

Institutional Problems in Thai Water Management

**INSTITUTIONAL PROBLEMS
IN THAI WATER MANAGEMENT**

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PART I: EXECUTIVE SUMMARY

INSTITUTIONAL PROBLEMS IN THAI WATER MANAGEMENT

This report presents the findings of a diagnostic survey of the institutional framework for water management in Thailand, which was conducted during June through November, 1993. The survey and analysis of Thai water institutions were carried out with three purposes in mind. First, the authors aimed to take a comprehensive approach to water management, looking at the interdependence of different areas of water policy and identifying the key management problems that have arisen in the system as a whole. Second, the authors strived to specify features of the institutional framework which are inadequate to resolving emerging water allocation problems. And third, the authors relied on the foregoing analysis to judge the potential impact and consequences of proposed legislation to introduce water pricing and new administrative arrangements.

In the main report the authors identify the chief problems in Thailand's water management system. Thailand has been suffering from three primary problems in the water sector, namely dry season allocation, ground water depletion, and the deterioration of water quality. At the root of these problems are egregious market failures stemming from a management approach which treats water as an "open access" resource, and from the production of negative externalities in the form of wastewater discharges into the water stream. For these market failures to be resolved, the introduction of economic instruments must be coupled with adjustments in the institutional framework. Recently, two pieces of water legislation have been drafted and submitted to the Cabinet for consideration. Upon reviewing the contents of these drafts, the authors argue that these draft Codes on their own are not likely to resolve some of the more critical institutional problems at hand.

Problems in Thai water management include the lack of a prevailing allocation philosophy; the existence of too many water agencies marked by overlapping mandates, vested interests, and acute turf battles; uneven water infrastructure, with some aspects of the system still at a very rudimentary level of modernization; and a tendency to focus on increasing the supply of water at hand, without enough attention paid to improving the water infrastructure or demand-side inefficiencies. As water supplies continue to dwindle and demand simultaneously increases, existing institutions come under greater stress, and improvements in the efficiency of water use become imperative.

To increase user efficiency and conservation in water use, Thailand will require something more than the passage of laws introducing economic instruments, such as pricing. In addition to the "open access" water regime which prevails in Thailand, inefficiencies in water use are encouraged by the poor quality of government water services. Moreover, the prevalence of an open access water regime is, in part, a consequence of the public sector's inability, or unwillingness, to enforce a different set of rules. The reform of the legal and administrative arrangements in water is a necessary ingredient both for improving the water infrastructure, and for supporting the introduction and enforcement of market-based policy instruments, should that option be pursued.

One chief drawback of both pieces of draft legislation is that they do not specify the kinds of institutional reforms that would be necessary to make either of the new laws effective. Economic incentives can encourage water users to conserve water. They can also be a powerful tool in making government services more efficient. By tying monetary rewards to the improvement of government services, much of the water infrastructure could be upgraded, while at the same time the enforcement of market-based policies could be improved. In either draft, new instruments are introduced but this connection is not established.

The analysis outlined above of the institutional framework and the potential impacts the draft legislation may have on water management yields the following conclusions:

- Water pricing -- whether for consumption or wastewater -- will require that the government clearly specify and enforce water-use rights (i.e. property rights). That task would in turn require a conducive administrative framework for the effective application of new economic instruments.

- There are a number of institutional problems, largely having to do with the poor capacities of government agencies and poor quality of government services, that will constrain the effectiveness of applying water pricing as a tool to change user behavior. Traditionally, the Thai public sector has preferred an administrative solution, as opposed to a market-based one, to water allocation problems. New laws and policies are often designed to enable government agencies to gain more authority over water allocations. Seldom have these efforts focused on improving the efficiency of the water infrastructure. Furthermore, the introduction of market-based instruments (i.e. pricing) would require extensive administrative reforms which could, in effect, "undo," or permit a departure from, the legacy of administrative control.
- The most effective changes in policy thus far have been those which use economic policy instruments, such as pricing, not only to persuade water users to change their behavior, but to encourage government agencies to improve their services as well. The Enhancement and Conservation of National Environmental Quality Act of 1992 contains several provisions along these lines, and already measures which might improve water quality and pollution control have been implemented. But these measures require further encouragement from the highest offices of government, and they require human resource development and improved administrative capacities in the government agencies charged with their implementation. Moreover, similar kinds of reforms need to be carried out in the area of agricultural water management (i.e. irrigation) and ground water management. By tying economic rewards to the performance of government agency services, economic instruments can be a powerful tool in getting the government to focus on inefficiencies in public water services which have encouraged waste in water allocation and consumption. But the introduction of economic policy instruments must be paired with extensive institutional development among the key water-related agencies.
- Each of the three water sub-sectors -- surface water allocation, ground water, and water quality issues -- presents its own set of complex engineering challenges, political problems, and particular clientele which the relevant government agencies must oversee. Because the overall institutional framework is so vast (30 department-level agencies, 3 national committees, 12 separate pieces of legislation), it may be most effective to phase in the use of economic policy instruments (e.g. pricing and penalties) by sub-sector, and, if not, to begin with differential pricing of water for different clientele. Industrialists, for instance, are currently more prepared financially and administratively to bear a higher cost for water than farmers are. Yet, water pricing for industrial users is set at regressive rates. It is also likely that farmers would pose the greatest political obstacle to the introduction of water pricing, since they are likely to appeal to their parliamentarians to defeat any pending legislation. Farmer resistance, however, should not distract attention from the progress that could be made in any case in the area of ground water monitoring and pollution control. Once these sub-sectors are addressed, then attention could focus at a later date on introducing economic instruments to improve irrigation management and surface water allocation.

PART II: MAIN REPORT

INSTITUTIONAL PROBLEMS IN THAI WATER MANAGEMENT

1. INTRODUCTION

Thailand has been suffering from acute bottlenecks in the allocation of water for agricultural, industrial, and domestic consumption. In hopes of providing a fix to these problems, the National Research Council has drafted a new Water Code which has now been put to the Cabinet for deliberation. Among other measures, the draft proposes that charges be levied, under specified conditions, and nation-wide if need be, on all water users for the water they consume.

