THAILAND ENVIRONMENT MONITOR

Integrated Water Resources Management: A Way Forward

June 2011



THE WORLD BANK

TABLE OF CONTENTS

ABBREVIATI	ONS	V
EXECUTIVE S	SUMMARY	vii
Chapter 1:	Overview on Integrated Water Resources Management (IWRM)	1
	1.1 Why IWRM?	1
	1.2 What are the implications in Thailand?	5
Chapter 2:	Thailand Water Resources Status	9
	2.1 Surface Water	9
	2.2 Water Storage	11
	2.3 Floods and Droughts	
	2.4 Groundwater Usage	15
	2.5 Water Quality	17
	2.6 Piped Water Supply Services	17
	2.7 Watershed and Land Use	
	2.8 Wetlands and Fisheries	20
Chapter 3:	Water Resources under Stress	23
	3.1 Economic and Population Growth	23
	3.2 Poverty, Agriculture, and Water Shortage	26
	3.3 Increasing Demand for Water Governance	
	3.4 Increasing Pressure on the Mekong Water Uses	
	3.5 Deforestation and Climate Change	
Chapter 4:	Policy, Institution, Management	
	4.1 Policy/Legal Frameworks	
	4.2 Institutional Framework	41
	4.3 Basin Plans and Budgets	45
	4.4 Monitoring and Evaluation	47
	4.5 Community Initiatives and National and International Support	48
	4.5 The King's Projects	
Chapter 5:	Challenges and Way Forward	53
	5.1 The Challenges/Opportunities	53
	5.2 Recommendations and Way Forward	64

LIST OF TABLES

Table 2.1: Water storage and irrigable area in 2004	
Table 2.2: Water storage and demand by region	
Table 2.3: Villages at Risk of Floods and Land/Mud slides (2004, by region)	
Table 2.4: Number of villages with risks for drought by region	
Table 2.5: Groundwater potential and extraction	
Table 3.1: Regional GDP 2009 at constant 1988 price	
Table 3.2: Water demand in 2004 and 2024	
Table 3.3: Waste Loads	
Table 3.4: Basic data on agriculture households	
Table 3.5: Agriculture-related data, 2004	
Table 3.6: Irrigated Area in Northeast Thailand (thousand Rai)	
Table 3.7: Development Potential	
Table 4.1: Institutional and legal frameworks related to water resources management	nt 44

LIST OF FIGURES

Figure 1.1: Simple framework for increasing water demand	
Figure 2.1: 2004 Annual average water runoff in m ³ per person per year	
Figure 2.2: Water Resource Pattern in the five regions	
Figure 2.3: Groundwater extraction per potential	
Figure 2.4: Forest degradation profile	
Figure 2.5: Production of aquaculture and capture fisheries in Thailand	
Figure 3.1: GNP per capita and population (1979-2009)	
Figure 3.2: Regional GDP ratio by major sectors	
Figure 3.3: Thailand's water shortage	
Figure 3.4: Number of people under poverty line (1988-2009)	
Figure 3.5: Percentage of people under poverty line by region	
Figure 3.6: Water stress in NE Thailand	
Figure 3.7: Mekong River Profile	
Figure 4.1: Connection among key agencies	
Figure 4.2: National Budget on Water Resources Management	
Figure 4.3: Monitoring and Evaluation (DWR)	

LIST OF BOXES

Box 1.1: Definition of IWRM	2
Box 1.2: IWRM Concept (GWP Southeast Asia, 2004)	3
Box 1.3: IWRM at MRC	4
Box 2.1: Reservoirs with capacity over 1,000 Mm ³	11
Box 2.2: Major floods, droughts, and natural disaster events	14
Box 2.3: Water, and Baht, goes down the drain	17
Box 3.1: Two real stories in the northern part of Thailand	31
Box 3.2: A project in Lao PDR: finding consensus in openness	33
Box 3.3: A Thai farming community adapts to climate change in a bid to save their livelihoo	od 34
Box 3.4: Background on Climate change	37
Box 4.1: National Water Vision and Policies (25 July 2000)	40
Box 4.2: Key elements of the Draft Water Act (2007)	40
Box 4.3: Key activities undertaken by DWR to promote IWRM	42
Box 4.4: RBC functions as delineated in the 2007 regulation	43
Box 4.5: Future investment challenges (DWR, 2007)	46
Box 4.6: Hoi Sam Mo's Vision and Plan from the PPP	49
Box 4.7: A look at The King's Projects research centers	50
Box 4.8: What is the "New Theory"	51
Box 5.1: Laguna de bay –Experience highlights	56
Box 5.2: Build on Existing Social Asset	58

ABBREVIATIONS

ADB	Asian Development Bank
BAAC	Bank of Agriculture and Agricultural Cooperatives
BDP	Basin Development Plan
BMA	Bangkok Metropolitan Administration
BOB	Bureau of Budget
BOD	Biochemical Oxygen Demand
CDM	Clean Development Mechanism
CF	Carbon Finance
CIF	Clean Investment Funds
DEQP	Department of Environmental Quality Promotion
DIW	Department of Industrial Works
DNP	Department of National Parks, Wildlife and Plant Conservation
DO	Dissolved Oxygen
DOLA	Department of Local Administration
DWR	Department of Water Resources
EGAT	Electricity Generating Authority of Thailand
EIA	Environmental Impact Assessment
GDP	Gross Domestic Products
GEF	Global Environment Facility
GNP	Gross National Products
IEA	Industrial Estate Authority
IWRM	Integrated Water Resource Management
m ³	Cubic meters
Mm ³	Million Cubic meters
MOAC	Ministry of Agriculture and Cooperatives
MOE	Ministry of Energy
MOF	Ministry of Finance
MONRE	Ministry of National Resources and Environment
MRC	Mekong River Commission
MWA	Metropolitan Water Supply Authority
NESDB	National Economic and Social Development Board
NGO	Non-Governmental Organization
NH3	Ammonia
NT2	Nam Theun 2
NWRC	National Water Resource Committee
ONEP	Office of Natural Resources and Environmental Policy and Planning
PCD	Pollution Control Department
РРР	People Participation Planning
PWA	Provincial Water Supply Authority
RBC	River Basin Committee

RBO	River Basin Organization
REDD	Reduced Emissions for Degradation and Deforestation
RFD	Royal Forestry Department
RID	Royal Irrigation Department

EXECUTIVE SUMMARY

Water is everyone's business. Beside a necessity for living, water has implications on public health and, most importantly, can cause social conflicts. This is because water is limited, is difficult to control, and can easily be polluted. The Integrated Water Resource Management (IWRM) process is considered worldwide as a means to reduce social conflicts from competing water needs as well as to facilitate effective and sustainable development of water resources. Effective implementation of IWRM however will require appropriate policy, regulation, and institutional frameworks which could facilitate cross-sectoral dialogue and cooperation among water users. A good example of IWRM is in the Lower Mekong River Basin. IWRM has been adopted by the Mekong River Commission (MRC) as a means to management water resources through the 1995 agreement, where as MRC countries are fully committed to manage water resources. In Thailand, IWRM has been technically recognized as a means to achieve sustainable water resources management and the concept has been incorporated in the national policy for more than 15 years, however clear institutional responsibility and introduction of the IWRM concept to local communities are relatively new. To address the challenges on water resource management in Thailand, particularly at the local level, stronger leadership and commitment of the key government agencies and effective cooperation of the water users will be important.

Below highlights status and pressure on water resources in Thailand that suggested for an effective application of IWRM:

- Limited water resources: Thailand has 25 river basins with 254 sub-basins, and rainwater is one of the most important sources of water. Data however suggested that Thailand's water resource per capita is less than other country in the region and one third of them flow into the Mekong. The West basins have the largest storage capacity, with the smallest total irrigation area. Existing water storage is about 37 percent of the annual runoff, on average, but in fact useable water is less. Meeting increased future water needs will require effective management and cooperation of stakeholders. Development of additional water storage, although technically possible, will require the acceptance of the local communities.
- Floods, droughts, water pollution, and degradation of other related resources have exerted major pressure on the current availability of water resources: Beside availability of water, flood, drought, water quality, and watershed-related activities are important aspects of water. More than three hundred villages face high flood risk. Droughts also occur annually, and can cause heavy damage in agriculture and industrial sectors. Nearly one-third of the country's area is classified at medium or high risk for drought. Water quality is acceptable on average, but about one-third of rivers are with high pollution. Watershed protection is critical for ensuring sustainable water resources, and actions are urgently required for all the basins. Thailand has many wetlands of international importance. Most have been encroached on and are rapidly degrading. Management and protection of these wetlands has not been effective. Fisheries and aquaculture development are closely related to wetlands uses and have brought about negative impacts on the wetlands. This should mention about hot spot (where water shortage is anticipated)

- Increasing pressures can be anticipated especially in the northeast. Economic and population growth does not only increase water demand directly, but also induce water pollution. Urban dwellers use much more water, and in a 'doing nothing' scenario, water demand is expected to increase by 35% in 20 years. Maintaining acceptable river water quality also requires effective control of wastewater, where as expanding wastewater treatment is a capital intensive and difficult. From distribution perspective, about 60 percent of Thailand's poor are concentrated in the Northeast. Slow growth in the Northeast imposes large impact to people, particularly those engaged in agricultural activities. Most farmers are poor and have been facing economic and financial risk due to climate changes and water-related emergencies. More than sixty-five percent of agricultural areas do not have good access to water. The Northeast suffers from water shortages, resource scarcity, and a relatively harsh climate which often result in floods and droughts. The Northeast has more farmers specializing in livestock compared to the other regions.
- Increasing demand for good water governance has made it difficult for development of medium and/or large scale water storage so different water resources development options must be considered: It is important to understand water sector's good governance, which focuses on a range of issues that affect the way water is allocated among competing uses. Institutional and legal actions are among those key issues. Despite its difficulty, improving the governance is only the first step in fostering effective cooperation among farmers. Effective consultation with key stakeholders on the tradeoffs will be required throughout the planning and implementation. Good governance and community's participation, which can be applicable to small-scale investment, also contribute to forest protection.

Disconnect between IWRM planning (through RBC mechanism) and budgeting process for local and sector agencies remains an issue: Although IWRM has been incorporated into the national policies to address the aforementioned issues, legislation to implement the program remains inadequate. Institutional fragmentation is one of the key bottlenecks. Thailand is divided administratively into 76 provinces (Changwat), including Bangkok; 927 districts (Umpher); 7,380 sub-districts (Tambon); and 74,779 villages (Moo Ban). Ministry of Natural Resources and Environment (MONRE), Department of Water Resources (DWR), Royal Irrigation Department (RID), and the Electricity Generating Authority of Thailand (EGAT) are the key government agencies and State-Owned Enterprise involving in water resources. Just from the numbers of entities involved, the coordination is apparently a challenge. Many of institutional developments are National Water Resources Committee (NWRC), River Basin Committees (RBCs), and Mekong River Commission (MRC). And in relation to flood and drought, many government agencies have established centers or taskforces to specifically address these issues. The real issue is not so much of the will to coordinate among agencies, but the lack of mechanism to connect the new RBC mechanism into the budgeting process. Plus, there is no political drive and administrative mechanism for the RBC.

Experience in other countries suggests that effective water legislation should clarify the entitlement and responsibilities of water users and water providers; define roles of the government in relation to other stakeholders; formalize the transfer of water; ensure sustainable use of water resources and water values; and provide legal status of water management institutions, including government and water user groups. Basin development plans have been established for the 25 basins, but due to the lack of budget and disagreement with local people, most of the plans have not been implemented. Integrated budget planning for water resources is being applied, but the budget on water resources management has been fluctuating. Although Local government budget can be another source of support to integrated water resources management, there has not been substantial initiatives at the local level. It is important to also mention The King's projects, which pre-date the adoption of IWRM in Thailand and their experience offers seminal lessons. During the past 40 years, a number of royal projects have been initiated and implemented all over the Thailand, where as the underlying principle are very much applicable to IWRM initiatives.

To move forward, three key issues must be addressed: (1) the existing legal/institutional issues; (2) the planning, technical, and financial inputs; and (3) the trans-boundary and administrative issues. The key recommendations in this report are:

Recommendation (1): Strengthen DWR and MONRE capacity on IWRM at national and basin levels. DWR regional offices should take the lead in forging IWRM implementation with supports (regulatory, engineering, technical, and financing) from the central agencies within DWR and MONRE and training and other capacity building should be provided. Public outreach, community connection, and cooperation with other key agencies are critical for effective IWRM process. Thailand capacity to address the Mekong water resources issues should be strengthen in light of hydropower development.

Recommendation (2): Strengthen RBC operations by establishing a clear procedure for connecting the RBC priority with the national and local agencies through government budget planning process. MONRE provincial office should assist in facilitating budget connection among RBC and local and national agencies. DWR's strategic plan (2008) outlining key principles and actions that should be undertaken by the RBC should be applied soonest. Effective cooperation within DWR at central and regional offices will be necessary for providing timely technical inputs to RBC. Coordination with sector agencies should be made both at the provincial and central levels.

Recommendation (3): Support community activities that promote IWRM in priority river basins. Special attention should be given to build knowledge and understanding on the water resources management issues and constraints in the basins and the principles of self sufficiency and cooperation among water users. Experience from pilot activities in the Northeast, suggested that active participation of the local people could be used to demonstrate effectiveness of IWRM process if it can lead to actual implementation on the ground and deliver the water services.

DWR regional office should take the lead with technical and financial supports from DWR central offices and other MONRE agencies.

Recommendation (4): Develop IWRM investment projects in priority basins. This is to demonstrate government's commitment to move IWRM forward. DWR regional office should take the lead with policy, technical and financial support from DWR and MONRE. Involvement of other key agencies including the Bureau of Budget, NESDB, and the ministry of finance will also be necessary. Ping River, Bang Pakong, Kong/Chi/Moon, and Songkla Lake basins are considered as priority basins.

A way to move forward is to take advantage of existing connection with MRC in addressing the water resources management issue in the Mekong River where technical assistance can be tapped and experience from the IWRM process may be replicated for other river basins.

Chapter 1: Overview on Integrated Water Resources Management (IWRM)

This chapter briefly presents the importance of water and the challenge of IWRM implementation and its application in Thailand. The water resources status, key stresses, and management and institutional aspects related to IWRM in Thailand are described in Chapters 2, 3, and 4 while the challenges and opportunities are discussed in more details in Chapter 5.

1.1 Why IWRM?

Water is limited, difficult to control, easily to be polluted, and could cause social conflicts and public health therefore water resources management is "everyone business". Water can be defined as rainwater, surface water (freshwater or sea water), and groundwater depending on its chemical property, temperature, pressure, and locations and it is difficult to be managed even with today technology. Freshwater is a necessity for a human being and important for sustaining a healthy ecology as well as socioeconomic development of a country; but its availability varies greatly with locations, seasons and climate, and socioeconomic condition and pressures. Only 3 percent of global water is freshwater of which only 13 percent of this amount (or 0.4 percent of total) could be accessible; and this limited amount is under increasing pressures and complexity. Figure 1.1 draws a simple framework for increasing water demand and the need for allocation of water resources.



Figure 1.1: Simple framework for increasing water demand

Main water uses include household consumptions, water supply, fisheries and aquaculture, irrigation, electricity generation, industry, tourism, maintenance of ecosystem, and receiving wastes. These users are independent and its competing uses are growing in all countries and

effective management of water resources has been a challenge mainly due to its scarcity and competing needs in dry season and floods in wet season.

IWRM process is considered worldwide as a means to reduce social conflict due to competing water needs as well as to facilitate effective and sustainable development of water resources (See Box 1.1). Continuing social inequity and conflict over scarce resources threaten to inflame social divisions and lead to further political and social unrest. Finding the right balance among the water uses will depend on government ability to forge cooperation among water users while preserve the interest of the whole country. The process recognizes the development potential in a river basin while incorporating the needs to respect interaction of human activities on land and water bodies, especially on the livelihoods and ecology implications. So far, it has been applied to address a broad spectrum of issues and activities including water awareness and conservation, food security, watershed or wetland conservation, and water use efficiency in irrigation.

