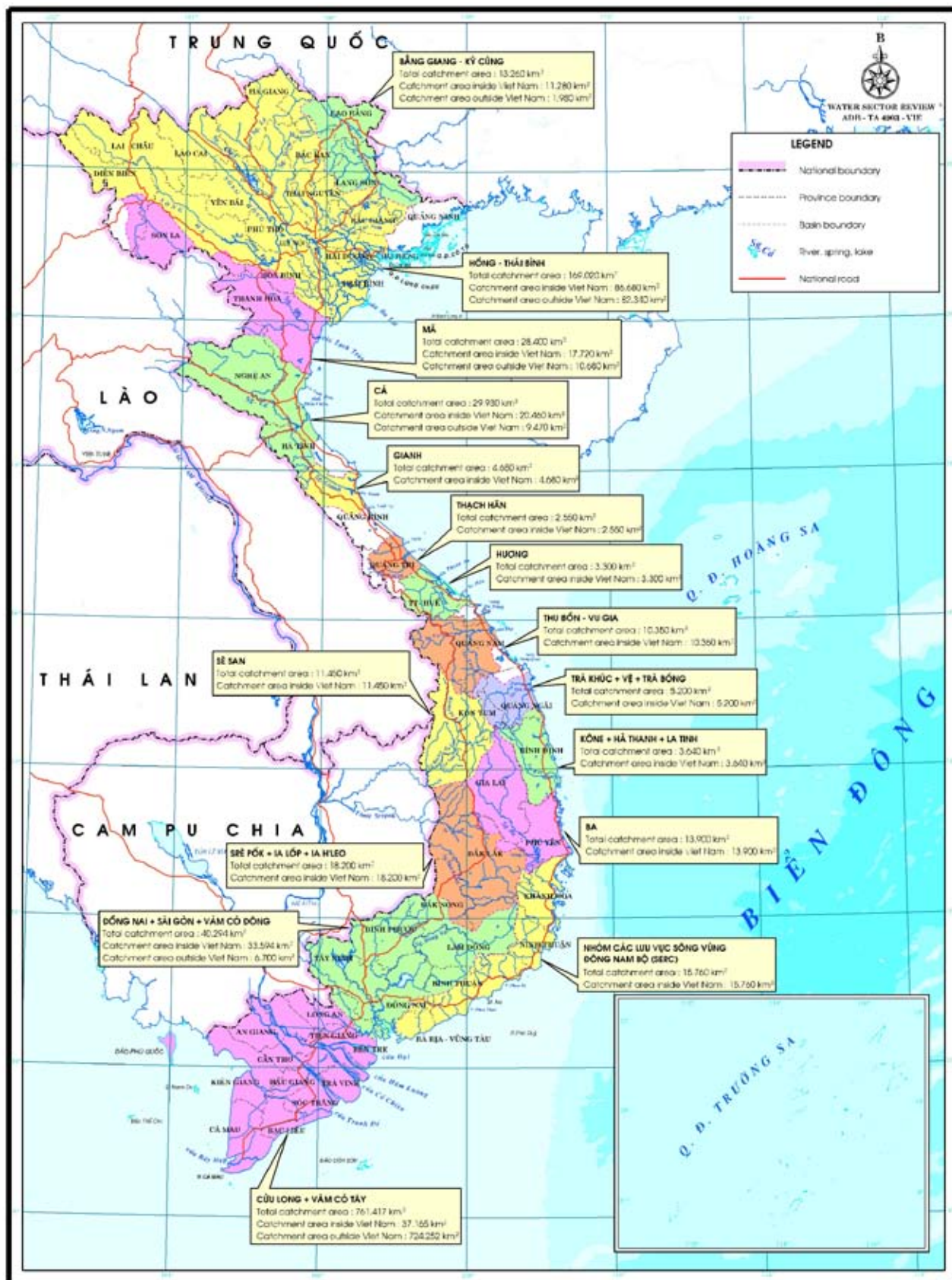
- **Considerable understanding and support from the Government.** *Central to this will be the urgent implementation of the recommendation for greatly strengthening the role of the NWRC and the establishment of a working structure under that, to ensure that the key Ministries can work together on the key recommendations that affect many Ministries.*
- **Considerable understanding and support from the IDPs.** *Increased resources in key areas are required for this, not only in new infrastructure (mostly water and sanitation) but just as importantly in IWRM – laws, policies, basin planning, water rights, water source protection and other IWRM tools. IDP input would be greatly strengthened if it were integrated under a common framework based on all or part of the programme presented in the Final Report of the Water Sector Review Project.*
- **Considerable support from the Government to MoNRE, as the state resource manager.** *Without strong and effective leadership, IWRM will be at best piecemeal and ineffective, traditional approaches will prevail, and most river basins will continue on their current downward spiral. Basin communities will bear the brunt of inaction and*