For any new legislation to be effective, it must be designed on the basis of a clear understanding of the particular nature of the water problem. New legislation should also create incentives which can overcome the shortcomings of existing institutions. On the basis of our diagnostic survey of the institutional framework, the authors argue that the draft legislation in its present form is not likely to repair some of the more critical problems at hand.

2. DEFINING THAILAND'S WATER PROBLEM: A SUB-SECTOR APPROACH

While the demand for water rises rapidly, the institutions for managing water allocation come under great stress. To fully appreciate the nature of that stress, however, demands that we look beyond the economics of supply versus demand. Supply shortfalls and surges in demand have been addressed elsewhere and will not be repeated in their entirety here.¹ Critical to our analysis is the fact that for any group of persons, water, like all resources, is *always* scarce. Likewise the management of a resource always requires institutions which delineate the rules and procedures for its use. It thus becomes necessary to carefully specify the *particular* supply bottlenecks that have arisen. We argue that at the root of the water problem are three fundamental stresses which will need to be resolved through institutional innovations: conflicts regarding dry season allocation, ground water depletion, and water quality problems.

2.1 Dry Season Allocation

The most visible and dramatic problem involves the provision of water for all users during the dry season, which officially lasts from January to June each year. This is primarily a sectoral conflict between agricultural and urban consumption, though recently problems within sectors have arisen as well. The conflict is centered almost entirely on the Central Plain's main river basins (the Chao Phraya, MaeKlong, Ban Pakong, and Ta Chin basins), since these rivers supply the water for most of the irrigation and urban consumption in the country. The supply bottleneck is caused by an increase in irrigation and urban use just as the inter-temporal supply has declined. In the past, the highest priority was given to agricultural allocation. But as structural change in the economy proceeds, with most of the industrial development located in the Chao Phraya Basin, there has arisen a critical need for new allocation criteria.

Of the total volume of water which was allocated by government agencies for consumption in 1991, agriculture used about 30 billion cu m, or some 90 percent of the total allocated stock.² The bottleneck in allocating water for agriculture comes in the dry

¹ See Sethaputra et al., 1990.

² Total allocated stock does not equal total volume consumption. The total volume of water consumed in Thailand includes all consumption of water during the rainy season, and this figure

season, when the second paddy crop requires on average about 9 billion cu m of irrigated water.³ The irrigated paddy area expanded from just 70,000 rai in 1957 to about 4.5 million rai in 1990. Most all of that area is located in the Central plain river basins, where dry season paddy, if planted throughout the basin, now requires more water than the region's storage facilities are able to provide. Urban demand also puts stress on the Central region allocation system. Industrial and urban consumption in the Bangkok Metropolitan Region (BMR) stands at about 3 billion cu m (1992 figures), and at projected economic growth levels the BMR's demand could double in ten years. An additional constraint is the Royal Irrigation Department's (RID) need for about 2.5 billion cu m per year to maintain enough flow through the Chao Phraya for flushing out waste and saline water in the lower end of the basin.

Resources to meet everyone's demands *in the dry season* have dwindled rapidly. Annual rainfall in the Chao Phraya Basin ranges from 1 - 1.4 billion cu m per year. Irrigators, industrialists, and domestic consumers in the Central region thus depend almost entirely upon the water stream which is released from the Bhumibol and Sirikit dams in the lower North's main river basins. These dams have a combined capacity of about 22.9 billion cu m of water, of which about 16.3 billion cu m is available for use. The remaining 6.6 billion cu m of dead stock, according to the Electrical Generating Authority of Thailand, must remain in the dams in order to power the turbines for electricity production.. But rapid growth in consumption further upstream in the North, the destruction of watersheds through deforestation, and recent drops in annual rainfall have reduced the yearly flow into the dams from about 11 billion cu m ten years ago to just 7 billion in 1993 (see Chart 1). The consequence is that, with the single exception of 1979, the combined water level in the dams at the beginning of the dry season has been lower in each of the past three years than ever before (see Chart 2). Moreover, the sideflow into the Chao Phraya Basin's tributaries and irrigation canals has been reduced by deforestation, caused by changes in patterns of highland land use, and upland cropping on the fringes of the basin. These trends also boost dry-season demand for the water harnessed in the dams.

has not been calculated with accuracy. Our total allocated stock refers to that volume of water which is allocated and/or monitored by the relevant government agencies. For example, irrigation consumption refers to that volume of water allocated by the Royal Irrigation Department in the irrigation system. Likewise, urban consumption equals that volume of piped water provided by the Metropolitan Waterworks Authority, in addition to groundwater volumes which are monitored and recorded. A large portion of groundwater pumping, however, goes unmonitored and unreported.

³. Figure obtained from the Royal Irrigation Department.