Box 1.1: Definition of IWRM

Integrated Water Resources Management (IWRM) is defined by the Global Water Partnership (GWP)¹ as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". There are different definitions adopted by various international organizations, but all share the following basic principles:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment;
- Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels;
- Women play a central part in the provision, management and protection of water; and
- Water has an economic value in all its competing uses and should be recognized as an economic good.

Effective implementation of IWRM however will require appropriate policy, regulation, and institutional frameworks which could facilitate cross-sectoral dialogue and cooperation among water users. (See Box 1.2) A number of guidelines² have been developed, mostly by international experts, regarding the game rules (policy, legal, finance, and incentives); institutional arrangement (organization, capacity building); and management tools (assessment, plans, efficiency use, social change, conflict resolution, economic instruments, information exchange, etc), however applying these guidelines in a country and/or region will require tailoring the process to local political, social and economic realities.

¹ GWP is a group of experience professionals that has been taking the lead in promotion and implementation of IWRM through a worldwide network that pulls together financial, technical, policy, and human resources to address the critical issues of sustainable water management (http://www.gwp.org)

² http://www.gwp.org/en/The-Challenge/What-is-IWRM/Dublin-Rio-Principles/



In the Lower Mekong River Basin, IWRM has been adopted by the Mekong River Commission (MRC) as a means to management water resources through the 1995 **agreement.** MRC is a regional body taking the lead in forging cooperation among riparian countries (Lao PDR, Thailand, Cambodia, and Vietnam) to manage water resources in an Efficient (attempt to maximize the economic and social welfare), Equitable (fair allocation of costs and benefits); and Sustainable (appropriate uses) manners. In 2006, MRC identified eight priorities areas for cooperation: economic development and poverty alleviation; environment protection; social development and equity; dealing with climate change variability; integration through basin planning; information based management; regional cooperation; and governance. With extensive assistance from international donors (Denmark, Finland, Australia, Japan, Germany, World Bank/GEF, etc.) the IWRM concept has been integrated into most MRC programs (See Box 1.3). Experience and lessons learnt from management and operation of MRC and MRC secretariat appear to reflect a combined effect of international practices with cultural behavior of governments and local peoples in the lower Mekong. MRC is moving on a riparianization3 process and the first Chief Executive Officer (CEO) of the MRC secretariat from a riparian country is expected to be on board in mid 2011.

³ This is the process to transfer the responsibility of MRC secretariat to the riparian countries. Four proposed key functions of the secretariat include (a) Secretariat administrative and management; (b) Core river basin management; (c) Tools development and capacity building; and (c) Consultancy and advisory; This functions however subject to debate and policy change.

Box 1.3: IWRM at MRC

During the first 10 years MRC programs focused on building trust and facilitating cooperation of riparian countries as well as building technical knowledge and management tools. Key programs include (i) implementation of water utilization (WUP) through modeling and establishment of operation procedures; (ii) basin development planning (BDP) through engaging local community into the planning process; (iii) environmental conservation (EP) focusing on developing environmental score card through monitoring of environmental health and development of environmental flows; (iv) fisheries building knowledge on fishing practices, species, and ecology; (v) watershed protection through participatory water shed management; (vi) flood management through modeling and other measures; and (vii) navigation. Most of these programs promote active participation of and engagement with local communities and sharing of IWRM implementation experience, however, scale and extent still remitted at the pilot basis. These MRC programs have been adjusted over time and there are 11 programs at present, with an addition of the following: hydropower development; agriculture and irrigation; tourism development; integrated knowledge management; and database management. A number of pilot studies, research and development, training, and capacity building were carried out, and below are the key outputs that likely to be important for future development in the Mekong:

- MRC procedures: Five operation procedures related to water resource uses have been established and/or under the final stage of negotiation: (a) the Procedures on Data Exchange and Information (PDIS); (b) the Procedures for Water Use Monitoring (PWUM); (c) Procedures for Negotiation, Prior Consultation and Agreement (PNPCA); (d) the Procedures for Maintenance of Flow on the Mainstream (PMFM); and (e) the Procedures for Water Quality (PWQ), in which the last two are under negotiation. PDIS and PWUM have been implemented while the PNPCA application was not initiated until recently when Lao PDR informed the other riparian countries to its intention to develop a mainstream dam at Xayabury. The PNPCA process is triggered and MRC secretariat is following the process however the final outcome will have to be seen.
- BDP 2 (2008-2010) focused its study on assessment of potential impacts of the proposed 11 mainstream dams using its modelling capacity to simulate various scenarios and assess the potential change in hydrology on water quality, wetlands, and endanger species. This information was used as the basis for the strategic environmental assessment of the mainstream dams which was carried out under the hydropower program. Despite a number of uncertainties and comments involved in the process, this is the first time that some quantitative data are presented, discussed, and made available for public access. Although additional studies will be necessary to facilitate decision making process, the countries begin to realize the benefits of the consultation and cooperation efforts with respect to future development in the Mekong. Better understanding on the definite scenario expected to occur after 2015 when six of the Chinese dams are in full operation have triggered the interests of the MRC countries to cooperate and identify potential benefits as well as measures to mitigate the potential negative impacts.

5

MRC countries are fully committed to manage water resources based on IWRM principles, but still facie institutional and financial challenges. Lao PDR has recently issued a decree establishing river basin organization and establishment of RBCs in a few priority river basins are ongoing. The Department of Water Resources which is established in 1997 as part of the Water Resource and Environmental Administration (WREA) is taking the lead in forging IWRM implementation. Extensive technical and financial supports to WREA and other key agencies are being provided by World Bank, ADB, and other donors (Australia, Finland, etc.) during the next 5 years. In Cambodia and Vietnam, the efforts are less pronounced and the RBCs are selectively established i.e. one for the 3S basin (Seprok, Sesan, and Sekong) in Cambodia and one for the Mekong Delta in Vietnam. Capacity and activities of these RBCs remain limited due to institutional issues and the lack of technical capacity and budget. ADB provides a technical and financial support to the Tonle Sap area under the responsibility of the Tonle Sap Authority.

1.2 What are the implications in Thailand?

In Thailand, IWRM has been technically recognized as a means to achieve sustainable water resources management and the concept has been incorporated in the national policy for more than 15 years, however clear institutional responsibility and introduction of the IWRM concept to local communities are relatively new. In 2005, the Department of Water Resources (DWR) of the Ministry of Natural Resource and Environment (MONRE) have been assigned to take the lead in forging effective IWRM implementation and 25 river basin committees (RBCs) have been established. DWR also made an effort to promulgate the water law and extensive consultation with agencies, local community, NGOs, and the general public was carried out, however political unrest and government instability have made the process a long and complex endeavor and the draft water law remains uncertain. Given the lack of legal provision, ineffective cooperation among key agencies, failure to engage water users and local stakeholders in the river basin planning process, and limited DWR budget that can be allocated to provide technical and operational support, capacity and performance of the 25 RBCs remains unsatisfactory in the eyes of RBC members as well as of the general public and frustrations have become increasing.

To address the challenges on water resource management in Thailand, stronger leadership and commitment of the key agencies and policy makers and effective cooperation of the water users will be necessary. Thailand has already experienced water shortage in many areas and water pollution is also mounting. Degradation of water and other natural resources in a river basin, land use conflicts, and damages due to droughts and floods have reached serious levels for more than 10 years and efforts are being made to mitigate them. It was estimated that increasing Thai population from 62 million in 2004 to 73 million by 2024 and this would increase average water demand from the present 57,000 million cubic meters (Mm3) to 77,000 Mm³ in the next 20 years. However development of additional water storage has found to be difficult and facing strong objection from local people. Water resources development during the past 50 years although benefited large number of farmers and the country has also created negative impacts on local community and local environment. It is time to review and reassess the level of "risks" and "tradeoff" in the water sector and initiate the discussion (negotiation) process that could maintain the country socioeconomic growth as well as be acceptable to key stakeholders. There are a number of problems that could be solved easier than others but without working together and

sort things out, water issues would become the barrier for the country development as well as well being of individual/community. IWRM process offers an opportunity for the agencies, water users, local communities, and other stakeholders to share the basic knowledge on water resources and constraint in a river basin as well as to express their views and/or concerns so that agreement could be reached on way to move forward.

Despite the lack of the water law, there are opportunities to move IWRM forward by building on exiting institutional and human capital. In Thailand there are extensive experiences and lessons learnt from large/medium scale development of water resources storage and/or infrastructure which is under the responsibility of agencies as well as from small scale structures (mostly in upper watershed areas) that are built through cooperation among agencies, local community, and private sector; and most importantly from the King projects. This institutional and human capital should be treated as a valuable asset for the sector and together with the decentralization process which is being implemented by the government, water resources management could render the country benefits and minimize adverse impacts to individual and local communities.

To move forward the existing legal/institutional issues; the planning, technical, and financial inputs; and the trans-boundary and administrative issues must be adequately addressed. These aspects are briefly highlighted below while more details are provided in Chapter 5.

- *Legal/institutional aspect:* In the absence of water law, forging effective integration of water resources at national and local levels will confront conventional institutional and administrative practices as well as will involve professional and decision-making challenges. For many reasons, similar to other developing country, the water resources planning and management in Thailand is the responsibility of central agencies and past development decisions were made with limited participation of water users and/or affected population. The IWRM approach promotes the concept of government as a facilitator and regulator, rather than an implementer and active participation of key agencies, water users, and other stakeholders in the decision making process; and a River Basin Organization (RBO) comprising a River Basin Committee (RBC) and subbasin committees and/or working groups (WGs) is normally used as an institutional instrument. In Thailand although 25 RBCs have been established but their roles and not clear and their capacity is lacking. There is also a need to engage local community and to build trust and cooperation among water users. This is a slow process and can be complex, especially where social conflicts have already occurred. Increasing knowledge and understanding of local community on water resources issues and constraints at national, basin, and sub-basin levels will be important for addressing communication gaps and facilitating local ownership and cooperation at an early stage. It could also facilitate fundamental changes in the values and behaviors of key agencies, water users, and other stakeholders. Without strong support from the government and key agencies it would be difficult to expect any effective RBO operation in Thailand.
- *Planning, technical, and financial inputs* -- a river basin area is used as a planning unit taking into account all the water resources related issues, especially water availability,

flood and drought, water allocations, water uses, water quality, groundwater, land uses, soil quality, watershed management, wetland conservation, and fisheries management. This is a rolling/living process where *timely technical and financial inputs* will be necessary to move forward a meaningful dialog that could demonstrate agreements and/or actions that could address specific needs of water users at the basin and/or subbasin levels. Thailand has developed water resources planning using both "top down" approach and "bottom up" approach but its connection remains unclear. To move forward it is important for a river basin planning process to demonstrate its usefulness in identifying priority investment and/or actions that meet the needs of water users at national and local levels. Implementation of priority investment (large, medium, or small) will be necessary to timely deliver the water services and this will be an incentive for farmers and water users to actively participate in the planning process. Cooperation among key agencies as well as timely technical and funding supports will be necessary to facilitate effective implementation of the planning process.

• *Trans-boundary issues in the Mekong.* Water knows no political and/or administrative boundaries. Both surface water and ground water flows across basins and/or countries and they are closely connected. Trans-boundary issue may occur at subbasin/basin level and/or at national/local level and may involve floods, droughts, water quality, fisheries and other aspects. Water can also be transferred within and among the river basins and could offer significant benefits and costs. Trans-boundary issues therefore are complex and need great attention of water managers and the water users at all levels. While addressing the national trans-boundary issues (such as between the north and the central basins) remains a high priority for the country due attention should also be given to the Mekong given rapid development of hydropower projects in the mainstream and its tributaries. In a large river basin like the Mekong, water-related investment decisions taken by one riparian country could significantly affect the others, and cooperation schemes could be more complex, and this has been the main reason for maintaining effective MRC operations.

Chapter 2: Thailand Water Resources Status

This chapter summarizes the status of water resources in Thailand, which includes the sources from surface water and groundwater, their storage, the usage and quality. Land use, watershed, wetland, and fisheries issues are also discussed as well as the quality of water. The chapter aims to depict the overview of water and related resources in Thailand. Issues are drilled down in latter chapters.

2.1 Surface Water

Thailand has 25 river basins (254 sub-basins), and rainwater is one of the most important sources of water. Thailand covers an area of 415,000 km², of which about one-third is in the Northeast. In line with IWRM, planning and management of water resources in Thailand take place within a river basin boundary. The 25 basins⁴ can be grouped into six regions: North-Central (N-C), Northeast (NE), East (E), West (W), and South (S).

Thailand is a tropical country. Heavy rain occurs every year during the wet period, from May to October, under the influence of the southwest monsoons and tropical storms coming from the Bay of Bengal. During the dry season – November to April – the climate is influenced by the northeast monsoon from China and tropical storms from the South China Sea. While rainfall varies over time and from one place to another, on average the south has the highest rainfall (with more than 2,400 millimeters per year) and the months of August and September are the wettest.

Water runoff varies with the country's topography and land-use. Almost two thirds of the total land area is mountainous or hilly, with the rest being flat land used for residential and other purposes. *"Water runoff"* is the amount of rainwater flow over the land and is measured in cubic meters (m³) per year per person. Figure 2.1 shows the annual average water runoff in Thailand per person in year 2004.

Seven river basins with relatively high populations and economic growth, and limited freshwater resources, have been identified as water management "hot spots". They are: *Chao Phraya* and *Thajeen* in the Central basin, *Chi* and *Moon* in the Northeast, *Bang Pakong* and the Eastern Seaboard in the East and *Songkla* Lake in the South. These basins have lower runoffs than the national average and the issues related to competition in water demand, water governance, and water pollution have been increasing.

⁴ These basins may be classified by hydrologists into nine hydrological groups or by environmentalists into three resource-based groups.



Figure 2.1: 2004 Annual average water runoff in m³ per person per year Source: Deartment of Water Resources (DWR), 2007

2.2 Water Storage

Existing water storage is about 37 percent of the annual runoff, on average, but in fact useable water is less. Electricity generation, irrigation, industry and domestic demand are the main sources of water usage. To meet the increasing demand for electricity and irrigation, Thailand has developed extensive water resource storage during the past fifty years. Up to 2004, nearly 17,000 projects were constructed with a total design capacity of 76,000 million cubic meters (Mm³) (See Table 2.1). Of this, 91 percent of the water is stored in 36 large reservoirs, many of them operated by the Electricity Generating Authority of Thailand (EGAT). Of the 36 large reservoirs, 9 have designed storage capacity over 1,000 Mm³ (See Box 2.1). In order to maintain the minimum water storage requirement, only about 60 percent of the design capacity is considered usable.

Regions	Irrigable area	Storage					
	(Million rai) in	[# Project]	Large (>100Mm ³) at Nov 1, 2010			
	2009		Design in Mm ³	Usable in Mm ³			
N-C	22.116.28	[5356]	27393 [10]	19128			
NE	8.8 6.37	[7406]	9732 [12]	6113			
Е	3.22.68	[1100]	1275 [5]	1092			
W	2.70.71	[493]	29850 [2]	13328			
S	4.12.68	[2143]	9874 [4]	6411			
Total	4128.72	[16498]	78123 [33]	46072			

Table 2.1: Water storage and irrigable area in 2004

Source: NSO 2011 and RID 2011.