an infinitely more serious problem will need to be resolved in the future. A significant injection of resources will be required and the IDPs should assist with this.

It remains for the Government, International Development Partners and other interested parties to digest the WSR report, determine their reaction to the program proposed and to plan the roadmap for the future. In doing this, it must be recognized that some hard trade-offs will need to be made. It is unlikely to be possible to achieve all the measures and fund all sub-sectors according to the recommendations, and priorities will have to be set. In a poor country as intensively exposed to economic growth as Viet Nam, it will be a challenge to precisely identify and resolve the right trade-offs. This process should be a cooperative activity between the Government and the IDPs. It is recommended that a common program between the Government and all of the main IDPs be developed, a detailed implementation plan prepared, and a process for the review and audit of performance established.

In October 2008, the National Water Resources Council held a high level meeting to discuss the Draft Final Report of the Water Sector Review Project. The meeting was chaired by Deputy Prime Minister HE Hoang Trung Hai, and attended by Council members and high-level delegates from the Ministries and the International Development Partners (IDPs). At the meeting, the Government members and the IDPs generally accepted the Report as setting out the water sector situation, and providing the broad thrust and future directions for water sector development in Viet Nam. The draft Report was accepted as a basis for the future management and development of the sector.

The meeting also agreed that, to provide a concentrated focus and drive to deal with the critical challenges facing the sector, a National Target Program (NTP) would be prepared. The Deputy Prime Minister agreed to this, and with assistance from the Netherlands Government, and coordination by ADB, the NTP is currently under preparation.



APPENDIX

RIVER BASIN SUMMARIES

The Bang Giang – Ky Cung has about 1% of the national water resources, with its surface water sources still in a relatively natural condition. This is due to the relatively low population density, the inaccessibility of the terrain, and its unsuitability for large scale irrigation development. Dry season water availability is adequate by international standards, but local or irregular water shortages may occur. Ethnic minorities make up a very high proportion of a sparse population that is amongst the poorest in the country, and they are poorly serviced in terms of water supply and sanitation. The basin includes terrestrial and aquatic ecosystems but, particularly below 1,000 m, shows extensive forest clearing and severely reduced biodiversity. The rivers of this basin both flow from, and to, China, making it susceptible to changes in water management across the border.

The Red - Thai Binh receives almost 40% of its water from China, so is vulnerable to changes in upstream water management. The basin has over 16% of the nation's water, produces over 25% of GDP, and has about 26% of total irrigation water use. The basin currently accounts for about a quarter of the nation's total water use. The irrigation development is, however, relatively inefficient and low value, being mainly for paddy rice. Hydropower in the basin accounts for roughly 10% of all 2010 energy production capacity, and 25% of the nation's hydropower capacity. By 2025 hydropower generating capacity is projected to increase by 260% and will represent 93% of the technical and economic capacity of the basin.

Despite an apparent water richness, the basin has a third of the Country's population, with a high population density, and the annual water availability per capita is low compared with other parts of the country. Dry season water availability is considered adequate by international standards, but local or irregular water shortages may occur. The current dry season stress level is at the high end of the moderate stress range. Under 2025 projected populations and water demands, the basin would be experiencing dry season water shortages and the stress level would be in the high stress range.