Chart 1 Yearly Inflow into the Bhumibol and Sirikit Dams, 1972-1993

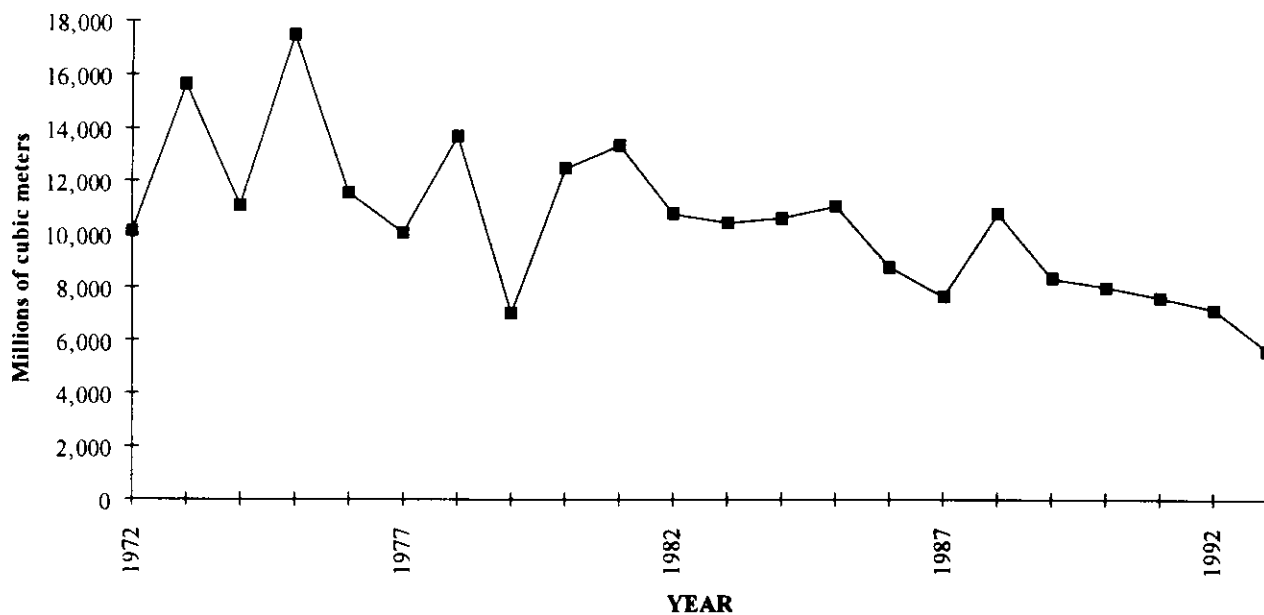


Chart 2 November Water Level in the Bhumibol and Sirikit Dams, 1972-1993

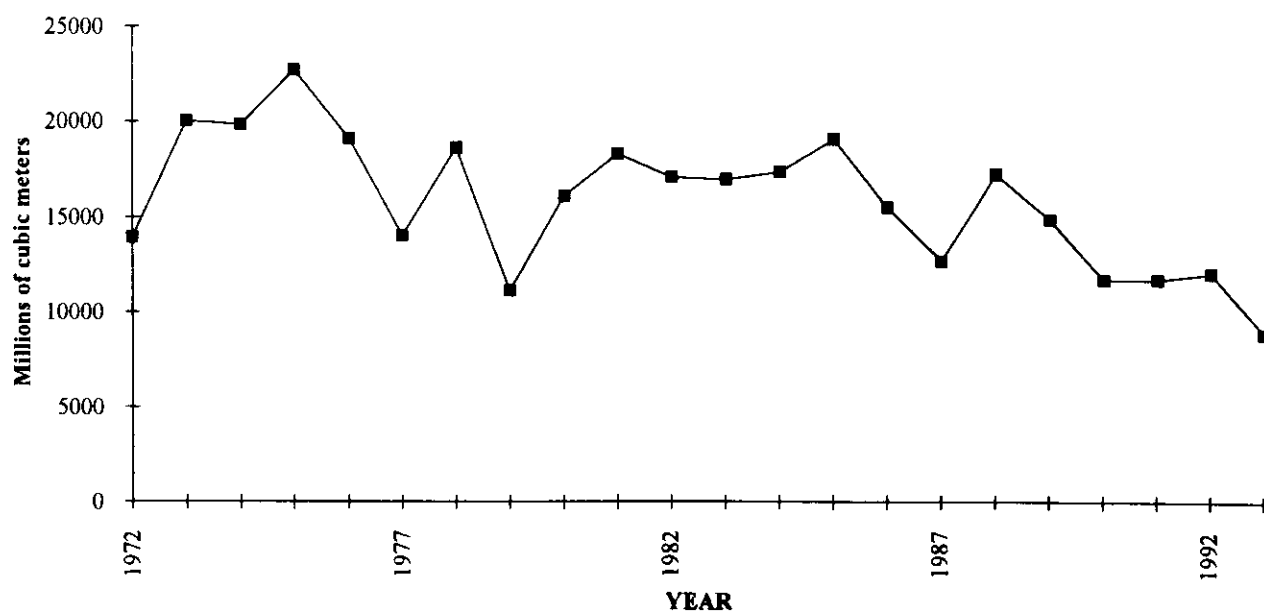


Table 1: Estimates of Water Use in Thailand, 1991-2000 (billion cu m/year)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Irrigation	30.890	31.740	32.580	33.420	34.260	35.100	35.950	36.790	37.630	38.480
Industry	1.611	1.676	1.740	1.803	1.869	1.932	1.996	2.210	2.275	2.339
Urban	1.608	1.738	1.879	2.032	2.180	2.327	2.479	2.631	2.792	2.967
Rural	.062	.131	.208	.292	.383	.478	.584	.693	.813	.938

Source: United Nations, 1991.

The government's typical response to these supply constraints has been to increase the quantity of water available by developing untapped resources. Improving the efficiency of the water infrastructure, or improving demand-side management through means such as water pricing, have not been practiced. But efforts to increase water supplies can no longer be effective as untapped resources quickly disappear. Most of the more suitable sites for dams and reservoirs have by now been used up. And future expansion of these facilities faces a steeply rising supply curve caused by higher financial, environmental, social, and political costs. As the dry season problem worsens, officials have responded with apparently the only means currently at their disposal: limit the flow of water into the Central plain's irrigation canals, and demand that dry-season paddy farmers switch to less water-intensive crops.⁴ The great difficulties faced in implementing that policy, however, demonstrate the need for new legislation which can expand the range of policy instruments available and create new incentives to induce more efficient consumption as demand continues to rise.

2.2 Ground Water Depletion

Estimates of water use by the manufacturing sector range from 1.4 billion to 2.1 billion cu m of water a year (1989 estimates).⁵ Of the portion of factories located in the

⁴. For 1993 the RID announced it would allocate only up to 6 billion cm³ for dry season agriculture, as compared to demand of up to 9 billion cm³, assuming all irrigated paddy areas were planted as such.