Note: Irrigable area from NSO 2011 and RID 2011

Large >100 Mm3 came from RID 2011 Design means ความจุที่ระดับน้ำสูงสุด

[#Project] is the sum of Large medium and small size of water reservoirs+สูบน้ำด้วยไฟฟ้า และแก้มลิง ข้อมูลปี 2010 จาก RID 2011

Region based on the work of NSO and RID

Total design capacity is conflict to Large design, so I suggest for report only number of project

Box 2.1: Reservoirs with capacity over 1,000 Mm³

- North: *Bhumipol* (13,462 *Mm*³) and *Sirikit* (9,510 *Mm*³);
- Northeast: *Ubonrat* (2,264 *Mm*³), *Lam Pou* (1,430 *Mm*³), *and Sirinthon* (1,966 *Mm*³);
- West: Srinakarin (17,745 Mm³) and Wachiralongkorn (8,860 Mm³); and
- South: Bang Lang (1,404 Mm³) and Rachaprapa (5,639 Mm³)



Picture of Bhumiphol dam (Source: DOE)

The West basins have the largest storage capacity, with the smallest total irrigation area. This is because all of these reservoirs in the West were created for hydropower generation. The North-Central basin also has high storage capacity (35 percent), with the largest area under irrigation. The Northeast accounts for 15 percent of water storage and 21 percent of the irrigated area. Figure 2.2 shows the water storage, water runoff, and water demand in the five regions. The East and Northeast are the two areas with higher demand and lower water storage capacity.



Figure 2.2: Water Resource Pattern in the five regions Source: DWR, 2007

Meeting increased future water needs will require effective management and cooperation of stakeholders. Water need (technically called *"water demand"* is defined as the combined amount of water required for the three main uses: irrigation, domestic, and industrial, including tourism. Water storage refers to the "design capacity" which is greater than the amount of water that will be available for use. In 2004, the population was 62 million and the average water demand was 57,000 Mm³, of which 90 percent was used for agriculture. Water demand in the North-Central and East areas has already exceeded water storage (Table 2.2). Water demand is expected to be 77,000 Mm³ in 2024 when the population is expected to reach 73 million.

Development of additional water storage, although technically possible, will require the acceptance of the local communities. Water use conflicts have reached a point where confrontation between water users and other key stakeholders is becoming increasingly common. Climate and land-use changes will have further effects and are likely to exacerbate water use conflicts. These aspects will be discussed in Chapter 3.

	Unit	Total	N-C	NE	Е	W	S
Population (2008)	(people)	66,481,687	26,547,323	22,651,688	4,497,295	3,641,958	9,143,423
Area	(Sq.km.)	514,008.27	195,023.81	167,338.02	37,548.03	43,522.90	70,575.51
Runoff	(Mm ³ /yr)	213,302.50	50,827.72	55,504.17	24,029.69	17,159.87	65,781.05
Design Storage	(Mm ³)	74,106.00	25,978.00	10,674.00	1,944.00	28,074.00	7,436.00
Total Demand	(Mm ³ /yr)	58,485.82	29,469.96	10,993.87	4,102.53	8,088.45	5,831.01
for agriculture	(Mm ³ /yr)	53,034.01	26,922.82	9,892.97	3,134.30	7,791.88	5,292.04
for other activities	(Mm ³ /yr)	5,451.81	2,547.14	1,100.90	968.23	296.57	538.97

Table 2.2: Water storage and demand by region

Source: DWR, 2007.

2.3 Floods and Droughts

More than three hundred villages face high flood risk. In Thailand flooding results from tropical disturbances and typhoons, or a combination of the two. Many urban areas are regularly flooded. The peak flood period lasts from early June in the North to early December in the South. Prolonged heavy rains on saturated soils often create landslides and casualties. Flash floods in highland areas cause casualties and serious damages due to land or mudslides.

Data collection in the past decades can provide the overview of risk on floods. Department of Water Resources (DWR) data suggests that during the past 10 years, floods occurred in about 10,000 villages, of which 312 were classified as high flood risk, where floods occurred 8-10 times a year. All these villages are located in the North-Central or the Northeast (Table 2.3). Most of these were backwater floods (overflow of rivers and streams). *Yom, Chao Phraya, Chi, Moon, and Chanthaburi* face serious flood risks, while *Kong, Kok, Ping, Wang, Sakaekrung, Pasak, Thajeen, Prajinburi, Petburi, Eastern Seaboard, West coast, Southeastern coast, Tapi, Songkla Lake,* and *Andaman Sea* face medium risks. There are an additional 1,577 villages at risk of flash floods due to heavy rain and rapid water runoff.

Flood level*	N-C	NE	E	W	S	Total		
Flood occurrence during the past 10 years								
Villages	23312	31153	4113	3264	8308	70150		
High	38%	34%	6%	3%	19%	3974		
Medium	37%	43%	6%	3%	12%	35016		
Low	25%	51%	7%	6%	11%	28254		
Total Villages in Risks	21561	30821	4049	2985	7828	67244		
Risk for land/mud slides, fl	lash flood, and	backwater flo	od	•				
Villages	23309	31152	4109	3262	8289	70121		
Total Villages in Risks								
land/mud slides	1466	118	10	157	314	2065		
Flash flood	1150	164	66	108	89	1,577		
Back Water	6399	1,365	977	733	889	10,363		

Table 2.3: Villages at Risk of Floods and Land/Mud slides (2004, by region)

Source: DWR 2010

Floods and droughts are increasing in frequency and cause real problems in Thailand. Heavy rainfall, limited rainwater and natural runoff, ineffective use of water in the agricultural sector and large areas of degraded forest are the main causes of floods or droughts. This also contributes to increasing water pollution. Having become a real problem in Thailand, the effects and intensity of flood/drought events have been worsening in the last few years (Box 2.2).

Box 2.2: Major floods, droughts, and natural disaster events



- 2001: Flood and land slide at Ban Nam Kor, Petchaboon –126 deaths, 80 cases of mental illness;
- 2004: Flash flood and mud slide in Ramad districts, Tak –affected 5,990 people, with 9 deaths;
- 1997-1998: "El Niño" effect caused frequent forest fires;
- 2005: Long drought in the East, while flooding occurred all over the country; Chiangmai was flooded 5 times in three months and heavy flooding occurred in Sonkhla city;
- 2006: Heavy rains caused flash floods and mudslides in five areas in the lower part of the North; these affected nearly 100,000 households (300,000 people), resulting in 80 deaths, affected 1,662 structures, and damaged 0.43 million *ra*i of agriculture area, valued at least 250 million baht.
- Drought in the East and floods in Chiangmai also created high tensions among water users.

(Source: State of Environment Report, 2006)

Droughts also occur annually, and can cause heavy damage in agriculture and industrial sectors. Rainfall, water runoff, and water availability are not uniformly distributed, so drought can occur in many different places within a basin, even if it has a good balance between water demand and supply. In agricultural areas, drought can cause serious damage to local production and to farmers' dwellings. During 1989-2003, drought affected 134 million people and 46 million *rai* of agricultural land, costing 4.5 billion Baht (an average of 200 million Baht per year). The cost of the 1999 drought alone was estimated at over 1.5 billion Baht. Water shortage in the Eastern Seaboard in 2004 impacted on the industrial sector.

Nearly one-third of the country's area is classified at medium or high risk for drought. Nearly 2,000 villages are classified as high-risk for drought. Half of them are in the Northeast (Table 2.4). Yom, Sakaekrung, Moon, Tonlesap, and Songkla Lake have serious drought problems due to inadequate storage facilities, a large agricultural area, and a lower runoff quantity per person. *Salawin, Kong (NE), Chi, Thajeen, Ping, Wang, Bang Pakong, Eastern Seaboard,* and *Southeastern Coast* are facing water shortages as well, though not as critical.

	N-C	NE	Е	W	S	Total
High	511	955	47	424	0	1,937
Medium	7,937	11,983	908	1,213	0	22,041
Low	13,287	17,854	2651	1,458	5,927	41,177
No risk	1,534	230	493	158	2,347	4,762
Total	23,269	31,022	4099	3,253	8,274	69,917

Table 2.4: Number of villages with risks for drought by region

Source: DWR 2010

2.4 Groundwater Usage

Groundwater is an important water source, but its use needs close control and monitoring. Thailand has the groundwater potential of about 33,000 Mm³ per year, of which 67 percent is being extracted through nearly 2.5 million wells (Table 2.5). The Northeast has the largest number of wells and the largest percentage of water extraction. The basins that have the groundwater potential for more than 2,000 Mm³ per year are: *the Southeastern Coast, Moon, Chi, Kong, Nan, and Chao Phraya.* The basins currently using more ground water than their potential are: *Moon, Kong, and Pasak.* Groundwater use in Songkla-Hadyai, in the South, and the lower part of *Mae Klong,* in the Central basin, has been increasing. A large-scale groundwater irrigation project has been carried out in the Sukhothai province. Figure 2.3 shows locations with groundwater potential and extraction in Thailand. Over-extraction of groundwater for Bangkok.

Region	Potential (P) in		% E/P		
	1,000 Mm ³ /yr	No. of wells x1,000	1,000 m ³ /day	1,000 Mm³/yr	
N-C	12.4	729	20.0	7.3	59
NE	8.8	807	32.5	11.8	135
Е	2.4	211	2.1	0.8	32
W	1.9	54	1.7	0.6	33
S	7.3	612	4.0	1.4	20
Total	32.8	2,413	60.2	22.0	67

Table 2.5: Groundwater potential and extraction

Source: DWR, 2007.



Figure 2.3: Groundwater extraction per potential Source: DWR, 2007

2.5 Water Quality

Water quality is acceptable on average, but there are areas with high pollution. Water quality is determined from the measurement of oxygen in water (dissolved oxygen, or DO), the ability of microorganisms to digest oxygen (BOD), ammonia (NH3) concentration, and the prevalence of coliform bacteria. Low DO and/or high BOD, NH3, and coliform indicate poor water quality.

Government data suggest that more than half of the rivers have acceptable water quality, while about one-third are degraded or polluted. Serious problems are experienced in the following areas: the lower *Thajeen River* (low DO and high NH3), *Lam Thakong of Moon River* (high BOD), and *Songkla Lake* (high bacteria and NH3); at the same time, *Mae Koung* and the middle and lower parts of the *Chao Phraya River*, *Bang Pakong River*, *Nakornnayok River*, and *Rayong River* are experiencing rapid degradation in water quality. Water pollution is discussed in more depth in Chapter 3.

2.6 Piped Water Supply Services

Piped water supply services reached 61 percent of the total population in 2004. Provision of water supply services in the South and the East regions is relatively low (46-51 percent) compared to the North-Central, the Northeast, and the West regions (72-77 percent). Urban supply is high while that in rural areas remains low.

Box 2.3: Water, and Baht, goes down the drain

Water loss in the piped water supply system is an important factor measuring effectiveness of the services. Bangkok's Metropolitan Water Supply Authority (MWA) services an area of 2396 square kilometers with 1.8 million connections. In 2010, it sold 1735.9 Mm³ of water on average at 13.825 Baht per cubic meter. The water loss was about 33 percent. This means that out of 100 cubic meters of treated piped water, more than two-thirds of the water reached users, while the rest leaked out. This situation not only implies monetary losses (in both raw water acquisition and treatment), but also socio-economic losses, as more investment will be needed to maintain the coverage.

The Provincial Water Authority had a slightly better record. In the same year, it serviced nearly 2.7 million connections: of the 1,118 Mm³ water produced, the water loss was about 26 percent.

Rural water access and village water supply remain inadequate. In 2005, DWR reported that about 15 percent of the total 5.8 million households in Thailand did not have an adequate water supply. Of the 50,000 villages, only 79 percent had access to a water supply system (i.e. irrigation and piped water). For nearly 29 percent of those having system access, the existing water system needed rehabilitation. That year, the government launched a major program to increase piped water supply services to villages. DWR took the lead for the first phase of

implementation and in 2006 5,436 villages received the services: in 18 percent of the villages, new construction was undertaken; 31 percent had their systems rehabilitated; and 51 percent received improvements. Since then, in line with decentralization policy, local governments have provided ongoing services with DWR's role being focused on regulation and technical assistance. The national target for piped water supply service is to provide access to all villages by 2012.

Bottled water has become a major source of drinking water. Safe water for drinking and human consumption is a high priority. The perceived quality and reliability of a product dictate the people's choice. In Thailand, bottled water costs from 1 to 30 Baht per liter, depending on the source and the technology used. Bottled water and potable water from filter-machines are the preferred sources of drinking water in urban areas. In some rural areas, rainwater and groundwater remain a major source.

2.7 Watershed and Land Use

Watershed protection is critical for ensuring sustainable water resources, and actions are urgently required for all the basins. Watershed areas are a critical element in water resource regeneration, provided they are covered with forest. Official records suggest that 136,000 km² (26 percent of the country's land area) is defined as watershed area, of which 120,000 km² (88 percent) is covered with forest. Most forest in low-lying areas has already been converted to other uses, with nearly 11 percent devoted to agriculture. Increasing populations in the watershed area will increase existing pressure on the forest and biodiversity resources. The basins that have small watershed areas and are facing problems with intensive land use change are mainly *Pattani*, *Southeastern coast, and Songkla Lake*.

Protection of watershed is inadequate. In the mid 1980s, the Government made an effort to control land use through the watershed classification system⁵. This measure has limited application, since it is triggered only when projects require an Environmental Impact Assessment (EIA). No additional measures have been established to control changes in land use in a watershed. A recent study suggests that setting specific targets for forest cover in a river basin could help protect the watershed.

Land use, land conversion, and soil quality can affect water quality and water uses. There has not been a big change in the amount of agricultural area under cultivation; but there is a small trend in conversion of rice paddy and upland crop land to use for growing fruit and other trees. In the West (especially *Mae Klong*), about half of the 1986's rice paddy area has been converted. *Nan, Kong (N), and Kok* have experienced high land conversion in Class 1 watershed areas, while *Pattani, Southeaster Coast, Songkla Lake, Kong (NE), and Pasak* have more problems with land conversion in watershed Class 2 and Class 3 areas. Changes in land use from forest-covered land to uses for agricultural and other development activities could seriously affect water quality and the ability to use water downstream.

Class1: (mountainous) All uses are prohibited;

⁵ Watershed classification system (based on the slope):

Class 2 (hilly) Careful and sustainable use is possible; and

Class 3: can be used for agriculture and other development.

The national target for forested area is 40 percent of the land, but unclear forestry data has made it difficult to verify achievement of this target. Forest, which by law is defined as protected area, comprises about 230,000 km², or 45 percent of the country's area. However, data from geographic information systems (GIS) suggest that the forest cover in 2004 was about 168,000 km², or 33 percent of the landmass. Of this forest cover, 98 percent is land forest and the rest is mangrove. Of the forest, 84 percent is natural, 11 percent is degraded, and 4 percent is reforested land. About 51 percent of the forest cover is concentrated in the North-Central area, 19 percent in the Northeast, 14 percent in the West, 11 percent in the South, and 5 percent in the East. In terms of forest cover per basin, the West has the highest average per basin (55 percent), followed by the North-Central (44 percent), the South (27 percent), the East (20 percent), and the Northeast (18 percent).

About 33 percent of forest cover has been lost during the past 40 years. Thailand's forest cover has been reduced from 274,000 km² (53 percent of country area) in 1961 to 168,000 km² in 2004, of which 19,000 km² are considered degraded forest. Land conversion appears to be the key reason for this reduction, especially in the watershed areas. *Figure 2.4* compares trends for forest area and agricultural land coverage over the past 20 years. The pace of forest reduction was high during the forest concession period (1961-1989), but slowed after the ban on forest concessions came into effect in 1989. Given the lack of clear boundaries for forest areas, more accurate figures are not available. The government noted that different figures related to forest areas might be due to the application of GIS technology in the estimation of a forest's area of coverage. There are five basins with more than 1,500 km² of degraded forest: *Nan, Mae Klong, Kong (NE), Sakaekrung, and Chi.* These river basins urgently need reforestation strategies.



Figure 2.4: Forest degradation profile Source: NESDB, 2011.