Groundwater is a significant resource in the basin for urban, rural and industrial uses. There are major concerns about the sustainability of current extractions in some areas, and water levels have dropped by up to 30 meters in parts of Hanoi. Groundwater quality is also being impacted by land use activities, posing significant risks to users. The delta areas of the basin are one of the areas potentially most affected by sea level rise.

The basin has large numbers of poverty affected people – over 6.5 million. The concentration of urban populations, large areas of irrigation, and high concentrations of some of the most significant industrial developments in the country, including most craft villages, are resulting in serious water quality deterioration in some areas, both surface water and groundwater. Given the major urban population centers, the basin is fairly well serviced in terms of water supply and sanitation, except in towns under the control of district authorities. Navigation is important in the basin, particularly for transport of heavy construction and materials that are difficult to transport by other means. The coastal zone of the Red River Delta supports a great diversity of wildlife, but with the high population and intensified aquaculture production, the Delta is most at risk of losing the natural and semi-natural wetland habitats and the essential functions they provide.



The following is a summary of the main findings of the WSR for each river basin. The basins can be seen on the map on Page 28 (opposite). It should also be remembered that in terms of the data used, “current” generally means the year 2006.

The Ma basin has 30% of its water originating in Laos. The basin about 2.5% of the nation's water, produces about 3% of GDP, and has about 6.5% of total irrigation water use. The annual water availability per capita is low compared with other parts of the country. Dry season water availability is less than that considered adequate by international standards and local or irregular water shortages occur. The basin has significant issues with water supply, suffering very high hydrologic stress assessed in terms of proportion of flows extracted for use. The current dry season stress level is at the high end of the high stress range. Hydropower generating capacity is projected to increase by 650% by 2025, representing over 70% of the technical and economic capacity of the basin. Under 2020 projected population and water demands, in the dry season the stress level would be at the 100% stress point – the total dry season water would be needed to meet projected demands each year, clearly a totally unsustainable level.

There is a large amount of low value irrigation from fairly inefficient schemes. The basin has the highest proportion of poor households of any basin, and a large ethnic minority population, with low GDP per capita, and relative poor environmental quality. It is, however, relatively well serviced in terms of water supply and sanitation, except in towns under the control of district authorities.

The Ca basin has 22% of its water coming from Laos. The basin has nearly 3% of the nation's water, produces about 3% of GDP, and has about 2.5% of total irrigation water use. Currently the basin is not as water stressed as the Ma, with less irrigation development, and therefore a greater volume of available water per capita. Hydropower generating capacity is projected to increase by 133% by 2025, representing over 77% of the technical and economic capacity of the basin. By 2020 the Ca would be experiencing shortages in the dry season and it would be at the high end of the moderate stress range. A large proportion of households remain in poverty, and the supply of clean water at the district level is amongst the worst in the country. Rich forest still covers a long strip of the Truong Son Range, near the Laos border.

The Gianh basin is naturally relatively water scarce, but it has a relatively low population density, and the water resources are not substantially developed, so the availability of water per capita is adequate. The basin has about 1% of the nation's water, produces about 0.4% of GDP, and has about 0.1% of total irrigation water use. By 2020 water extractions would see the basin at the low end of the moderate stress range. Irrigation development in the basin is of very low value in terms of returns per unit of water use, compared to other basins.

The basin has a high number of important species, significant conservation areas, and the flows are largely unregulated by dams. There are also 2 World Heritage areas in the basin (Phong Nha and Ke Bang). Aquaculture has developed on the back of these relatively natural flows. A large proportion of substantially rural households have, however, been assessed as living in poverty, and unemployment rates are high. Provision of clean water services is poor in urban areas controlled by both the province and district authorities, and sanitation services are available in less than half of district town households. Water quality appears to

have suffered as a result of this, and perhaps aquaculture practices. Disasters have a significant impact on the people of the basin, with more than 12 people per million of total population killed each year as a result.