⁵. Sethaputra et al., 1990.

BMR, or more than one-half of the total in the country, a study by the Thailand Development Research Institute in 1990 estimated that only 0.5% of the water they consumed was piped in from the Metropolitan Waterworks Authority (MWA).⁶ The balance was obtained from ground water pumping (95%) and other sources such as rivers and canals (4.5%). In addition, the MWA pumped about 43.8 million cm³ in 1989, or over 4% of its total production, from ground wells.

Industrialists in Bangkok and the provincial urban centers have every incentive to deplete ground water wells. The MWA and the Provincial Water Works Authorities (PWAs) in the towns cannot meet the growing urban demand. Perhaps more importantly, the private cost of ground water pumping is very low -- about 1 - 2 baht per cu m, compared with the average piped water rate of 6 baht per cu m; well water is cleaner than water pumped from rivers and canals, and thus it does not require costly treatment; and ground water pumping is monitored very poorly by the public sector. Public agencies at this time simply do not know whether the consumption rate outpaces the recharge rate, but it is clear that the costs to society accruing from rapid groundwater depletion are very high. It is estimated that land subsidence in the eastern areas of the BMR is about 5 - 10 centimeters per year, contributing to billions of baht in losses from flood damages.

2.3 Water Quality

While wastewater discharges increase rapidly each year, Thailand has only begun to build its capacity for sewage and wastewater management (S&WM). In nearly every municipality nation-wide, most all waste water is discharged without any treatment at all.⁷ Currently there are four sewage treatment plants for the BMR in the pipeline. Even if these are constructed without delay, they will have the capacity to treat only one-fourth of the one million cu m/day of sewage that is discharged into the lower Chao Phraya and the capital's khlongs and streams.

Of the key industrial wastes -- Biochemical Oxygen Demand (BOD) Loading (primarily from agro-industries and textiles) and hazardous or "toxic" wastes (from industries like minerals, metals, petrochemicals, and plastics) -- there is critical need for the installation of proper treatment facilities and, perhaps more importantly, for the setting

6. Ibid.

7. Unkulvasapaul and Seidel, 1991.

of new water quality standards as a prerequisite for the management of those facilities. The government currently lacks a complete data base on industrial wastewater discharges. Private estimates of only nine agro-based industries put the level of BOD loading in 1991 at 525,000 tons.⁸ A study by Engineering Science Inc. estimated there were one million tons of hazardous wastes (including solid wastes and sledge) dumped into the water stream in 1989.⁹ About 71% of that discharge was produced by the BMR. In 1991 the World Bank projected that the production of hazardous wastes in the BMR would *triple* beyond those levels by 2001. The decentralization of industry to the provinces can only make matters worse in absence of improved wastewater monitoring and pollution control. Damages resulting from pulp factory discharges in Khon Kaen and severe BOD loading into the Nam Pong River, to name a few instances, are likely to be repeated with much greater frequency in the years to come.

It is estimated that perhaps one-half of the factories in the BMR are meeting current effluent controls. Indeed many factories lack the necessary know-how and monitoring capacities. The larger issue, however, is the need to establish an *environmental quality* standard. The old effluent controls of the Department of Industrial Works (DIW) are an "end of the pipe" control based on an emission level for each factory. Under the 1992 Environmental Act, emission standards will be revised for each industry, not each firm. Furthermore, a goal enshrined in the new Act is to establish an *ambient standard* for the water stream. The task then is to set emission standards for each industry which would meet the established ambient standard.

The 1992 Environmental Act contains provisions for revising water quality standards and emission levels for factories. It also introduces a new structure of penalties and incentives which has begun to improve the water treatment infrastructure and encourage less pollution by factories. The revision of standards is currently being undertaken by the Division of Water Quality Standards in the Department of Pollution Control (DPC), Ministry of Science, Technology, and Environment. In addition, the 1992 Environmental Act and 1992 revisions to the Factory Act incorporate the following adjustments which hold great promise for improving water pollution control:

⁸. Ibid: 88.

⁹. Ibid: 88.

- The 1992 Environmental Act incorporates the "polluter pays principle" by introducing economic incentives which, if implemented appropriately, would discourage pollution and improve wastewater treatment and government monitoring thereof.
- The 1992 revisions to the Factory Act permit the DIW to raise penalties on industrial polluters, while the 7th National Development Plan (1992-1996) authorizes the DIW to increase expenditures on centralized industrial wastewater treatment. The DIW will also participate in overseeing the development of about 10 billion baht worth of centralized waste treatment facilities, most of which is being contracted by the Bangkok Metropolitan Administration.
- The new Environmental Act decentralizes environmental management authority to provincial administration. Regarding wastewater charges, the new legislation requires polluters to pay fees to treat water at central treatment facilities, or to set up their own treatment ponds. Initially, the larger factories are at an advantage since they are better able to afford the investment in facilities. In response, the DIW has proposed setting up a treatment facility in Samut Prakan which the agency hopes will service smaller factories.

3. THE INSTITUTIONAL BASES AND CONSTRAINTS ON MANAGEMENT

When searching for a solution to these problems, many officials point out that rice growers are the largest consumers of water in Thailand and that they use water inefficiently. These same officials have insisted that the amount of water provided for paddy irrigation must be reduced. That response has largely failed, however, because it misses the more fundamental problem of which the farmers' wasteful consumption is a symptom, and because in any case the vast majority of paddy farmers balk at this policy. Ironically, given government policy, what has prevailed is an allocation system that responds to interest groups who clamour for access to water. The State has been particularly sympathetic to farmers' groups, whose political strength has increased under elected governments.