2.8 Wetlands and Fisheries

Thailand has many wetlands of international importance. Most have been encroached on and are rapidly degrading. Wetlands and fisheries are integral factors in water resources management in a river basin. Reduction of forest and wetland areas will reduce the basin's ability to regenerate and store water and will increase the danger and impacts of flooding. *"Wetlands"* are defined as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." Wetlands are important habitats for fishes and other water species and effective protection is urgently needed. Thailand has a large number of wetlands (nearly 43,000 locations) covering an area of about 50,000 thousand km², or 10 percent of the land area. In Thailand, there are 61 wetlands of international importance and 48 of national relevance. Of the 61 internationally important sites, 30 are located in the South, 13 in the Northeast, and 10 in the North-Central region. Ten wetlands have been identified as Ramsar⁶ sites.

Management and protection of these wetlands has not been effective. Most of them have been made shallower and encroached upon by development activities, and are degrading rapidly. Twenty-eight sites need urgent rehabilitation. The main difficulties in effectively managing and protecting these wetlands are a lack of: clear authority, local capacity and knowledge, and the required budget to manage these sites. Local communities do not have the necessary awareness nor do they have the capacity or resources to take care of the wetlands.



Source: Fisheries Statistics of Thailand 2011

⁶ The Convention on Wetlands (Ramsar, Iran, 1971) -- called the "Ramsar Convention" -- is an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. Unlike the other global environmental conventions, Ramsar is not affiliated with the United Nations system of Multilateral Environmental Agreements, but it works very closely with the other MEAs and is a full partner among the "biodiversity-related cluster" of treaties and agreements. (http://www.ramsar.org)

Fisheries and aquaculture development are closely related to wetlands uses and have brought about negative impacts on the wetlands. The rapid increase in aquaculture production during the past 10 years (Figure 2.5) suggests that attention should be given to ensure proper management of aquaculture development in a river basin. Water resources development could have significant impacts on both fisheries and the conservation of wetlands.

Chapter 3: Water Resources under Stress

This chapter examines the current pressures on water resource management, shows the link between poverty and agriculture, and looks at the effects of population and economic growth, projected climate changes and the increasing demands on the Mekong River. Specific attention is given to the Northeast, where 60 percent of the country's poor reside. Heavily dependent on farming, they are most vulnerable to the effects of continued water stress and their situation illustrates the urgent need for good governance.

3.1 Economic and Population Growth

Thai economy continues to expand. Gross National Products (GNP) per capita naturally increases over time, and so does population. Figure 3.1 presents such trend during 1979-2009. Of the 25 basins, 16 have populations exceeding 1 million with the two largest basins being the *Chao Phraya* (11 million) in the Central region and the *Moon* (10 million) in the Northeast. With population growth rates in the range up to 1.3 percent annually, it is estimated that population will increase from 62 million in 2004 to 67 million, 73 million, and 80 million in the following 10, 20, and 30 years, respectively. About 41 percent of these people will be concentrated in the North-Central region, and 34 percent in the Northeast.

The growth distribution varies by region. In terms of gross regional products, northeast has the lowest real GDP per capita at less than 20,000 Baht per person annual income. This is only half of western and southern region, and approximately one-fifth of others. Table 3.1 and

Figure 3.2 show the breakdown of GDP in each region and by major sectors. Sector-wise, agriculture contributes less than 10 percent to the GDP, with the *Moon* basin being the highest contributor to agricultural output.

	Northeastern	Northern	Southern	Eastern	Western	Central	Bkk. and Vicinities	Total
GDP at constant price (Million THB)	443,211	350,630	376,503	646,521	163,288	400,566	1,882,420	4,263,139
Agriculture	84,986	67,779	128,454	38,392	30,167	20,897	19,688	390,362
Industries	107,205	107,924	77,633	440,252	57,128	308,991	886,420	1,985,551
Services and others	251,021	174,928	251,021	174,928	251,021	174,928	251,021	1,528,866
Population (1000 persons)	22,771	12,132	9,261	4,543	3,663	3,031	11,501	66,903
Real GDP (THB) per capita (baht)	19,464	28,901	40,655	142,311	44,578	132,156	163,674	63,721

Table 3.1: Regional GDP 2009 at constant 1988 price

Source: NESDB, 2011.



Figure 3.1: GNP per capita and population (1979-2009) Source: Bank of Thailand, 2010.



Figure 3.2: Regional GDP ratio by major sectors Source: NESDB, 2011.

Population growth does not only increase water demand directly, but also induces economic growth and water pollution. Firstly, a growing population directly influences how much additional water is required for personal and household uses (also known as "domestic use"). Secondly, population growth expands economic activities, such as agriculture and industry, which also require additional water. Increased population and economic expansion will also increase waste generation and water pollution. Overall, population growth results in an increasing demand for water and also increases water pollution. The total water demand in Thailand was more than 70,000 Mm³ in 2008.

Urban dwellers use much more water. In Thailand, water required for domestic use is classified as rural or urban. The water use in rural areas is estimated at 50 liters per person per day, compared with 250 liters for urban dwellers.⁷ Water conservation at the household level in urban areas could contribute significantly in reducing the pressures on water demand.

In a 'doing nothing' scenario, water demand is expected to increase by 35 percent over the 20 years. While agriculture uses the most water, industrial water use is expected to increase significantly, especially in the Northeast and the East. The large increase in the Northeast is due to the expansion of sugar industries in the upper Chi basin. Without proper actions, the water deficit is expected to increase from 5,000 to 9,000 Mm³ during this period. *Figure 3.3* shows basins with serious water shortages in orange. If water management is not streamlined and improved, total water demand, not including that necessary to maintain the ecological balance, is expected to increase from 57,000 Mm³ in 2004 to 77,000 Mm³ in 2024 (See Table 3.2).

⁷ Study on National Water Resources and Management of 25 River Basins, Office of Public Policy, Office of the National Economic and Social Advisory Council, 2547.


Figure 3.3: Thailand's water shortage

[Orange: serious, yellow: moderate, green: low] Source: DWR, 2007

Table 3.2: Water demand in 2004 and 2024

	N-C	NE	Е	W	S	Total			
Total Water Demand (billion cu.m.)									
2004	29.34	11.00	4.10	8.13	4.90	57.47			
2024	35.76	18.89	6.15	9.69	7.12	77.61			
% increase	22	72	50	19	57	35			
Agriculture (billion cu.m.)									
2004	26.80	9.89	3.13	7.79	4.34	51.95			
2024	32.13	16.43	4.66	9.13	6.23	68.58			
% increase	20	66	48	17	57	32			
Domestic and tourism (billion cu.m.)									
2004	1.43	0.64	0.22	0.16	0.28	2.73			
2024	1.62	0.91	0.46	0.22	0.38	3.59			
% increase	14	41	103	37	44	31			
Industry (billion cu.m.)									
2004	1.12	0.46	0.74	0.18	0.28	2.78			
2024	2.00	1.56	1.04	0.34	0.51	5.45			
% increase	79	241	40	96	60	96			

Source: DWR, 2007.

Maintaining acceptable river water quality also requires effective control of wastewater. Increasing water pollution will in turn reduce water available for high-valued water uses. The Pollution Control Department (PCD) is responsible for the management of overall water quality, while the sector agencies are responsible for the control of wastewater discharge at the source. Wastes from industries are controlled by the Department of Industrial Works (DIW) and the Industrial Estate Authority (IEA) of the Ministry of Industry. Wastes from agriculture are controlled by agencies under the Ministry of Agriculture and Cooperatives (i.e. the Royal Fishery Department, the Department of Livestock, and the Department of Agriculture). The local governments control domestic waste. Public disclosure of the monitoring and enforcement results will help ensure good water governance and the effectiveness of water pollution control.

Only 13 percent of domestic waste is treated. Careful consideration should be given to the construction of new treatment plants. Although domestic and industrial uses are not the major users of water, wastes generated from these activities pollute water, rendering it unsuitable for other uses. Table 3.3 summarizes an estimated waste load from these sources in Thailand.

	N-C	NE	Ε	W	S	Total
Waste generation (Mm ³ /day)						
Domestic	5.5	5.4	0.9	0.6	1.6	14
Industry	3.5	10	0.9	0.6	0.8	7
Agriculture	53	77	8	4	5	147
Total	62	92	10	5	8	168
BOD (tons/day)						
Domestic	997	1,037	165	106	300	2,605
Industry	1,831	79	548	150	138	2,746
Agriculture	332	282	118	71	43	847
Total	3,160	1,398	831	327	481	6,198
# of Waste Water Treatment Plants	37	18	15	8	17	95

Table 3.3: Waste Loads

Source: Pollution Control Department (PCD) and DWR, 2007.

Expanding wastewater treatment is very capital intensive and is a major challenge. From 95 wastewater treatment plants around th country, there are 7 in Bangkok; 84 in municipalities; 2 in Pattaya; and, 2 in sub-districts. The designed capacity of these treatment plants is approximately 3 Mm³/day, but many of them experience low efficiency due to low BOD of the incoming waste.

3.2 Poverty, Agriculture, and Water Shortage

In general, Thailand has done well in reducing poverty. The Millennium Development Goal (MDG) target of halving the number of poor from 1990 to 2015 has already been achieved, despite facing challenges such as population growth and the Asian economic crisis in the 1990s. The number of people living in poverty fell from 44.21 percent in 1988 to 8.12 percent in 2009 (NESDB, 2010). This represented a drop from 22.1 million to 5.3 million. (See Figure 3.4)

About 60 percent of Thailand's poor are still concentrated in the Northeast. Although the overall poverty improves, the distribution has been quite a challenge. Figure 3.5 shows that a substantial numbers of the poor still remain in the Northeastern and Northern regions. Overall, 60 percent of the poor still remain concentrated in the Northeast. And, about 44 percent of these poor are rice farmers, many of whom have no access to irrigation.



Figure 3.4: Number of people under poverty line (1988-2009) Source: NESDB, 2010.



Figure 3.5: Percentage of people under poverty line by region *Source: NESDB, 2008.*

Slow growth in the Northeast imposes large impact to people, particularly those engaged in agricultural activities. Economic growth in the Northeast has lagged behind other regions largely related to agricultural activities. Insufficient agricultural yield, an absence of off-farm income, infertile land, the large number of small landholdings and unsustainable farming methods and, last but not least, a scarcity of water are among the reasons of slow growth in the Northeast. In 2004, Thailand had approximately 18 million households (each with an average size of 4.5 persons, as compared to 3 for the national average). Of these 18 million households, 5.8 million (31 percent) were engaged in agriculture (and in the Northeast, it was 51 percent). Of the 4.4 million households growing paddy rice, 2.7 million were in the Northeast. About 65 percent of agricultural households (857,000 households) did not have access to water.



Most farmers are poor, earning an average of less than US\$1 per day. A 2002 survey by the DWR, the most recently conducted, indicated that:

• Average annual income is about 99,000 Baht per household or 22,000 Baht per person (Table 3.4).

• All regions except the Northeast had a household income higher than the national average.

• The Northeast had an income of 76,000 Baht per household per year.

• On average, about 40 percent of a household's income came from agriculture.

• An average income was about 22 Baht per person per day.

	N-C	NE	E	W	S	Average
Socio-economic survey (2002)						
Average net income,	113	76	140	147	118	99
(Thousand Baht/household/year)						
Average net income	27.4	16.7	31.3	31.6	26.0	22.0
(Thousand Baht/person/year)						
Size of agricultural household	4.14	4.58	4.46	4.65	4.54	4.49
(person/household)						
Total agricultural household (million)	1.63	2.73	0.31	0.18	0.81	5.66
Average agriculture net income	55	20	77	87	48	39
(Thousand Baht/ household/year)						
Average agriculture net income	13.2	4.4	17.2	18.6	10.6	8.8
(Thousand Baht/ person/year)						
% net agriculture income/household income	48%	26%	55%	59%	41%	40%
Socio-economic survey (2004)						
Total household, million	8.27	5.22	1.73	0.85	2.39	18.43
Total agricultural household, million	1.75	2.64	0.31	0.21	0.88	5.80
% agricultural household / Total	21%	51%	20%	26%	37%	31%
Household with rice paddy, million	1.25	2.70	0.13	0.07	0.26	4.41

 Table 3.4: Basic data on agriculture households

Source: DWR, 2007.

Poor farmers have also been facing economic and financial risk due to climate changes and water-related emergencies. Agricultural yields normally fluctuate wildly from one year to another due to changes in climatic conditions. Rice production requires large amounts of water, and therefore is subject to higher risks related to intensity, frequency and overall amount of rainfall. During 2004, a dry spell damaged more than 2 million *rai* in 28 provinces, mostly in the Northeast. The government had to provide financial support to more than 827 million Baht to about 330,000 farmers. In some cases, poor farmers are penalized when there is a need to urgently divert water away to protect a more important area (such as Bangkok Metropolitan). Without effective controls, farmers will continue to suffer from weather shocks. The risk will be higher with uncertainty on climate change impacts.

An insurance scheme based on a rainfall index is currently being implemented by the Bank of Agriculture and Agricultural Cooperatives (BAAC) to mitigate the risks.

More than sixty-five percent of agricultural areas do not have good access to water. Agriculture requires water, but only about 33 percent of agriculture land is irrigated or has access to small water schemes (See Table 3.5). About two million households benefit from irrigation and small-scale water schemes, which is about 35 percent of the 5.8 million agricultural households. In terms of households, this means about 857,000 thousand agricultural households do not have access to water for agriculture.

	N-C	NE	E	W	S	Total
Basin area, (million rai)	124.6	105.5	22.8	23.5	44.2	320.7
Agricultural area, (million rai)	38.3	58.0	10.5	5.1	19.2	131.1
Irrigation area (million rai)	13.3	4.2	2.2	1.9	2.2	23.7
Other water scheme, small, (million rai)	8.8	4.6	1.0	0.7	1.9	17.0
% of irrigation access /Agricultural area	35	7	21	38	0.7	20
% of other scheme/Agricultural Area	23	8	9	14	2	13
% of Agricultural area/basin area	31	55	46	22	42	40
Household with water shortage for	273	422	44	32	86	857
agriculture (thousand households)						

Table 3.5: Agriculture-related data, 2004

Source: DWR, 2007.

The Northeast suffers from water shortages, resource scarcity, and a relatively harsh climate which often result in floods and droughts. Though rainfall in the Northeast region is very similar to the national average, a very high evaporation rate and a porous and salty red laterite soil limit the agriculture development potential of the area. Nearly seven percent of the Northeast has salty soil, of which most is in the *Moon* basin. About 70 percent of land is dedicated to rice production compared to the 54 percent in the North and 43 percent in the Central region, and only 13 percent of the farmers are specialized in non-rice crops, such as cassava, maize, fruits, and vegetables. According to the DWR, a "water-stressed" area is defined as suffering shortages of both agricultural and domestic water, and being influenced by poverty. The DWR uses color-coded maps to assign areas degrees of stress with "most severe" (red), "severe" (pink), "moderate" (yellow), and "no issue" (brown). Figure 3.6 shows that several water-stressed areas are concentrated in three provinces of the upper Chi and *Moon* basins.



Figure 3.6: Water stress in NE Thailand Source: DWR, 2007.

The Northeast has more farmers specializing in livestock compared to the other regions. Fishery, however, plays no role in the Northeast for agricultural households, while it provides income for at least five percent of agricultural households in the Central area and up to eight percent in the South. Agricultural households are poorer than non-agriculture households, and rice farming households are poorer than other sectors. The rice farmers in the Northeast account for 44 percent of Thailand's poor. Table 3.6 shows the irrigated area in the Northeast. It is estimated that the irrigated area in the dry season is less than 20 percent of that in the wet season.