The Thach Han basin has about 0.4% of the nation's water, produces about 3% of GDP, and has about 0.15% of total irrigation water use. It is the smallest in the country in terms of natural water availability. The water resources are not very developed, and while dry season water availability per capita is adequate by international standards, local or irregular water shortages may occur. This will worsen by 2020, but even then water extractions would see the basin in the low stress range. Given the low levels of development, GDP per capita is low compared to other basins. Supply of urban clean water at the district level is poor, as is the supply of clean water to rural households - the case for much of the Country. Disasters take a huge toll on this basin, with 15 people per million of population killed on average each year, and damage costs equivalent to more than 8% of the basin GDP per year.

The Huong basin has 0.8% of the nation's water, produces about 0.7% of GDP, and has about 2% of total irrigation water use. The basin is largely unregulated by major dams at present but three major hydropower dams are under construction. It has a high number of important native species. The basin has a high population density, and dry season water availability per capita is considered just adequate by international standards. The rivers are, however, currently highly stressed in terms of the proportion of water that is extracted. Current dry season extraction puts the river into the high stress category, which in turn will affect river health and the social and economic values that depend on this. Under 2025 projected population and water demands, in the dry season the stress level would be in the middle of the high stress range – almost all of the total dry season water would be needed to meet demands each year.

The basin has a relatively low GDP per capita, and ranks the lowest in terms of provision of clean water to rural households. By far the greatest issue in the basin is the impact of natural disasters. On average, more than 36 people per million of population die each year as a result of natural disasters, and damage costs are equivalent to about 6% of the basin GDP per year.

The Thu Bon & Vu Gia basin has about 2.5% of the nation's water, produces about 1.5% of GDP, and has about 2% of total irrigation water use. It is relatively well endowed with water, but the water use appears to be very inefficient, and the value of irrigation production per cubic meter of water use is low. In the dry season, as a result of extraction, the rivers of the basin are creeping up to the moderate stress level by international standards. Hydropower generating capacity is projected to increase by 275% by 2025, representing over 88% of the technical and economic capacity of the basin. By 2020 water extractions would see the basin in the middle of the moderate stress range. Again, the impacts of disasters on this central provinces basin are high, with 23 people per million of population killed on average each year, and damage costs equivalent to about 7% of the basin GDP per year. This basin also has high conservation importance.

The Tra Khuc basin has a relative small catchment area and total available water is quite limited. The basin has about 1.1% of the nation's water, produces about 0.8% of GDP, and has about 1.1% of total irrigation water use. Dry season flows are moderately stressed by international standards. Hydropower generating capacity is projected to increase by 2025, representing over 26% of the technical and economic capacity of the basin. Under 2025 projected populations and water demands, in the dry season the stress level would be in the lower end of the high stress range. Ethnic minorities make up a high proportion of the population that has the second lowest GDP per capita of any basin in the country. The basin is poorly serviced in terms of water supply and sanitation. It has significant areas of aquaculture development, and consequently seems to have significant water quality problems. The impacts of disasters on this basin are high, with 24 people per million of population killed on average each year, and damage costs equivalent to more than 1% of the basin GDP per year.

The Kone basin is a small coastal system and total available water is quite limited. The basin has about 1% of the nation's water, produces about 1.1% of GDP, and has about 1.4% of total irrigation water use. According to international standards of water availability, local or irregular water shortages may occur. The basin suffers from moderate dry season water stress in terms of extractions compared with flows. Under 2025 projected population and water demands, in the dry season the stress level would be in the middle of the high stress range – almost all of the total dry season water would be needed to meet demands each year. The population density is high and rural sanitation is poor. There are significant areas of aquaculture in the basin. Again, disasters play a significant role in the lives of people in the basin, with more than 22 people per million of population killed on average each year, and damage costs equivalent to about 1% of the basin GDP per year.