Market Failure: Water management problems are the result of market failures in water. These arise in two principal forms:

- One form is the absence of a pricing mechanism for water. This, in turn, arises from the fact that property rights to water are neither specified nor enforced. Water in Thailand has been treated as an "open access" resource. When the ownership rights to water are not clearly specified, the market cannot price the good and the demand and consumption for it will not reflect its real value. Thai farmers enjoy free access to water, while urban consumers pay a fee which accounts only for the cost or part of the cost of *processing* piped water. In the case of ground water users pay only the private cost of tapping the aquifer. Since water in Thailand not appropriately priced, it is used inefficiently, and consumers have no incentive to economize.
- A second form of market failure is the production of "negative externalities." An externality is the effect of one person's activities which spills over onto another person. Pollution of the water stream and the negative environmental consequences of depleted ground water wells are the key externalities in the water sector. These activities impose negative effects on other water users. Externalities arise because, again, the restrictions on producing them are not well defined, and hence the market cannot express the cost they impose on society. If a market can be defined in the form of penalties, then pollution would be discouraged. This is the rationale behind the so-called "Polluter-Pays-Principle."

Institutions and Government Failure: Repairing these market failures demands intervention by a third party -- usually the state, and on occasion local or community institutions. But the lack of a coherent administrative framework or policy enforcement bureaucracy can lead to fallibilities in the institutional interventions. Government failures can, in turn, reduce a society's ability to repair market failures. The State may not intervene wisely, and it may fail to fix the problem of missing markets. The State can fail in this regard in three ways, and each is evident in Thailand:

- First, the State could choose to ignore or overlook market failures. The Thai State has been particularly sensitive to interest group pressures. It has been reluctant to impose user charges for irrigation on farmers, and it has been reluctant to enforce industrial effluent controls on businesses. Farmers and business are perhaps the two most influential interest groups in Thailand. Elected governments find it difficult to rationally diagnose market failures, owing to the immediate and conflicting demands of

their clientele.¹⁰ Although they are elected by a rural majority, political campaigns are often usually by large businesses.

- Second, the State may intervene to correct market failures unwisely. It might miscalculate the price of water and undercharge users, or it may disrupt community-based institutions which are devised to repair market failures at the village level.
- Third, the State may earnestly try might try to repair market failures by command and control mechanism, or it might choose market instruments such establishing property rights and implementing a pricing system. In either case, a lack of manpower, information, technical skills, and enforcement capacities can impair the State's response. The State may also lack the knowledge base and technical skill to monitor pollution and set effluent standards. Monitoring, the enforcement of pricing instruments, and the regulation of the water supply and related infrastructure are heavily knowledge-intensive tasks. It is in these areas, however, that the Thai State has been performing poorly.

Thailand is currently experiencing a number of fallibilities in its institutional capacity to address supply bottlenecks and market failures in water. Generally, the public sector lacks the necessary enforcement capacities to carry out an effective command and control strategy for dealing with water allocation problems. Certainly the State succeeds at withholding water from the irrigation canals during the dry season, but the fact remains that, if it were not for reliance on increased ground water pumping, Bangkok's industrial water users would not survive. The State's attempt to ration water between urban and rural areas in the Central Plains thus leads to more rapid ground water depletion. Moreover, the institutional framework is currently inhospitable to specifying and applying market-based instruments, such as pricing policies. These constraints are due to the rather ad hoc design and sometimes erratic behavior of water policy institutions, and to something we have chosen to call "institutional stress."¹¹

To begin with, there is no single decision-making mechanism for water policies in Thailand. Even in the sub-sectors of water policy where such mechanisms have been set up, moreover, there is an habitual lack of effective coordination among the numerous

¹⁰. Christensen, 1993.

¹¹. This concept is a modification of Robert Wade's notion of "bureaucratic stress" in India's irrigation canal bureaucracy (see Wade, 1988).

government agencies concerned, and application of new rules once they are established. These conditions reflect deeper management problems -- the absence of a single allocation principle which the various overseeing administrators can agree upon, and the lack of an adequate information base and trained personnel to manage it in the relevant government agencies. Many officials tend to see this purely as an administrative problem which could be tackled by creating new committees and a central water agency, but the problems go much deeper than coordination alone.

These management problems severely constrain the performance of the country's water infrastructure. If the new legislation is to have any impact on the behavior of water consumers, bureaucratic reform measures to improve the information bases and enforcement capacities of public sector institutions would have to be implemented. Reforms along these lines are necessary to address the demand-side inefficiencies which ultimately give rise to overuse and environmental damage.

3.1 Problems of Coordination and Enforcement

Overlapping Agency Mandates: The institutional landscape for water management is littered with some 30 department-level agencies under seven different ministries. Two national committees attached to the prime minister's office -- the National Water Resources Committee and the National Rural Development Committee -- are, in theory, responsible for drafting water guidelines and coordinating the activities of these agencies. In practice the relationships among the various agencies are ad hoc, episodic, and often erratic, responding to shifts in the water supply, the emergence of bottlenecks outlined earlier, and clamoring by interest groups seeking access to water.

Coordination problems arise from the fact that water agencies are not legally obligated to inform other agencies of their activities. Another consideration is that some agencies, for example the Electrical Generating Authority (EGAT), the National Energy Administration (NEA) and the MWA, are also water users that consume free of charge. The lack of effectively defined property rights among public agencies themselves leads to competing claims and bottlenecks within the government. The key competition has occurred in the Chao Phraya Basin among the RID, EGAT, and the MWA. To date, conflicts have been resolved by making agricultural allocations residual. Water available

for irrigation is now determined once these other agencies have voiced their claims.¹² As we shall see later in the report, the draft legislation proposed by the National Research Council is based partly on the view that water is currently an administrative problem, and that legal adjustments which would enable public agencies to better coordinate their activities would help to mitigate water supply constraints. We argue, however, that these inconsistencies in the public bureaucracy would limit the effectiveness of introducing pricing instruments.