Table 5.0. If figated Area in Northeast Finananu (thousand Kar)							
	Kong Basin	Chi Basin	Mun Basin	Total			
Year 2000	1732.656	1754.712	2289.350	5776.718			
Year 2005	2034.800	2102.418	2627.843	6765.061			
Year 2009	1729.375	2676.875	1966.250	6372.500			
		1 2006 1100 2011					

 Table 3.6: Irrigated Area in Northeast Thailand (thousand Rai)

Source: RID, Irrigation Yearbook 2001-2006, NSO, 2011.

3.3 Increasing Demand for Water Governance

It is important to understand "good governance" in the water sector. Good governance in the context of the water sector describes how an organization that provides water or serves water users is structured and operated in order to provide services according to user demand (external accountability), and to create incentives for efficient, user-focused organizations (internal accountability). Most of the debate on water sector governance has been focused on: how best to promote decision making at the most appropriate level; exploring structural reforms to eliminate inefficiency and corruption; and on matters of accountability to users.

Water governance focuses on a range of issues that affect the way water is allocated among competing uses. These include charging for water services; formal and informal water rights; defining roles of government versus communities; planning to address risk of floods and droughts; water pollution control; and the negative impacts of some water resources development projects. Poor water governance, especially related to an inability to resolve upstream-downstream water uses, is likely to increase conflicts among water users and lead to unsustainable water management and inequitable water use⁸ that could lead to adverse impacts on the downstream users. Box 3.1 presents two stories related to poor water governance in the northern part of Thailand.

⁸ Unsustainable water management means that the usefulness and availability of water resources will not be maintained in the long term, and future generations will be denied the advantages of the sustained resources. *Inequitable* water management means that the resources will not be equally shared among different stakeholders. *Inefficient* water management means that the water resources are not used and managed in an effective and consistent way.

Box 3.1: Two real stories in the northern part of Thailand

Upstream-downstream conflict caused the collapse of the traditional rice irrigation systems in the lowland part of a River Ping's sub-basin in Chom Tong District, near Chiangmai. In the upper part of this sub-basin are many hill tribes' cabbage farms, while the lower part hosts several traditional irrigation systems operated by local people that rely on the water coming from upstream. To boost productivity and ensure protection against pests, the upstream farmers overused pesticide. The residues drained into the stream, thereby polluting it. The rice farmers downstream, however, didn't realize that there was a problem until they discovered that their buffalos didn't want to bathe in the stream. Eventually they realized why. Finally this situation led to tensions and conflicts between the two groups of stakeholders. In the end, as no proper moderation or management of the issue was attempted, most of the traditional downstream irrigation systems collapsed.

An example of **inequitable water management** is the improper land and water use very common in a large number of golf courses and tourist resorts. One particular golf course in Mae Rim (Chiangmai province) blocks a natural stream to impound water. This stream is public and has been used by subsistence farmers downstream for generations, long before the golf course was built. Without water for farming, the farmers were forced to migrate to the city to be able to survive.

Institutional and legal actions are important in promoting good governance in water sector. Addressing governance issues require the development of institutional mechanisms that promote a transparent administrative process and procedures for information disclosure and stakeholders' participation, as well as fostering effective communication among stakeholders and increasing their knowledge on the issues and constraints. Implementation of the Public Disclosure Act (1997) and integration of public opinions in the Environmental Impact Assessment (EIA) process could help improve transparency and good governance.



Despite its difficulty, improving the governance is only the first step in fostering effective cooperation among farmers. Demand-side management (*reducing water use per production unit*) will become increasingly necessary, or even unavoidable, in the future due to the scarcity of resources. Effective discussion on various options for the agriculture sector -- such as growing alternative non-rice crops (like young corn, seeds, etc.), undertaking contract farming, and applying new technologies -- is possible only when farmers understand and are convinced that they will benefit from cooperation and will receive fair treatment. Other innovative approaches that have been successfully implemented in Australia involve the establishment of tradable water rights, so that a farmer can 'trade-in' his water rights to a city that is facing water shortage and willing to offer premium prices.

Effective consultation with key stakeholders on the tradeoffs will be required throughout the planning and implementation of a water resource development project. Water infrastructure is land intensive, and the development of storage and distribution infrastructure may involve land acquisition, resettlement of local people, and loss of forest and agricultural land, which may adversely affect upstream and downstream fisheries and the rivers' character. Increasing grievances expressed by local populations affected have finally managed to raise public awareness. In some cases major public concerns have arisen and have heightened expectations regarding developers' performance. Given the complexity of issues and limited resources, the decisions about tradeoffs and compensations will not be easy. The recent development of a large hydropower project (NT2) in Lao PDR could serve as an example of how to move forward on these issues. However, this experience should be carefully adjusted to fit the national and local context. (See Box 3.2)

Box 3.2: A project in Lao PDR: finding consensus in openness

Throughout the development of the Nam Theun 2 (NT2) Project in Lao PDR, a focused effort was made to communicate a broad array of information as well as to proactively consult with stakeholders. This included both national and international audiences – from the villagers being impacted to government representatives and international parties. The aim was to get feedback from relevant stakeholders as to the design of the documents, particularly the social and environmental ones, in order to improve the project. Information was produced in both English and Lao language, and special efforts were put into developing materials, including posters, brochures, and photos, that were appropriate for the people being impacted. The proactive disclosure of information and undertaking of consultations were a crucial part of the projects of developing and preparing the project, and continue to be throughout project implementation. This has allowed for the project to be more open and transparent, for improvements to be made to documentation and the project itself, and has enabled the project to gain national and international credibility.

In practical terms the enhanced communication with stakeholders produced feedback that influenced the design of resettlement housing for impacted people as well as enabling input from international civil society on biodiversity conservation. By being open, transparent and consultative, the project has been able to communicate the full scope of its work and allow others to learn from it and make opinions or suggestions based on all the available information. The NT2 experience also shows that even more value can be obtained from consultations involving brain storming for solutions to problems, carried out early on in the process.

There is the potential for new water storage development, but large investment and extensive consultation would be required. Preliminary studies by the Royal Irrigation Department (RID) indicate that about 30,000 Mm³ could be developed through 246 large and medium projects (Table 3.7). Of these, several basins in the North, Central, and East regions have development potential for large storage capacities. Development of 123 smaller projects with a storage capacity of less than 30 Mm³ each would cost about 146 billion baht and benefit about 5 million *rai* of land, costing about 36 baht/m³, or 30,000 baht, per *rai*. About one-third (80 projects) are located in the North-Central, and another one-third (78 projects) are in the South. The Northeast, the East and the West have low development potential. Of the 18 small projects for the Northeast, 15 are located in the Chi basin.

Regions	Storage Capacity in Million cu.m. (No. of projects)					
	30-100	>100	>30			
N-C	1,701 (31)	4,004 (9)	5,705 (40)			
NE	727 (15)	582 (3)	1,309 (18)			
Е	978 (18)	912 (4)	1,891 (22)			
W	291 (4)	-	291 (4)			
S	1,429 (29)	4,489 (10)	5,919 (39)			
Total	5,126 (97)	9,987 (26)	15,115 (123)			

Table 3.7: Development Potential

Source: DWR, 2007.

Box 3.3: A Thai farming community adapts to climate change in a bid to save their livelihood

For 57 families in the Northeast's impoverished Yasothorn province, immediate action was needed as they were watching their rice crops wither from what locals described as the worst drought in 57 years. Then they learned about an adaption program initiated by a local NGO, Earth Net Foundation (ENF), and Oxfam.

The program, which ENF has been fostering in eight Yasothorn districts since 2004 to promote organic jasmine rice farming has been successful in their village, according to farmers from Goot Choom district. As soil fertility increased, so have yields per acre, as has the health of the farmers. One family's output has even doubled at 873kg/rai. The highest yield ever recorded in Thailand was a mere 450 kg/rai in conventionally grown rice. Organic farming depends less on off-farm inputs, requires less energy, is environmentally sound, and crops can withstand drought better A study by ENF showed that an average harvest for organic farmers in the project is around 350 kg/rai, slightly bigger than those farming conventionally. But the organic farmers could make much higher profits because they could save on chemicals.

Yasothorn is part of a legendary plain called *Thung Kula Ronghai* or "Weeping Plain," for its barren landscape is the country's most arid region. As global warming has taken its toll, water has become scarcer, especially since there is no irrigation support. A 10-year village record on annual rainfall showed the rain arrived later and later every year. The province also recorded an upward trend in temperatures with a wider gap between the maximum and minimum. The local phenomena were borne out by a recent study by the Global Change System for Analysis, Research and Training (START) Southeast Asia Regional Research Centre.

Through hours of discussion and consultation Oxfam and ENF provided knowledge on climate change impacts and how to minimize them, and a number of villagers were then able to design and construct their own water supply systems, unique to each farm.

(From Oxfam International April 2009)

3.4 Increasing Pressure on the Mekong Water Uses

Increasing population and development pressures in the Mekong basins will affect water use in the Mekong River. The Mekong River is one of the worlds' most significant rivers (Figure 3.7). It originates in the Tibetan Plateau (the highest and largest plateau on Earth), and flows through six Asian countries (China, Myanmar, Laos PDR, Thailand, Cambodia, and Vietnam). The river is one of the largest in the world (4,800 km long with 795,000 km² of watershed) and supports the livelihoods of more than 70 million people. The topography, climate and water chemistry influence the structure of the river, and high variations in rainfall result in large seasonal differences in flows. Of an average annual flow of 475,000 Mm³, 35 percent comes from Lao PDR, 18 percent from Thailand; 18 percent from Cambodia, 16 percent from China, 15 percent from Vietnam, and 2 percent from Myanmar. The river is considered of high

value for fisheries and other ecological resources, especially once it reaches the *Tonlesap* in Cambodia.

High social and environmental cost from the developments along the Mekong river basin should be explicitly addressed. Southeast Asia's rapid development (especially China's) and the population and economic growth in the Mekong basin will become a pressing factor impacting on competing water uses. A number of hydropower development projects are planned or under construction along the mainstream Mekong or its tributaries; as/if they all become fully operational, possibly in the next five to 10 years, they have the potential to significantly change the Mekong's water flow and pattern. While these development projects certainly have the potential to provide benefits to the countries involved, it is unlikely they will fully compensate for the high social and environmental costs. An opportunity exists for Thailand to benefit from these changes, but a series of measures must be undertaken to mitigate the negative impacts.



Figure 3.7: Mekong River Profile

The Mekong River Commision (MRC) is an example of a large-scale IWRM. In 1995, Lao PDR, Thailand, Cambodia, and Vietnam entered into a cooperative agreement, and the The Mekong River Commission (MRC)⁹ was established to ensure fair and equitable use of water resources in the lower Mekong basin. Key agreements include sharing of information, notification, minimum waterflows, and water quality. MRC and its agreements are considered a means to address potential issues related to water use in the Mekong region. MRC has been promoting the implementation of IWRM and has made an effort to involve China and Myanmar, which are dialogue partners.

⁹ For more information, see the MRC's website at: http://www.mrcmekong.org/

3.5 Deforestation and Climate Change

Forest protection is much more effective than reforestation and the role of local communities is critical. Deforestation and degradation of watersheds remain a problem, and pressures are increasing due to population and economic growth. Forest cover and rainfall are critical for the renewal of water resources. To recover the forest area lost in Thailand during the past 40 years, reforestation efforts have been made by the government, local communities, and the private sector. However, the recovery of the forest's ecological functions takes time and requires continuous protection. An effort to establish a community- managed forest remains pending. The Ministry of Natural Resources and Environment (MONRE) needs to revisit the reforestation strategy and facilitate the promulgation or the revision of the appropriate acts.

Climate change could affect the normal rainfall and water cycle, therefore compromising ecological balance. Increases in air temperature will accelerate the water evaporation rates and change the frequency, duration, intensity and geographical patterns of rainfalls and water runoff. Changing climate patterns could induce significant damage due to more frequent floods and droughts, or other extreme events. (See *Box 3.4*) The life-cycles of insects and microorganisms are also likely to be influenced, and therefore create serious impacts on agricultural outputs, ecosystems, and public health. Scientific data also suggests that the sea level would increase significantly. Recent damage due to cyclones, typhoons and the outbreak of SARS, bird flu and the re-appearance of the old scourges, dengue fever and malaria, reflect some of the negative effects of climate change on human and animal health.

Box 3.4: Background on Climate change

Temperatures in South East Asia are expected to increase in the next 50 years by 1 to 2 degrees, with hotter hot seasons and shorter cool seasons.

An increase in global temperature, in a likely range of 1.1-6.4°C, is expected to occur in the 21st century (according to the latest IPCC Special Report on Emission Scenarios). This would significantly change precipitation patterns, making some areas much more humid and others much drier. The World Bank's 2007 Environment Monitor for East Asia and the Pacific "Adapting to Climate Change" report suggests that for Southeast Asia the range of temperature change will be between 1 and 2°C. The hot period of the year will be longer while the cool period will be significantly shorter but with more rain. These changes in the climate pattern will result in higher discharge from most of the Mekong River tributaries, which are the highest contributors to the increases in precipitation. Agricultural sectors, especially rainfed systems will also be affected by changes in climate patterns.

Change in rice productivity was studied as a means of assessing the likely impact on rainreliant farms. Field studies in simulated conditions indicated that yields of rice crops in Thailand could increase by 3-6 percent; in Lao PDR, on the contrary, yields might be reduced by almost 10 percent. The Mekong River delta in Viet Nam tends to be particularly vulnerable to climate change. The summer-autumn crop production could be severely affected, with reductions in yield of more than 40 percent.

The flow of the Mekong and its tributaries would likely increase due to the higher rainfall. In dry years, however, many sub-basins may have slightly less water.

Adaptation strategy and capacity are urgently needed for Thailand. Thailand does not have any obligations under international climate change agreements, but there will doubtlessly be effects of all kinds on the Thai population. Better understanding of the likely consequences of climate change, and building resilience in the country, would reduce the Thai peoples' vulnerability. While the national agencies are developing an adaptation strategy at the national level, building local capacity to understand and be responsive is considered critical. There are also opportunities for Thailand to benefit from the existing Clean Development Mechanism (CDM) and the upcoming financial mechanisms, such as Reduced Emissions for Degradation and Deforestation (REDD), Clean Investment Funds (CIF), and other Carbon Finance (CF) mechanisms being promoted by various countries and international agencies.

Chapter 4: Policy, Institution, Management

This chapter discusses the policy, regulatory and institutional frameworks that support IWRM implementation, focusing on the performance of the 25 River Basin Committees (RBCs), the structure of the institutions, and the planning and budget allocation process. It also presents IWRM experience at the sub-basin levels and the valuable and groundbreaking experience of the King's projects. The institutional and policy challenges are discussed in Chapter 5.

4.1 Policy/Legal Frameworks

IWRM has been incorporated into the national policies, but legislation to implement the program remains inadequate. The concept of IWRM has been included in several national policies, and in mid-2007, to celebrate the King's 80th birthday, the government declared "*Water*" as one of key national agenda. A number of activities were carried out to increase public awareness and cooperation on water resources management. Box 4.1 highlights the vision and key elements of the national water resources policy.

Institutional fragmentation is one of the key bottlenecks. The existing regulations were developed for implementation of a subsector planning approach, and consequently the responsible subsectoral agencies have established operating procedures to suit their sector purposes, rather than viewing water holistically. This situation has made it difficult for Thailand to change the existing planning and budgeting processes without a clear legal provision capable of forging effective integration of various subsectors.