The Ba basin is moderately sized, and has about 1.2% of the nation's water, produces about 0.1% of GDP, and has about 2.5% of total irrigation water use. Both the annual and dry season water availability per capita appear to be adequate by international standards. However, both the annual and dry season water exploitation as a proportion of surface water are quite high, with the basin categorised as of high hydrological stress in the dry season. Under 2025 projected populations and water demands, in the dry season the stress level would be in the middle of the high stress range – almost all of the total dry season water would be needed to meet demands each year. Ethnic minorities make up a significant proportion of the population, and the GDP per capita is low. The basin is highly regulated by dams, but the value of irrigation per cubic meter of use is low. Water supply and sanitation services are generally relatively poor. About 7 people per million of population are killed on average each year by natural disasters, and damage costs equivalent to about 1.6% of the basin GDP.

The Dong Nai basin is the home to HCMC, and significant industrial development. The basin has about 4.2% of the nation's water, produces over 28% of GDP, and has

about 7.3% of total irrigation water use. Current annual water availability per capita is considered adequate by international standards, but local or irregular water shortages may occur. In the dry season, the picture is much more dramatic, with water availability per capita classed as almost 'water short'. Water is transferred out of the Dong Nai for hydropower generation in the SERC basins. Some further hydropower developments are planned representing over 90% of the technical and economic capacity of the basin. Although it has a high population density, water use per capita is also low, as agriculture plays a smaller role than in other basins. The rivers are, however, classed as of high hydrologic stress in the dry season. Under 2025 projected population and water demands, the basin would be experiencing serious dry season water shortages and the stress level would be in the middle of the high stress range – almost all of the total dry season water would be needed to meet demands each year.

The basin is comparatively well serviced in terms of water supply and sanitation, but the high population density and concentration of industrial activities are causing significant water quality problems. The basin is highly regulated by dams for generation of almost a quarter of the nation's hydropower. The hydrology has, therefore been significantly altered, with consequent impacts on river health. Navigation is important in the Dong Nai, particularly for transport to the industrial zones of heavy construction and plant materials that are difficult to transport by other means. Groundwater is a significant resource in the basin for urban, rural and industrial uses. There are major concerns about the sustainability of current groundwater extractions in some areas, and water levels have dropped by up to 30 meters in Ho Chi Minh City. Groundwater quality is also being impacted by land use activities, posing significant risks to users.

The SERC basin has about 1.1% of the nation's water, produces about 10.5% of GDP, and has about 2.2% of total irrigation water use. It is one of the 2 most hydrologically stressed in the country, with as much as 75% of the dry season flows being extracted – a very high stress classification. Even on an annual basis, the basins would be classed as moderately stressed. Including the inter-basin transfers in from the Dong Nai, dry season water availability per capita is the lowest in the country, classed as 'water short' by international standards. Under 2025 projected population and water demands, the basin would be experiencing serious dry season water shortages and the stress level would be well above the 100% line – even more than the total of all dry season water would be needed to meet demands each year.

The urban population has relatively good clean water and sanitation services, but the same cannot be said for the rural areas. With a large industrial sector, the GDP per capita is the highest in the Country. This figure is, however, significantly reduced if the economic activity associated with oil development of Ba Ria - Vung Tau is removed. There is a significant amount of aquaculture development in the provinces in this basin. Disasters also have a significant impact on these basins, with more than 15 people per million of population killed on average each year.

The Se San basin has about 1.6% of the nation's water, produces about 0.6% of GDP, and has about 0.3% of total irrigation water use. Over 70% of the water in the Se San flows to Cambodia, and there have been, and will continue to be, significant trans-boundary issues associated with this basin. It is developed for hydropower - it accounts for about 16% of the nation's hydropower generating capacity. Hydropower generating capacity is projected to increase by 114% by 2025, representing over 92% of the technical and economic capacity of the basin. Other surface water development is not extensive, and the rivers are not considered stressed. Water availability per capita is also high and this is not expected to change much by 2020. Flow patterns have, however, been changed as a result of the hydropower generation. The largely ethnic population does not appear to have shared in the benefits of hydropower development in the basin, and there has been significant dislocation of communities. The basin has a large proportion of households assessed as being in poverty, and the mountainous region is poorly serviced in terms of water supply and sanitation. Water used for irrigation provides a high return per cubic meter of water used, being for high value crops such as tea and coffee. Groundwater is used extensively in this basin, both for domestic supplies and irrigation. There is increasing competition for the groundwater, and extraction appears to be unsustainable in some areas, with water levels declining, and water supply becoming more difficult during the dry season. This in turn will have an impact on groundwater contributions to rivers flows.