Lax Enforcement of Existing Laws: The authority to charge consumers for water is provided in numerous legislative Acts. The State Irrigation Act of 1942 and its subsequent amendments allow the RID to impose a charge of up to Baht 0.50 (\$0.02) per cu m for irrigators, and the same charge per cubic meter of water for all other users. Moreover, the Dykes and Ditches Act of 1962 and the 1974 Agricultural Land Consolidation Act authorize the RID to impose charges on land owners and other irrigators for Operations and Maintenance (O&M) and the capital costs of land improvements. The laws, however, have proven difficult to enforce, and often their enforcement has simply not been attempted. In practice, the actual subsidy paid to farmers in the form of charges waived or deferred has depended on farmers' ability (or willingness) to pay.¹³ Electoral democracy has strengthened the political clout of farmers in this regard.

Moreover, water supplied by the MWA and PWA is often drawn from RID canals. These agencies as well do not pay the RID any fees, though the water they consume often reduces the quantity available for irrigators.¹⁴

Problems of coordination and enforcement only contribute to rent-seeking behavior and over-exploitation. For example, the Ground Water Act of 1977 introduced a one baht/cubic-meter ground water charge. The Department of Mineral Resources, which oversees ground water utilization, lacks the administrative capacities to issue permits to all users and enforce this charge on industry. Moreover, the ceiling charge of one baht in real

12. Authors' interviews, Office of the Prime Minister.

13. Vadhanaphuti et al., 1992: 200.

14. In the Chiang Mai municipality, for example, the PWA draws most of its water supply from the RID's Mae Taeng Canal. Irrigators who depend on the canal must queue up in a specified monthly rotation schedule, while the PWA draws water freely 24 hours a day, each day of the month. The rapid increase in PWA pumping from the canal has caused conflicts especially with farmers downstream from Chiang Mai city in Hang Dong and San Patong (authors interviews, Royal Irrigation Department, Station #12, Chiang Mai).

terms is equal only to one-half baht in 1977 prices. When considering the nominal piped water rate of 6.1 baht/cubic-meter levied by the MWA in 1989, industrialists have every incentive to overutilize the aquifer in and around Bangkok.¹⁵

Institutional Diversity: Thailand has a very centralized government, and a very decentralized society. The organization of the society is characterized by institutional diversity and autonomy, but that autonomy is often threatened by central government interventions which are sometimes oblivious to local organization and needs.

With regard to formal administration, the provinces are literally begging to be granted greater financial autonomy in managing their own affairs. Financial autonomy -- the ability of local governments to raise and spend their own tax revenues -- is a critical ingredient in encouraging localities to provide public goods and develop their infrastructure. Greater political and administrative decentralization is needed to enable local authorities to more effectively develop waste management capacities and address bottlenecks in monitoring and enforcement and inefficiencies in government water services. The PWA already operates along more decentralized lines, and this trend should be encouraged. The 1992 Environmental Act contains provisions for limited decentralization, but implementation would depend on the ability of the DIW and DPC to decentralize their own monitoring and services.

In addition to formal public sector agencies, informal community institutions have been created, mostly in the rural areas, to manage village-level irrigation. These institutions exist autonomously from the government, outside the boundaries of RID projects, though there are no legal guarantees that they would be protected or preserved by official policies. Should a water user or even the RID decide to divert the flow of water upstream from one of these communities, it is difficult for villagers to use the law as a recourse. Village institutions lack the status of juristic entity (*nithibukol*) and cannot prevail legally over public agencies backed with laws, regulations, and notifications. Many of the traditional *muang fai*, or community irrigation schemes, in the Northern region have been disrupted in this fashion.¹⁶ In such cases, government intervention works not to correct market failures, but to disrupt informal institutions which are created at the local level to resolve the collective action problems relating to the provision local public goods.

¹⁵. Sethaputra et al., 1990.

¹⁶. Authors' interviews, Faculty of Social Science, Chiang Mai University.

3.2 Institutional Stress

Institutional stress occurs when the institutions for managing a resource are not adjusted appropriately enough to address the bottlenecks that arise as the supply of the resource declines. If the supply of institutional innovations falls short of the need to manage the decline in the availability of a resource, then the level of institutional stress rises, leading possibly to more social conflict over resource allocations. This is precisely what is occurring throughout Thailand at the moment. There are at least five points of stress which demand relief.

The RID's Role and Constraints on the Agency's Authority: The first involves the RID. This constraint arises from the fact that while the RID is the primary water allocation authority in the country, responsible for sustaining the flow of water to Bangkok's factories and households while meeting the demands of irrigators, its capacity to manage water is severely limited by both external and internal constraints. Historically the RID's role has been to provide water for everyone. Under that mandate the RID has, ironically, had very little effective authority to dictate its policies to other government agencies. Instead it must honor the supply requests of other agencies first, and it is left therefore to assign lowest priority to its own clientele, Thailand's farmers. RID allocation priorities for the Chao Phraya Basin are listed in table 2 below. These inter-agency allocation decisions are reached in the form of an informal agreement which is struck on the eve of every dry season by representatives of EGAT, the MWA, and the RID. As the country's water allocation agency, the RID is expected by EGAT and the MWA to honor the latter's water requests for the dry season. This allocation decision does not take the form of a formal law which mandates the RID to comply; instead it is a matter of policy, ostensibly consistent with the national development plans, that Bangkok and the manufacturing sector have priority in the country's economic growth. As the water level in the Chao Phraya Basin's dams has fallen in recent years, demand from the two former agencies has increased, and the RID's allocations for farmers have been squeezed.¹⁷

17. Authors' interviews, Office of the Prime Minister, and the RID.

Table 2: Water Allocation Priorities of the Royal Irrigation Department

Order of Priority	Type of Allocation
Priority #1	Supply the Metropolitan Waterworks Authority (Bangkok)
Priority #2	Flush out Waste and Saline Water in the Lower Chao Phraya Basin
Priority #3	Release Water into the Central Plain Irrigation Canals

Source: Royal Irrigation Department

To mitigate bureaucratic conflicts, EGAT and the RID for several years have improved their coordination by having the RID submit weekly demand estimates to EGAT in the dry season. In the short term this has enabled the RID to cope with the stress caused by the refusal of Central region paddy farmers to obey RID guidelines for restricting the area planted in paddy. But as the water level in the dams has declined, this method cannot address the deeper problem of demand-side inefficiencies in the irrigation infrastructure.