Experience in other countries suggests that effective water legislation should clarify the entitlement and responsibilities of water users and water providers; define roles of the government in relation to other stakeholders; formalize the transfer of water; ensure sustainable use of water resources and water values; and provide legal status of water management institutions, including government and water user groups. A draft Water Act has been developed (Box 4.2) in line with the above principles, but promulgation of the Act has been a long process (starting in the mid-1990s) and has involved at least 19 public consultations to date. The final draft was submitted to the cabinet in late 2007 and awaits submission to the parliament. The proposed water use classifications and the proposed water fees attracted much discussion and debate among various parties. Of the three-fold water use classification proposed (household, commercial, very large water users) the household users and small farmers would not be required to register and pay fees, while the latter two classes would be. This information should be made known to water users and local communities as widely as possible

Box 4.1: National Water Vision and Policies (25 July 2000)

Vision: By the year 2025, Thailand will have sufficient water of good quality for all users through an efficient management, organizational and legal system that would ensure equitable and sustainable utilization of its water resources with due consideration on the quality of life and the participation of all stakeholders. Key policies include:

- 1. Accelerate the promulgation of the Water Act as the framework for national water management
- 2. Create water resource management organizations both at national and river basin levels with supportive legislation
- 3. Emphasize suitable and equitable water allocation for all water use sectors
- 4. Formulate clear directions for raw water provision and water resources development
- 5. Provide and develop raw water sources for agricultural purposes
- 6. Develop and include water related topics at all levels of educational curriculum
- 7. Promote and support participation of the public, non-government and government organizations
- 8. Accelerate preparation of plans for flood and drought protections.
- 9. Provide sufficient and sustainable financial support for action programs in line with the national policy.

Box 4.2: Key elements of the Draft Water Act (2007)

- Water rights: for Thai people and the public.
- Water classification: Commercial and large-scale water users are required to register and pay for water; household and small-scale users do not.
- Set up the National Water Resources Committee (NWRC) and the River Basin Committees (RBCs): responsible for systematic management of water resources at national and river basin level, respectively; the water user groups can be established.
- Set up a Water Fund; can be used for protection and management of water resources.
- Development and conservation: defines ways to plan and implement when trans-basin transfer is needed, including compensation, and conservation of important areas.
- Monitoring and surveillance: yearly report
- Penalty: fines and/or jail.

4.2 Institutional Framework

Many committees, agencies and stakeholders will be involved in IWRM and their effective cooperation will be critical. The institutional structure for IWRM comprises ministries and agencies responsible for policy, planning, and implementation at the national level and local agencies responsible for local operations. There are also national and sector committees established for policy decisions. The National Water Resources Committee (NWRC) and the 25 River Basin Committees (RBCs) are the key decision makers while the Ministry of Natural Resource and Environment (MONRE), especially it's agency the Department of Water Resources (DWR), is the leading agency overall.

Figure 4.1 presents the organization structure of water related agencies, following by key functions of the committees and agencies as well as institutional issues.



Figure 4.1: Connection among key agencies

Local authorities

Thailand is divided administratively into 76 provinces (Changwat), including Bangkok; 927 districts (Umpher); 7,380 subdistricts (Tambon); and 74,779 villages (Moo Ban); and they are administered through the Ministry of Interior (MoInt.). Bangkok Metropolitan Authority (BMA) and the Pattaya local authority have their own special mandate.

Sector agencies

Ministry of Natural Resources and Environment (MONRE) is responsible for management of natural resources (including surface water, groundwater, forestry, protected area, mineral resources, and coastal resources) and the environment, including pollution control and Environmental Impact Assessment (EIA) review. With such a wide responsibility, effective cooperation among key agencies within MONRE will be critical for forging effective IWRM implementation. MONRE, however, is a relatively new ministry, with more than 50,000 personnel moving there from different ministries and departments in late 2002.

Department of Water Resources (DWR) is the lead agency under MONRE responsible for fostering IWRM implementation and key activities are summarized in Box 4.3. Established in 2002, DWR is also a new agency, with most staff coming from the rural development department of the Ministry of Interior.

Royal Irrigation Department (RID) and the **Electricity Generating Authority of Thailand** (**EGAT**) are the two key water users. In the past they have been the two main agencies responsible for the overall planning, development, and management of water resources. As RID and EGAT will play a leading role in future development and operation of large and medium water storage, their cooperation in the implementation of IWRM will be vital.

Box 4.3: Key activities undertaken by DWR to promote IWRM

(1) Establishment of RBCs for the 25 basins in 2004, including setting up guidelines and operating procedures. The RBC performance was reviewed and the regulations and guidelines have been revised and improved.

(2) Conducting a number of meetings and workshops to share experience and/or increase knowledge and understanding on IWRM and RBC operations, including conducting pilot studies in several sub-basins.

(3) Developing a strategic map on participatory river basin management (2009) describing detailed activities that should be carried out at the basin and sub-basin levels. Training is being provided.

Institutional Developments

The National Water Resources Committee (NWRC) is responsible for providing policy direction regarding water resources management in Thailand; NWRC is chaired by a deputy prime minister and reports directly to the Cabinet. The committee comprises representatives

from agencies, local government, NGOs, and experts. The NWRC appoints RBCs responsible for planning and supervision at basin level.

The 25 **River Basin Committees (RBCs)** have been established, each comprising 35 representatives from government and key stakeholders. Key functions of the RBCs are summarized in *Box 4.4*.

Thailand is a member of the **Mekong River Commission** (**MRC**) and has established the National Mekong River Committee (NMRC) in line with the MRC 1995 agreement. DWR, through its Bureau of International Cooperation, serves as the secretariat to this committee. NMRC is chaired by the Minister of Environment.

There are also **other national committees** established by most sectors, the most relevant being the National Environment Board (NEB) and the National Economic and Social Development Board (NESDB). NEB is responsible for overseeing the implementation of the Environmental Quality Act (1992), and NESDB is responsible for development of the national development plan, including appraisal of large investments.

Box 4.4: RBC functions as delineated in the 2007 regulation

- (1) Make recommendations to NWRC on policy, plans and projects, corrective measures on water resources development; uses and conservation, including activities of other agencies in the basin.
- (2) Develop water resources development plan for the basin and coordinate action plans of various agencies in the basin in line with the basin plan;
- (3) Prioritize water allocation to users, including set amount and measures, equitably and efficiently.
- (4) Monitor performance of water agencies.
- (5) Collect data and information related to water resources management, conservation, floods and drought management, and water quality.
- (6) Facilitate planning process and mediate conflicts.
- (7) Coordinate actions with other RBCs.
- (8) Inform public on the water issues and RBC activities, and
- (9) Form working groups to undertake activities as assigned by RBC.

In relation to flood and drought, many government agencies have established centers or taskforces to specifically address these issues. DWR has established a Water Crisis Prevention Center and installed a number of gauges in priority river basins, including an early-warning system in some of the most vulnerable areas, notably 398 villages identified at high risk of flooding and mudslide. The Royal Irrigation Department has also improved its capacity to predict the water flow and improved efficiency of its reservoir operations, while Bangkok

Metropolitan Authority has strengthened its capacity to deal with flooding in Bangkok. As for emergency response, after the 2006 tsunami, the government established an emergency response center at the Prime Minister's office and a local early-warning system along the Andaman Sea, while another is planned for the upper gulf. The Department of Mineral Resources has also carried out various research studies related to sink holes and coastal erosion issues. Table 4.1 summarizes the primary functions relevant to water resources management under each government agencies, as well as the related legal frameworks.

Primary functions	Ministries	Agencies	Regulations
National plan	Prime Minister's	NESDB	
	Office		
Hydropower development	Ministry of Energy	ЕСАТ	EGAT (2511)
and operations	(MOF)	Department of Energy	LOAT (2511)
and operations	(MOL)	Promotion	
Irrigation development	Ministry of Agriculture	Royal Irrigation Department	Irrigation Canals (2483)
ingation de verophient	and Cooperatives	(RID). Department of Land	and related regulations.
Agriculture development	(MOAC)	Development (DLD).	Land Reform (2517)
and land use. and Land		Department of Agriculture	2
reform		(DOA), Royal Fisheries	
		Department (RFD), and	
Fisheries		Office of Land Reform	Fishery (2490)
Permanent Secretary		Including 76 provincial	
Office	Ministry of Natural	offices on natural resources	
	Resources and	offices on natural resources	
	Environment	and environment and 10	
	(MONRE)	environmental regions	
Natural resource policy		Office of Natural Resources	National Environmental
and plan, EIA		and Environmental Policy	Quality Act (NEQA)
	-	and Planning (ONEP)	(2535)
Surface water resources		Department of Water	
management		Resources (DWR)	
Groundwater management		Department of Groundwater	Groundwater (2520)
Marina and accestal	-	Resources (DGR)	
		Coastal Resources (DMCR)	
Forest management		Royal Forestry Department	
i orest management		(RFD)	
National Protected Areas	-	Department of National	National Forest Reserves
		Parks. Wildlife and Plant	(2504): Wildlife (2505)
		Conservation (DNP)	
Mineral resources		Department of Mineral	
management		Resources (DMR)	
Water management and		Pollution Control	NEQA (2535)
pollution control		Department (PCD)	
Public education and		Department of	NEQA (2535)
outreach		Environmental Quality	
		Promotion (DEQP)	

 Table 4.1: Institutional and legal frameworks related to water resources management

Primary functions	Ministries	Agencies	Regulations
Pollution control from	Ministry of Industry		Industrial act (2535)
industries	(MOI)		
Pollution control from			Industrial Estate Act (2522)
industrial estate			
Public health	Ministry of Public health (MOPH)	Department of Public Health, etc	Public Health (2535)
Local administration and	Ministry of Interior	BMA, Pattaya, DOLA, etc.	BMA Act, Pattaya Act,
people wellbeing	(MOInt)		Local Government Act
Water supply		MWA, PWA, Tambon, etc.	Metropolitan Water Supply (2510); Provincial Water Supply (2522); Water Supply Canals (2526)
Disaster Prevention and		Department of Disaster	
Mitigation		Prevention and Mitigation	
Meteorology	Ministry of	Thai Meteorological	
	Information and	Department	
	Communication		
	Technology (MICT)		
Water transport	Ministry of Transport	Marine Department	River Traffic (2456); Pier
	(MOT)		(2494)

4.3 Basin Plans and Budgets

Basin development plans have been established for the 25 basins, but due to the lack of budget and disagreement with local people, most of the plans have not been implemented. DWR prepared a national strategy on water resources development and a basin development plan for 2003-2007. The strategy calls for: (i) "sustainable and proactive" water development through increasing water supply, developing the water grid, and adding increasing value to water; and, (ii) an "adaptive strategy" building potential for IWRM and people's participation, as well as developing a database, knowledge, and technology to support IWRM. Key recommendations include investments in mostly large- and medium-sized projects costing about 750,000 million Baht (\$21 billion) total over the next 10 years (Box 4.5).

Box 4.5: Future investment challenges (DWR, 2007)

Key expected targets include:

(1) Rehabilitation of degraded forest : 1.72 million *rai* in five years, including soil erosion protection;

(2) Promote demand-side management by replacing the rice growing in dry season with other crops and thus increase efficiency in irrigation by 10 percent;

(3) Increase storage volume from improvement of natural water bodies;

(4) Increase water storage from water resources development projects;

(5) Increase water in Bhumipol dam, and transfer water from Mekong to Moon and Chi;

(6) Change non-irrigated area to irrigated area of 4.57 million *ra*i in large and medium projects;

(7) Conserve groundwater and recharge; and

(8) Conserve water for ecological purpose of not less than 15 percent in the *Chao Phraya*, *Thajeen*, and *Mae Klong*.

Strategic	Esti	Estimated investment cost in Billion Baht							
Objectives	N-C	NE	Е	W	S	Total			
Sustainability	243	97	85	59	69	553			
Proactive	155	4	6	23	1	189			
Adaptive	1	3	1	0	1	6			
Total	399	104	92	82	71	748			

Integrated budget planning is being applied, but the budget on water resources management has been fluctuating. The total budget for 2010 and 2011 are 1.7 trillion Baht and 2 trillion Baht, respectively. About 0.5-2% have been allocated for water resources management, which is under the strategy for natural resources management (See Figure 4.2). Fluctuating budget allocation and limited budget impose difficulties for the water resource management activities.



Figure 4.2: National Budget on Water Resources Management Source: Bureau of Budget (2011)

Local government budget can be another source of support to integrated water resources management. Decentralization in Thailand transfers some of responsibility from central agencies to local authority. A significant amount of the government budget (i.e. about 25% of overall budget) will be available at local level. The question is whether integrated water resources management is one of the local government's priorities. Currently, local government expenditures are standardized and categorized into (i) general administration, (ii) security, (iii) education, (iv) public health, (v) social, housing, (vi) community development, (vii) religion & recreation, (viii) industry & public works, and (ix) agriculture. There is no explicit water management section, but rather a part of agriculture or community development groups. It is important to make IWRM a priority at the local level to achieve its potentials.

4.4 Monitoring and Evaluation

Several methods have been used to measure water stress, but these focus on the physical aspects. Several approaches have been developed internationally for the assessment of water stress and effectiveness of water resources management. In Thailand, water severity assessment is based on the natural conditions in a water basin. The results suggest that the nine most severely stressed basins are (from the most stressed): *Yom, Chao-Phraya, Sakaekrung, Pasak, Thajeen, Chi, Moon, Bang Pakong,* and *Songkla Lake.* Due to their relatively high population and low water availability, six of these basins (i.e., *Chao-Phraya, Thajeen, Chi, Moon, Bang Pakong, and Songkla Lake)* are considered *"hot spots"* for water resources management. Evaluation of water stress using the natural conditions, as well as accessibility and equitability for water resources management in terms of the Water Poverty Index or WPI¹⁰ was also carried out.

Recently, DWR has also developed its own yardsticks for measuring the effectiveness of IWRM investment. A set of monitoring criteria: *Participation Process, Efficiency, Effectiveness, Output*, and *Outcome* have been applied to different types of investments. The results (See Figure 4.3) suggest that construction of large and medium size reservoirs has resulted in high outputs and effectiveness but have recorded very low values in other aspects, while construction of levees, check dams, ponds, dredging, and water supply resulted in better balance among these five parameters. Rehabilitation of watersheds resulted in a very high score on process but a lower score on efficiency, while flood protection in communities appeared ineffective. This method can be an effective tool for monitoring and evaluation, and it should be reviewed and improved periodically.

¹⁰ WPI was developed by the Center for Ecology and Hydrology, Wallingford, of the Environment Research Council, the United Kingdom.



Figure 4.3: Monitoring and Evaluation (DWR)

4.5 Community Initiatives and National and International Support

Local communities, state enterprises, and the private sector are also active in water resources management. In 2006, to celebrate the King's 80th birthday, DWR published and widely disseminated many success stories about local water resources management. Most of the activities were linked to watershed protection, including reforestation, soil protection with vetiver grass, construction of check dams, protection of fishing habitats and cleaning up water pollution. Many state enterprises such as EGAT, the Petroleum Authority of Thailand (PTT) and the private sector have also been working closely with local communities, schools, and local government in such projects.

Piloting of activities related to IWRM was carried out at the sub-basin level with international support, but the efforts should be considered as a starting point. As a member of MRC, Thailand has participated in all activities, including the preparation of an investment project designed to promote IWRM in the four countries. With technical and financial assistance from the MRC through DWR, the concept of IWRM has been initiated with pilot schemes in two sub-basins in the Northeast (Houi Sam Mor and Nam Poong).

People Participation Planning (PPP) process were initiated, but insufficient funding limited follow-up activities. Local organizations and working groups were mobilized and the sub-basin visions and plans were developed. As a part of the process, a number of working groups

representing women, youth, organic farmers, and their networks were established. But follow-up activities were limited due to the lack of budget. During the process, valuable information was gathered. It was noted, for example, that most of the data reported in various studies on water availability and irrigation areas in small projects was inaccurate; that local conflicts and misunderstandings surrounding water uses had been exacerbated by a lack of adequate consultation and water allocation mechanisms; and that issues related to the overlap between the river basin and administrative boundaries have become problematic. Although a plan has been developed (Box 4.6), budget limitations only allowed for training activities to be carried out. In 2007-08 a feasibility study was carried out and a conceptual design created for a high priority investment for Hoi Sam Mor, identified through the PPP process, accomplished with support from the World Bank through DWR. In *Nam Poong* and *Nam Kum* a similar PPP process was undertaken and a community network has been expanded to cover *Nam Kum* and lower *Songkram* sub-basin. Additional technical and financial input, priority investment and capacity-building through PPP should be continued and scaled up. The nature of such community working groups requires a high level of flexibility in their operations.