The Sre Pok basin has about 1.8% of the nation's water, produces about 1.6% of GDP, and has about 1.2% of total irrigation water use. About 50% of the surface water in the Sre Pok flows to Cambodia, and there is currently no formal bilateral agreement on water management. Hydropower generating capacity is projected to increase by 112% by 2025, representing over 94% of the technical and economic capacity of the basin. By 2020 the basin would be experiencing shortages in the dry season and it would be at the high end of the moderate stress range. The basin is also a relatively poor mountainous area that is poorly serviced in terms of water supply and sanitation. Groundwater is also used extensively in this basin, both for domestic supplies and irrigation. There is increasing competition for the groundwater, and extraction appears to be unsustainable in some locations. Water levels are dropping, and access is becoming more difficult during the dry season. This in turn will have an impact on groundwater contributions to rivers flows.

The Cuu Long basin has nearly 60% of the nation's water, produces about 17.3% of GDP, and has over 44% of total irrigation water use. The Cuu Long receives 95% of its water from upstream countries, and is vulnerable to the water use and management arrangements that exist or are proposed in these. Development in the mid to upper basin remains a significant issue for the entire Mekong, and Viet Nam's continuing support for, and strengthening of, the Mekong River Council and Commission will be critical in this regard. The Cuu Long has nearly 60% of Viet Nam's water resources, and both annual and dry season water availability per capita are

more than adequate. The river does, however, fall into the moderate stress category in terms of proportion of flows extracted during the dry season. By 2020 the basin would, in the dry season, be at the low end of the high stress range.

The extensive irrigation water use occurs almost exclusively for paddy. The basin also hosts over 65% of the country's aquaculture, although the economic return per cubic meter of water used appears to be low compared to other areas. Groundwater is also used extensively in the Mekong Delta, and the sustainability of current extractions in some areas is being questioned. Water levels are declining, and there is some evidence of intrusion of salt water into the fresh groundwater as a result of extractions. The densely populated Cuu Long has poor levels of rural and urban sanitation at the district level. This, and the high concentration of aquaculture activities, is causing unacceptable water quality deterioration. The basin has high conservation values, especially for wetlands. It is also likely to be highly impacted by sea level rise. About 8.5 people per million of population are killed on average each year from natural disasters, and damage costs are equivalent to about 1.1% of the basin GDP.

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References

Note that contextual information and all of the documents and reports prepared under the Project are available at the website: www.vnwatersectorreview.com.

Water: Vital for Viet Nam's Future

The Water Sector Review is a joint project of the Government of Viet Nam and its international development partners. The project's immediate objective is to review the state of the Viet Nam water sector and to establish a common framework to guide development decisions in the sector over the forthcoming 10 years.

The project was funded by a number of development partners (the Royal Netherlands Embassy, Danida and AusAID), and led by the Asian Development Bank (ADB). The implementation of the project is taking place under the Office of the National Water Resources Council (NWRC). The World Bank funded a review of the irrigation and drainage subsector as part of the overall water sector review.

This brochure presents a summary of the state of Viet Nam's water resources within the context of rapid population and economic growth and structural change. It focuses on the Integrated Water Resources Management (IWRM) approach to management, and the arrangements needed to start Viet Nam on this pathway. It outlines in brief some of the complex and related issues that need to be included in a reform programme to provide the basis for investments over the next 10 or more years.

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