Internal organizational constraints in the RID, however, help to limit the attention the agency is able to give to the efficiency of public irrigation services. First, for long there has been an institutional bias within the agency in favor of construction over O&M. Professional reputation is rooted firmly in construction, and the construction divisions are the primary tracks for promotions. The tenure security and educational backgrounds of O&M staff are generally poorer by comparison.¹⁸ Second, because the already low user charges are not enforced, there is no connection between the revenues the RID collects and the services it provides. The RID depends primarily on handouts from the central government, supplemented with soft loans from abroad, and hence the agency has no hard incentives to concern itself with the productivity of its infrastructure. Third, there is very little coordination between the RID's water allocation decisions and the decisions of other

¹⁸. RID, 1993.

Agriculture Ministry agencies that provide important inputs into irrigated agriculture.¹⁹ The result is that very little attention is paid to demand-side management of irrigation services.

Uneven Irrigation Infrastructure: These internal constraints are compounded by the severely uneven development of Thailand's irrigation infrastructure. Numerous irrigation officials interviewed spoke frequently of the poor quality of the RID's O&M services, attributing that performance in part to the structure of the various irrigation systems.

The World Bank distinguishes between two major types of irrigation technologies in monsoon Asia -- the "structured" and the "just-on-time" types of water distribution systems.²⁰ Structured systems are characterized by a limited number of gates, so that a command area is either running full or running empty all at once. All of the offtakes in this system are ungated proportional openings that deliver water equally to all areas from the main canals. Farmers drawing water from the various main canals of the structured system take "turns," and they are acutely aware of the timing of their turns. The just-on-time system, in contrast, is a fully gated system in which not all the canals are running at full flow simultaneously. This system is highly vulnerable to farmer manipulation of the thousands of gates and weirs, and it requires much more careful monitoring. Because it is much more easy to shut off some groups of farmers in the just-on-time system, it is also said to be much less equitable than the structured system. The poor performance of the just-on-time system in the highly unstable monsoon climates of South and Southeast Asia has led some engineers to call for sophisticated control structures and automatic feedback technologies, often monitored by a computer system, in order to enhance the hydraulic stability of the system.

Approximately one-fourth of Thailand's irrigation systems consist of these two types of distribution technology. The just-on-time type is known as the "land consolidation system," while the structured type is referred to as the secondary canal system (see table 3). The remaining three-fourths combine very simple main canal systems with the so-called "conservation" system, the old drainage canals which were designed at the turn of the century to release flood waters from the basin flatlands and to retain water

19. Authors' interviews, Bank for Agriculture and Agricultural Cooperatives, Office of the Prime Minister, and RID.

20. This discussion is based on Burns, 1993.

well into the dry season. These canals worked well when the run-off from upstream was steady and predictable, but inter-temporal supply problems have caused this system great stress. The diversity of the infrastructure makes it difficult for the RID to take a coherent approach to more effective irrigation management, and it suggests the utility of more decentralized management at the level of the river basin. Moreover, the uneven development of the infrastructure requires that resources be spent on modernizing the irrigation systems first, particularly those upstream where greater efficiency can conserve water for downstream users, before any greater certainty can be achieved in the country's water delivery networks.

Boosting spending on irrigation infrastructure, particularly in the Central plain, is difficult, however, owing to one additional constraint. It has now been recognized, both by international lending agencies and the RID, that the Chao Phraya irrigation system was "overbuilt."²¹ The most recent additions to the system in the 1970s and early 1980s were based on an unrealistically high estimate of Thailand's rice consumption needs for the 1990s and beyond. Moreover, because the irrigation system helps to yield a huge rice surplus each year (note that Thailand's rice surplus is on average twice that of its nearest global competitor, the United States), the RID has great difficulty securing funding for additional infrastructure in the Chao Phraya Basin, even more so because many of the RID's projects to improve O&M on existing infrastructure have not fulfilled their stated aims (e.g. the Maeklong Basin).

²¹. World Bank, 1990.

Table 3: Classification of Irrigation Infrastructure

Type	Portion of Total Irrigation
Land Consolidation System (just-on-time) (e.g. Lam Nam Oon)	5-7%
Main and Secondary Canal System (structured)	20%
Main Canal System only	10-20%
Conservation System (i.e. drainage)	40-50%

Source: Royal Irrigation Department.

Highland/Lowland Allocation Conflicts: A third source of stress involves emerging conflicts between upland farmers who draw from the streams that flow into the various river basins and farmers in the lowland areas. Many of the lowland farmers are located within the RID's irrigation projects, whereas many highland farmers have devised their own institutions to manage water allocations in their communities. As watersheds disappear in the upland areas, farmers there face greater constraints in the dry season. These constraints cannot always be mitigated by community innovations alone.

One reason is due to inadequate legislation. According to Section 1355 of the Thai Civil and Commercial Code, a riparian landowner is entitled to withdraw water passing through his/her land in the amount necessary to its need, but to the extent that the amount does not cause injury to another riparian landowner downstream. But if a group of users upstream depletes the flow of water, *the upstream users must pay compensation only when it is proven that each individual withdrawal of water has caused damage to downstream users.*²²

A second reason is that RID interventions in these areas which lie outside of the RID's conventional project boundaries have not proven uniformly effective, since the agency is not obligated to incorporate local participation into the design of facilities in

²². Wongbandit et.al., 1993: 15-19, 80-85, and 107-112.

these areas, or to contribute to their maintenance. Areas where these highland-lowland conflicts occur, for example the Chiang Mai valley, require more effective third-party interventions which can balance the needs of RID irrigators with the very different needs of more autonomous community-based irrigators.