Box 4.6: Hoi Sam Mo's Vision and Plan from the PPP

Vision: Strong basin organization for forging sustainable water resources management and rehabilitation of natural health using local wisdom and government. Strategic plans are:

- (1) Access to more water: 13 sub-plans were identified, including transfer of water from Hoi Pra Town to seven existing storages, and the rehabilitation of irrigation areas;
- (2) Organic farming and livelihoods: seven sub-plans were identified;

(3) building capacity of RBO and its network: nine sub-plans were identified;

(4) Local curriculum, knowledge, and community rules: eight sub-plans identified; and

(5) Promotion of women and youth: eight sub-plans were identified.

Hoi Sam Mo is a small river basin located in the upstream part of the *Chi* basin, with a population of about 54,000 comprising 12,000 households, most of them farmers. Average income was about 27,000 baht per person per year. Average water runoff is about 149 Mm³ (maximum about 61 Mm³ in October); water demand is about 38 Mm³ per year.

4.5 The King's Projects

The King's projects pre-date the adoption of IWRM in Thailand and their experience offers seminal lessons. It has been widely recognized both within and outside the country that water resources management and poverty reduction have been the main trust of the Royal Projects, and have always been a personal interest and priority of the King.

During the past 40 years, a number of royal projects have been initiated and implemented all over the Thailand. The primary beneficiaries are poor farmers in rural areas and ethnic minority hill tribes in remote mountain regions. The activities cover a wide range of waterrelated activities, including soil and watershed protection and management; reforestation and building of check dams; agriculture and livelihood development; making artificial rain; construction of small to large dams for irrigation and flood protection; and wastewater treatment. Six research centers have been established in different parts of the country and they were designed to address conditions in specific areas, such as the mountainous regions (*Huay Hong Khrai* in *Chiangmai* and *Phu Phan* in *Sakon Nakhon*); flood plains (*Khao Hin Sawn* in *Chachoengsao*); and coastal areas (*Pikul Thong* in *Narathiwat*; *Huay Sai* in *Phetchaburi* and *Koong Krabaen* in *Chanthaburi*). Some key features are summarized in Box 4.7.

Box 4.7: A look at The King's Projects research centers

Houy Hong Khrai in Chiangmai, was the first research center aiming to demonstrate an integrated effort related to watershed management, focusing on conservation of forest, soil, water, and watershed. Vetiver is used as a "living wall" for soil erosion protection in construction of check dams to increase moisture content in forest areas. Various methods of fisheries production have been developed as well.

Huay Sai, Petchaburi: this project aims to restore the desertified/deforested land by managing water sources and building a forest "fire wall" known as "wet forest system" to keep the areas moist. The center applies the *New Theory* using a revolving integrated farming system by a core group of farmers. The farmers are encouraged to grow vetiver grass and vegetables in alternating rows. The robust vetiver root system, which penetrates vertically deep into the soil rather than spreading over the topsoil, makes it possible for it to grow alongside other plants without affecting their growth. The land, which once was at risk of becoming desertified, became fertile.

Koong Krabaen Bay, *Chanthabur*i (1987) focused its efforts on coastal resources management, covering conservation and management of mangrove areas, the seabed, shrimp farms, and water quality. *Sufficiency Economy* was also applied to agriculture through the promotion of cash crops such as mushrooms, and fully integrated rice-growing, as well as using organic farming methods to reduce farmers' dependence on chemical fertilizers and pesticides.

Pikul Thong, *Narathiwat* (1982, 1087 acres) The study focused on peat soil. The low-quality saline land was not viable for agriculture, so freshwater was used to remove soil acidity in what is dubbed "*Klaeng Din*". This technique has since been applied in many areas.

Understanding, reaching out, and developing. The King's projects recognize the need to understand issues in light of local conditions and social context. The projects give high priority to developing local technology, providing training to poor farmers, and increasing understanding on constraints and issues specific to the area through research and development. Research on vetiver grass has demonstrated its effectiveness in soil protection and management and this technology has been widely and successfully applied.¹¹ Investing in the research centers, including allocating qualified and dedicated staff, demonstrates long-term commitment and

¹¹ In 1993 H. M. the King received an Award of Recognition of technical and development accomplishment in the promotion of the vetvier technology by the International Erosion Control Association, presented by the World Bank

willingness to be part of the development process. On-the-job training and marketing support provide knowledge and capacity- building. The project also promotes cooperatives. These activities demonstrate practical means of integrating resources management operations with poverty reduction efforts. In this way, two of the fundamental theories underlying the King's self-sufficiency philosophy are put into practice: the "Sufficiency Economy" concept and the "New Theory." Both are being applied widely in Thailand. The Sufficiency Economy is a philosophy for the people to live their life based on the three basic principles: "Sufficiency," "Within Reason," and "Small Risk" with two basic foundations: "Morality and Knowledge." The New Theory (Box 4.8) demonstrates ways for small farmers to apply the Sufficiency Economy.

Box 4.8: What is the "New Theory"

The Theory is built on the principle that small farmers (people with 10-15 *rai* of land per household) are poor, need water for producing agriculture products, and construction of large reservoir will be too difficult. Therefore, storing water on the farm and reducing farmers' dependence on cash will be necessary. The theory calls for dividing the area into four parts in a ratio of 30-30-30-10. The first 30 percent (3 *rai*) is used for water storage (at 4m depth); this 9,000 m³ volume will be adequate for a year's water supply and could also be used to raise fish and vegetables for household consumption. The second and third parts (60 percent, or 10 *rai*) is for agricultural production (rice and fruit trees). This would require water in the dry season of about 10,000 m³, or 1,000 m³ per *rai*. The last 10 percent (2 *rai*) is for household and other facilities, vegetable, animal rearing, etc. The evaporation rate is estimated to be about 1 cm per day, so if there was no rain for 300 days the water level would reduce 3m. If larger storage could be provided, this approach could be even more effective. This new theory has been successfully tested as a pilot project in *Wat Chaimongkol, Saraburee* province, and has now been widely accepted and applied by the local people.

Chapter 5: Challenges and Way Forward

While the concept and objectives of IWRM are acceptable to most parties in Thailand, its implementation remains at an infant stage and requires additional time, financial resources, and technical inputs, as well as the strong political commitment to move forward. Thailand has a relatively large population and a rapidly developing and diversifying economy. Under these circumstances successful implementation of IWRM could increase water access and reduce ecosystem stress while also reducing potential conflict among local population; the challenge is how to move the IWRM approach forward in a context where the RBCs remain institutionally weak and key legal provisions are lacking.

This chapter examines the challenges and/or opportunities to move forward IWRM in Thailand, giving particular attention to the following aspects: (i) capacity of RBOs; (ii) engagement of local community and water users, (iii) strengthening effectiveness of the basin planning process; and (iv) the need to address trans-boundary issue in the Mekong River. To move forward three recommendations were provided: (i) Develop IWRM investment projects in priority basins; (ii) Support community activities that promote IWRM in river basins; (iii) Strengthen RBC operations by establishing a clear procedure for connecting the RBC priority with the national and local agencies through government budget planning process; and (iv) Strengthen DWR and MONRE capacity on IWRM at national and basin levels.

5.1 The Challenges/Opportunities

(1) Strong Supports for IWRM Exist at National and Local Level. Forging effective implementation of the RBC mechanism has been a challenge in Thailand given the legal, institutional, and political constraints as well as the large number of stakeholders and the conflict of interest among them. It is noted however that there are strong interests from academic, civil society, community, private sector, and local NGOs to move forward IWRM and many are serving as a member of the RBC and/or it working groups. There are also women and youth groups who also participate in the IWRM process, however, most of the activities were supported by international agencies in cooperation with government agencies. A small study was conducted during 2008-09 to assess RBC performance¹² after 4 years operations and below highlighted key weaknesses and strengths of the RBCs, as expressed by the RBC members:

• *Weaknesses include: (a)* the lack of clear operational procedures and inadequate budget for RBCs to perform effective integration of water resources management in the river basins; (b) inadequate commitment of national agencies and disconnect between the National Water Resource Committee (NWRC) and RBCs, including the lack of clear national direction regarding the RBCs, the national agencies, and local authorities; and (c)

¹² Funding was supported by the Netherland water partnership program through the World Bank and in close cooperation with DWR and the RBCs from 25 basins; the study was divided into three tasks: (1) using questionnaire and target group discussion with representatives from the 25 RBCs; supporting the two working groups in the northeast which was introduced the concept of IWRM from MRC; and (3) sharing experience with MRC countries.

weak capacity of RBCs and knowledge gaps among the members, including understanding on roles and responsibilities of RBC with respect to other agencies at national, regional, and local levels and inadequate support from the RBC secretariats, which are hampered by the lack of budget and political interference at local and national levels.

• *Strengths include:* (a) RBC provides an opportunity for water users and interested parties to participate in the water planning process and thereby discussion and dialog between concerned agencies and stakeholders could be made during the planning stage so that local needs and concerns could be incorporated into the future investment; (b) wide diversity of RBC members which come from agencies, private sector, academics, and local community, water resource issues also provide a wide discussion that could lead to an improved knowledge and understanding on water issues.

Supporting the working group activities of the two pilot basins in the northeast suggested that there are strong interests at the local level to move forward the IWRM concept. However given that the consultation process also offers an opportunity for those who felt dissatisfaction and/or suffered from past experience of water resource development to express their bitter feeling and it is often difficult to facilitate constructive discussion and/or reach an agreement. Some members felt left out by the national agencies and tried to build their own capacity and raised their own fund, however there has not been much that they could do without helps from the agencies. This may be one of the reasons why government representatives do not want to actively participate in the IWRM process. They also appreciated opportunities for the RBC members to share experience with other countries through cooperation with regional and international agencies including MRC and the World Bank. The working group members also experienced some difficulty in connecting with local authority.

All these findings suggest that:

- Without a clear national direction and support from NWRC and adequate allocation of the budget, it will be difficult to expect any improvement from the RBC operations;
- Efforts should be made to build trust and cooperation among agencies and local representatives and the IWRM process should be seen as a means to facilitate constructive discussion and negotiation to achieve a mutual benefit between the national and local interests and timely technical input and continuity of the financial support to the working groups will be necessary to achieve this objective; and
- Connection with the national and local agencies through the government budget planning process seems to be the only way to ensure sustainability of the IWRM process in Thailand.

To move forward, capacity of the RBCs and its secretariat needs to be strengthened in all aspects and additional budget will have to be provided. As a follow-up to key recommendations from the RBC members DWR revised the RBC procedures and prepared as guideline for RBC operations and this is being applied in 2009. However, to be effective, attention should be given to address the following aspects:

- (a) The operating procedures should also include clear procedures and responsible entities for connecting the RBC activities, including the basin development plan, with the provincial and sector development plans so that adequate resources are available for IWRM. DWR regional offices which serve as the RBC secretariat, should take the lead in coordinating with MONRE provincial office and the local agencies to facilitate effective implementation of the procedures.
- (b) Clarify roles and responsibility of RBC in relations to the national and local agencies under the present condition. However, if possible, effort should be made to discuss the future role and responsibility of the RBC, water users, and key stakeholders and the possibility to promulgate a legislation (water law) authorizing RBC to be the IWRM manager of the basin. In developed country an RBC will also have the responsibility to exercising regulatory oversight on basin-related matters, such as establishing an RBC operating fund, which is authorized to collect fees from issuing water permits as well as other revenue sources. This practice is also being applied successfully to the Laguna de Bay in Philippines (see Box 5.1). However, it should be noted that while the RBC's jurisdiction could relate to regulating IWRM issues at the basin level, those affecting multiple basins should be handled by a central body such as the NWRC.
- (c) Building capacity of the RBC and its secretariat and working groups will be a long term process given different background and interests of different water users groups. In Thailand existing local community networks and civil societies are quite strong and technically capable and local knowledge and practical experiences are quite extensive and this is discussed more in section (2) below. Therefore capacity building on various aspects of IWRM could be made through training courses and study visits as well as on-the-job training for farmers.

Box 5.1: Laguna de bay –Experience highlights

Background

- The Laguna Lake Development Authority (LLDA) is the apex organization in the management of the lake basin, with strong legal identity created through an Act of the Philippine Congress.
- LLDA can generate own funds to support its operation and is recognized in the international community as both a River Basin Organization and a Lake Basin Organization with almost 40 years experience.
- LLDA's IWRM practice is reflected in Integrated River Basin Management and Integrated Lake Basin Management, where as the sub-basin is the basic planning unit.
- River Basin Councils in the 24 sub-basins of the lake were created, and LLDA assumed a mentoring role on the initial years and creation of RBCs, who are empowered to form a Federation and operate as an NGO
- LLDA introduced the Laguna de Bay Environmental Action Planning (LEAP) process – a highly participatory approach in identifying problems in the sub-basin and in coming out with solutions in terms of concrete projects in addressing the environmental problem – and assisted local government units and the River Councils to institutionalize LEAP in their planning process

Key Lessons

- Legislated actions for sustainable lake management
- *Politics* in lake governance is sometimes inevitable
- *Community* Networking and Co-management for Watershed Development is essential
- *Sustainable financing* to ensure continuity of programs
- Importance of *scientific data* and availability of management and technical tools in lake management

(2) Engaging Local Communities and Water Users in Planning and Implementation of Basin-level Integrated Programs. The role of local communities and water users in the IWRM process is critical. A bottom-up approach, placing the stakeholders in the center, can increase effectiveness and sustainability of water resources management. However, this process would take considerable time and effort to improve knowledge and facilitate common understanding among stakeholders. World-wide experience suggests that IWRM can be best promoted by connecting top-down or a bottom-up planning approach and with active participation of local communities.

In Thailand, while securing the budget requires the full support of national agencies, including NESDB, the Bureau of Budget, and the Ministry of Finance, implementation depends on the active participation of basin-level stakeholders. During the past few years, consultations with stakeholders and IWRM process had been initiated in many areas, but the absence of sustainable financing mechanisms has greatly inhibited effectiveness of many local initiatives. The

disconnect between the bottom-up planning and the government budget allocation process has made it difficult to secure adequate budget for facilitating the IWRM bottom-up activities.

Past experience (Box 5.2) suggested that with strong government support and effective cooperation among agencies the bottom-up approach can be built on existing social values and local activities. Thai tradition and culture with a strong local leaderships and commitment of local members can be treated as a valuable asset for the country. At present strong social networks and an array of community organizations could be found in every region in Thailand.

DWR itself has been promoting local community participation in national events, various training programs, and pilot activities using government budget and in cooperation with various international agencies (e.g., World Bank, Asian Development Bank, and the Mekong River Commission). It also prepared a report on important local wisdoms related to water resources management in Thailand.

Experience from working with local organization and civil societies in Thailand however suggested that most of these networks and/or organizations were created by them self based on a set of common issues and/or objectives and normally with a strong local leader. They therefore prefer to make their own prioritization according to their specific needs and willing to participate in the water development process if the participatory planning process is used, and their views are considered during the planning and implementation. Engaging local community and water users as a driving force is one of DWR strategy¹³ to strengthen the RBC operations, however technical and financial supports have to be timely provided to demonstrate DWR commitment and maintain the trust and cooperation of these organizations. Providing knowledge on water resources issues and constraints in the river basin to the community leaders could be very effective.

To move forward, the following strategy could be considered:

- Timely technical and financial inputs from DWR and other agencies of MONRE and MAF to: (i) foster the participatory planning process in the pilot sub-basins from implementation stage to completion of the project development cycle; and (ii) scale-up the implementation model to apply the knowledge and experience to other sub-basins and basins.
- Promote bottom-up IWRM at the sub-basin/watershed level with the establishment of grassroots IWRM committees, which can discuss and debate local water opportunities and challenges.

¹³ Draft Strategic Map on River Basin Management (October 2551)

Box 5.2: Build on Existing Social Asset

Strengthening local communities started more than 30 years ago and was initiated by the government of Prime Minister Kurkrit, when money was given to support community development projects. Since then, there have been many forms of government community funding aimed at job creation and solving specific local problems, including programs such as the Jar Program (water storage) and the Latrine Program (toilets). Initiatives by subsequent prime ministers Prachatipat, Taksin and Surayut resulted in a number of communities being strengthened, and it is likely that such programs will continue.

Proponents of a bottom-up approach to water resources management feel that this type of funding should be used to improve community IWRM. Strengthening local communities should be a shared effort among all government agencies, international agencies, civil society and NGO's, and should follow the following basic principles:

- *Target Areas:* instead of starting at a river basin level, initial target areas should be as small as needed and should be selected according to the simplicity and coordination potential (from the smallest unit of identifiable hydrological catchments areas). Initial target areas do not even need to be strictly defined. This is because there are many existing successful examples of IWRM implementation in Thailand on small areas such as a village or a group of villages. Given that there is no similar successful case for larger areas such as a river basin, even after having put in place all 25 river basin committees, it seems reasonable to suggest that IWRM is more easily applied to small target areas.
- *Common Stakeholders' Problem:* Based on the hypothesis that a common problem shared by majority stakeholders in a community unites them, this approach postulates that if more than 75 percent of stakeholders share the same single most important problem, participation will be strong enough to set up effective organization, ruling, planning and action mechanisms. This common problem need not be necessarily water-related, but could be related to any other natural resource such as land or environment. A common problem is defined here as one caused by an exogenous threat (such as drought, flood or land and mud slide) and that is shared by the majority of stakeholders.
- Organization, Rules and Planning: the new approach advocates a bottom-up approach, as opposed to IWRM's top-down approach where Strategic Planning and Management (vision, mission, strategies, etc.) is prepared and implemented from a central agency. The bottom-up approach is unstructured, allowing community stakeholders to freely discuss among themselves and set up their own organization, ruling and planning strategy to address the common problems.
- *Natural Resources:* the new approach does not require a holistic view of natural resources. Instead, it focuses on a single most problematic resource (which need not be water), and lets the stakeholders decide at later stage if other natural resources will be included in the decision-making process.

(3) Facilitating Future Development in Water Resources Sector. In Thailand water resource development will be necessary to support socioeconomic development during the next 20 years. The approach and priority for investment however may have to be shifted from building large and medium size storage systems to a smaller one with a combination of other measures that are more responsive to the local needs and create acceptable impacts on local environment. This is where IWRM process could be useful in bringing key stakeholders together so that discussion on priority issues and needs from the national and local aspects could be made an part of an integrated basin planning and an agreement could be made on how to move forward and who will do what. The process could also be used to facilitate discussion on complex issues like floods and droughts and development of agriculture policy options, including the possibility to promote public-private partnership in infrastructure development to reduce the burden on limited public resources. Below highlighted some of the key challenges and opportunities:

(a) Integrated basin planning

Review of water resources status and pressure in Thailand suggested that the time has come for the government to implement the integrated water resources planning seriously. *Chao-Phraya, Bang Prakong, and Ping* river basins in the north and central, *Kong-Chi-Moon* in the northeast, and *Songkla Lake* in the south were identified as priority basins and significant investment were made in water resources infrastructure as well as in initiate the participatory planning process at different levels. However, with political unrest, instability of government, and inadequate technical and funding supports during the past few years most of the gains, especially on community net works may have been lost. Water resource issues in these basins will continue to be serious in the near future. To move forward effectively, the following issues should first be addressed:

- *Clear procedure for budget planning and allocation.* Effective integration of in the planning and budgeting process in light of decentralization is urgently needed. This is to ensure continuity of government support for the RBC consultation process and void misperception of local community on government commitment. RBC operation is a new mechanism and its connection to the planning and budget allocation has not been established. DWR includes a budget for RBCs support as part of DWR budget plan, but only small budget has been allocated through this mechanism (about 1 million baht/basin/year) and is inadequate to facilitate active operations of RBCs given complexity of water resource in a river basin. It appears that exiting budget allocation process do not favor water sector agency to handle budget that involve other resources (beside water) which are under the mandate of other agencies. This is to avoid duplication and inefficient use of limited resources.
- Need for a special fund for river basin management. Past experience has shown that existing budget allocation mechanism can undermine the benefit of having an integrated planning since there is no incentive for the agencies to work on cross cutting issues. In an integrated water resource planning, the activities are designed to support and/or compliment other activities and a concerted effort will be necessary to maximize the

benefits of each output that could lead to a common outcome, so timing for the activity implementation is critical. When the activities are split according to the budgeting process for each agency, priority of the activity often lost in the budget planning process and timely implementation will be difficult. It is therefore necessary to establish a special budget allocation mechanism that could accommodate integrated planning based on river basin management approach. This mechanism will significantly enhance effectiveness and efficiency in water resources management since the agencies will have financial incentives to cooperate and integrate their activities with other agency. Promulgation of the water law and/or special agreement with BOB and MOF should be explored. This possibility should be discussed among key agencies, including BOB, NESDB, and MOF, to clarify who should take the lead in the planning and budgeting process to support RBC.

• *Clear responsibility for the Songkla Lake:* A high-level committee (chaired by a deputy prime minister) was set up for management of *Songkla Lake* and the Office of Natural Resources and Environment Policy and Plan (ONEP) was the secretariat. Local networks in the area are also well established. There has been very little activities during the past few years and it is not clear who will be responsible for taking the lead in managing water resources in Songkla Lake. To move forward, it is logical that ONEP conduct a consultation process on organization for Songkla Lake in consultation with key agencies and local communities. The results should then submit to the government for consideration so that management actions could be resumed.

(b) Identification of priority investment

As the champion of IWRM, it is also important for DWR to demonstrate how IWRM could lead to capacity building and investment that benefits local communities, including reducing water use conflicts. To achieve this objective, DWR could assist RBC in the priority basins to develop a 5-7 year investment project through the IWRM process comprising policy and institutional support elements as well as priority investments. Cooperation with other key agencies, especially those within MONRE, and key stakeholders (especially the private sector) will be necessary to promote effective integration of policy, investment, and capacity building. It is a national policy to promote private sector participation in infrastructure investment and this option should also be investigated. Effective RBC operations in the basins could help identifying key stakeholders and facilitate discussion on public-private partnerships in water infrastructure. Priority basins could be:

- *Ping:* due to its upstream and downstream conflicts and importance for water use in the central area, including Bangkok.
- Bang Pakong: due to its current conflicts among various user groups;
- *Songkla Lake:* Due to its rapid development, unique ecosystem, conflicting uses, and conservation value; and
• *Kong, Chi, Moon:* Due to the large number of poor farmers, limited development potential, the degradation of natural resources, and rapid development of hydropower in the Mekong mainstream in China as well as Mekong tributaries in Lao PDR.

(c) Flood/drought

Technically, floods and droughts are part of the water cycle process and occurrences can be predicted to a certain extent. However, deforestation, changing land use, and other man-made activities during the past 50 years have exacerbated their impacts. Studies show that more than four percent of the river basins in the North are subject to flash floods and mud slides. Large floods and mudslides also occurred in *Chanthaburi* in the East, several areas in *Suratthani*, and in *Hadyai* and *Pattalung* in *Songkla* province. Flash floods and mudslides can cause loss of life while major water pollution and droughts can cause both temporary and permanent damages to both water users and the ecology.

DWR has developed some technical and management capacity to address floods and droughts issues and a study¹⁴ is being conducted to strengthen modeling capacity taking climate change into account. However, government budget will be needed to continue strengthening this capacity.

Key challenges are:

- Maintenance and enhancement of technical capacity to monitor and predict floods and drought, including effective cooperation among key agencies;
- Adequate investment and local training for the early warning systems in critical areas; and
- Development of local capacity to address floods and droughts.

To address floods and droughts issues, IWRM should be used for:

- Promoting cooperation among agencies and local communities, especially at the local and basin levels, in conservation, rehabilitation and protection of watershed (forest, soil, and water resources), including reducing change in land use;
- Addressing water conflicts during water crises such as floods and droughts; and
- Enhancing effectiveness of emergency response plans.

(d) Agriculture and irrigation development

The development of large- and medium- scale irrigation projects was used as a means to address rural poverty and enhance food security in many developing countries, including Thailand. Such investments have both positive and negative environmental and social impacts. Addressing the issues and options by working through the RBCs will greatly improve the results.

Experience from other countries indicates that a wide range of choices exists for areas of focus, such as: on-farm productivity of water, encouraging conjunctive surface-ground water use for agriculture; improving existing dam management; encouraging on-farm water storage, etc.

¹⁴ On-going technical assistance with funding support from the World Bank (TFESSD)

These alternative lower-cost options should be explored in close consultation with farmers and key stakeholders before any major investment decisions are taken. Effective operation of the RBCs could also facilitate these discussion however with technical support from national agencies (RID and/or DWR).

(4) Addressing Trans-boundary Issue in the Mekong River. Thailand shares a quarter of its total water basins in the north and northeast along the Mekong River. As a member of the MRC, Thailand has played an important role in the management of water resources in the Lower Mekong Basin (covering Thailand, Lao PDR, Cambodia and Vietnam). Acquiring additional water from the Mekong River has to be consistent with the procedures and guidelines that have been developed and agreed to by the member countries.

Recent development of hydropower in the upper Mekong (China dams) as well as those in the lower part (mainly in Lao PDR) have increased public and local concerns on the potential negative impacts on local environment and communities along the Mekong. MRC conducted studies and facilitated discussions and consultations with agencies and information is available for public access. Thailand is expected to gain the benefits from buying electricity generation however social and environmental cost is also likely to be substantial. Protection of natural habitats and fisheries in the Mekong river system is also critical for the conservation of fisheries and natural habitats in Thailand.

A carefully-considered and proactive management approach should be applied in the MRC cooperation process to ensure that mutual benefits occur and the country's interests are not unreasonably compromised. MONRE's capacity to address the Mekong issue should be strengthened to be proactive and responsive to public expectation.

(5) Forging Effective Cooperation within DWR and MONRE on IWRM. DWR is the secretariat of the NWRC and, through its regional offices, of the RBCs so effective implementation of IWRM would mainly depend on policy and capacity of DWR and other agencies of MONRE. MONRE and DWR were created in 2002 by combining officers and staff from various agencies/ministries with different technical background and practices. Given that IWRM operation is relatively new to most sector agency staff, training on IWRM principles and implementation procedures and sharing of experience will be necessary. Additional budget for operation of RBCs and strong political support at the national and local levels will also be necessary. Key performance indicators for DWR should reflect the extent of their support to RBC operations. Training of DWR staff on IWRM process and implementation would help enhance capacity both at the central and regional levels.

Below provides some suggestions on key responsibility and training needs for DWR and MONRE:

• *At the basin level*, DWR regional offices should take the lead in forging effective IWRM implementation and key performance indicators (KPI) should include their ability to: (a) Connect the local, regional, and national interests; (b) Integrate the basin plans into the

provincial plans and secure local budget; and (c) Encourage cooperation with and among local community and key stakeholders.

- DWR regional offices should also assist in the preparation of RBC budgets, including identification of funding sources (e.g., local authority, DWR, Environmental Fund, or other sources).
- The supporting role of the Provincial Natural Resources Offices and other sector agencies within MONRE will be critical for ensuring effective integration of the RBC's plan to that of the provincial plan. If possible, this function should be a KPI for the office/agency.
- To perform these functions, capacity of DWR regional offices should be strengthened to provide technical and secretariat support to RBC and its working groups, including assist in planning and budgeting while capacity of the Provincial Natural Resources offices of MONRE should be enhanced to understand the concept of IWRM and the need for integrated budget planning.
- At national level, DWR central bureaus/offices should be responsible for providing regulatory and technical support to the regional offices and the KPI could include their ability to provide: (a) Regulatory support (e.g., relating to laws, regulations, and internal operational procedures); (b) Engineering inputs (e.g., feasibility studies, conceptual designs, detailed design, supervision of construction, etc.); and (c) Other technical services (e.g., guidelines, data, information, and other management tools).
- To perform these functions, priority should be given to capacity building activities for the central bureaus/offices, which could include:
 - Strengthening technical capacity to develop appropriate policies and plans, including research and development in hydrology monitoring; flood and drought forecasting; people participation process; and economic instruments appropriate for management of extreme events.
 - Organizing conferences, workshops, and other public outreach activities to clarify the water resources-related issues such as the concerns raised with respect to the draft water law, RBC operations, and new issues like climate change, trans-boundary issues, and good governance.
 - Meetings with key agencies to discuss the concepts and coordination mechanisms of IWRM and RBC operations, especially in the context of decentralization and coordination across the administrative borders.
 - Key mechanisms for water allocation and conflict resolution should be developed and tested to ensure effective implementation of the law when it has been adopted.

- Training on various aspects of IWRM to DWR staff and other concerned agencies, especially the local government.
- Enhancing effective use of the monitoring indicators (e.g., WPI, resources based, and/or indexes) and other planning tools as a means of securing better understanding of stakeholders' perspectives on issues and the status of water resources management and IWRM performance at the national and basin levels.
- To proactively handle Mekong development issue, technical and budget support to NMRC secretariat would be necessary. It is important to enhance public outreach and undertake consultation with local communities on the Mekong issues and assist them in mitigating the potential negative impacts. If possible, the NMRC secretariat should be upgraded to the level that could handle international issues and force effective cooperation among agencies.

5.2 Recommendations and Way Forward

Recommendation (1): Strengthen DWR and MONRE capacity on IWRM at national and basin levels. DWR regional offices should take the lead in forging IWRM implementation with supports (regulatory, engineering, technical, and financing) from the central agencies within DWR and MONRE and training and other capacity building should be provided. Public outreach, community connection, and cooperation with other key agencies are critical for effective IWRM process. Thailand capacity to address the Mekong water resources issues should be strengthen in light of hydropower development.

Recommendation (2): Strengthen RBC operations by establishing a clear procedure for connecting the RBC priority with the national and local agencies through government budget planning process. MONRE provincial office should assist in facilitating budget connection among RBC and local and national agencies. DWR's strategic plan (2008) outlining key principles and actions that should be undertaken by the RBC should be applied soonest. Effective cooperation within DWR at central and regional offices will be necessary for providing timely technical inputs to RBC. Coordination with sector agencies should be made both at the provincial and central levels.

Recommendation (3): Support community activities that promote IWRM in priority river basins. Special attention should be given to build knowledge and understanding on the water resources management issues and constraints in the basins and the principles of self sufficiency and cooperation among water users. Experience from pilot activities in the Northeast, suggested that active participation of the local people could be used to demonstrate effectiveness of IWRM process if it can lead to actual implementation on the ground and deliver the water services. DWR regional office should take the lead with technical and financial supports from DWR central offices and other MONRE agencies.

Recommendation (4): Develop IWRM investment projects in priority basins. This is to demonstrate government's commitment to move IWRM forward. DWR regional office should

take the lead with policy, technical and financial support from DWR and MONRE. Involvement of other key agencies including the Bureau of Budget, NESDB, and the ministry of finance will also be necessary. *Ping River, Bang Pakong, Kong/Chi/Moon, and Songkla Lake* basins are considered as priority basins.

To move forward, an immediate action could be focusing on the preparation of the Mekong-Integrated Water Resources Management (M-IWRM) project where technical assistance has been secured through MRC. Experience from the project preparation process may be replicated for other river basins.