Industrial Water Supply: A fourth source of stress arises from the need to replace industrial groundwater pumping, particularly in the BMR, with piped water services. In light the social costs incurred by depletion of the aquifer, the government promulgated a new Groundwater Act in 1985 which mandated that groundwater pumping be phased out in the BMR by 1998. But even if we assume there will be more effective demand management through higher industrial water rates, fewer leakages, or an increase in recycling, there would still be a huge supply shortfall in the BMR which would need to be supplemented by the Chao Phraya Basin, and which would probably require conveyance from the MaeKlong Basin, the Mekong River, or from the Kok Basin in the North as well. A reduction in urban ground water pumping, deemed essential to avoid massive social and environmental costs, could make sectoral conflicts between agriculture and industry more acute in the Central river basins, and would most certainly create allocation conflicts *between* the Central basins and the various other river basins upstream which would be affected by the diversion of water from them.

Water Quality Standards: A fifth point of stress in the institutional framework involves the enforcement of water quality standards. The Environmental Act of 1992 authorizes that ambient standards for the water stream be established. Currently the Department of Pollution Control (DPC) is creating a database on wastewater production which would provide the basis for setting those standards. Enforcement, however, would rest with the DIW. That the DPC and the DIW are located in different ministries which compete with one another for budget allocations for environmental projects does not make this achievement an easy one. Currently the Budget Bureau has a shortage of information and know-how regarding water quality issues. It has not yet separated environmental quality control from industrial policy in its criteria for project approvals. The Bureau is currently adjusting its criteria so that it would accommodate the legal mandates in this area of both the DIW and the DPC.²³

²³. Authors' interviews, Department of Pollution Control.

Furthermore, the enforcement of new environmental standards will require more effective practices on the part of the key monitoring agency, the DIW. One necessary ingredient will be a professional and independent monitoring system. The 1992 Environmental Act calls for professional inspectors to participate with DIW officials in monitoring factories. Some officials claim, however, that this method would be encumbered by regulatory restrictions that local governments could impose on the inspectors. These officials were also doubtful that, should an inspector report a polluter's activities to the local police, any disciplinary action from the DIW would be forthcoming.²⁴

Further constraints on the implementation of the 1992 Environmental Act arise from the following:

- An acute lack of manpower to inspect facilities and manage the relevant information base. The Water Quality Standards Division in the DPC only has a core staff of 80 people to conduct sampling and set standards for the entire country. Moreover, the Division lacks the necessary laboratories and related scientific facilities to handle and process water samples appropriately.
- The Public Works Department of the Ministry of Interior, which is responsible for overseeing and providing technical support for the construction of waste treatment facilities, has a total technical staff of 600, but only about 22 of them are trained in the field of engineering or water quality management.
- There is a severe deficit in treatment facilities for urban sewage, and even if all the various facilities proposed and under construction (about 5 at present for the BMR) are completed in a timely fashion, they will not be able to treat all the sewage that is discharged into the waterstream.

Summing Up: As a general rule, the stress in the water infrastructure and related services limits the attention which is paid to demand-side management of water. Moreover, while the State has tended to opt for a command and control solution to water

²⁴. Authors' interviews, Department of Pollution Control, and Office of the Prime Minister.

allocation problems, for example by dictating water rationing between rural and urban areas, it often lacks the enforcement capacities and bureaucracy coordination necessary to succeed at fully controlling the allocation and use of water, ground water problems being the key example. The provisions of the 1992 Environment Act mark a step away from the command and control option with the introduction of market-based instruments, namely the polluter pays principle. But to make these market-based instruments effective there must still be a coherent and facilitating policy enforcement apparatus. To date there has been no new legislation passed for addressing surface water allocation problems in the dry season and ground water depletion. Ideally, measures to address these problems could be linked to the provisions of the new Environmental Act. For example, by sharply raising the penalties for discharges or fees for wastewater treatment, factories might have an incentive to recycle water and to economize in their use of water from various sources. In particular this linkage could help to relieve the problem of ground water depletion. Any of these measures, however, would require a more conducive administrative framework. Put another way, a more coherent bureaucracy is needed not only to enable the State to gain more effective control over water allocation and consumption, should a government in power choose a command and control solution. Bureaucratic reforms are also necessary to facilitate the introduction of market-based instruments as well.

4. THE DRAFT LEGISLATION

There are currently three pieces of legislation under consideration. One, which proposes the creation of a national "Water Ministry," has been submitted to parliament for deliberation. The two others, which are reviewed and evaluated below, are draft Water Codes introducing economic instruments of various forms.

Shortly after the National Research Council (NRC) produced a draft of its version of a new Water Code in 1992, the Department of Pollution Control (DPC) commissioned the Law Faculty of Thammasat University to draft an alternative Water Code. As of this writing it is not clear which draft if either would be submitted to the Parliament. Some officials in the prime minister's office are considering merging the drafts into one piece of legislation. Both drafts reflect some of the conventional wisdom among officials and other water experts in Thailand about how to improve the country's water management.

The NRC draft primarily addresses water allocation problems. It deals only secondarily with incentives facing water users and economic instruments for changing those incentives. Water remains an "open access" resource in the NRC version, except in the event of a water "crisis," at which time the draft empowers government officials to establish and enforce water allocation priorities. The NRC draft does not introduce a market for either water use or disposal, and it treats Thailand's water problem primarily as an administrative problem which should be addressed with a more coordinated bureaucracy.

The Thammasat law faculty draft, on the other hand, introduces a market in water. It requires a permit for *all* water users, except for domestic consumers serviced by public piped utilities. A permit is also required for discharging effluent. The Thammasat draft thus attempts to create a market for both consumption and disposal.

These drafts will be evaluated in two respects: first, on the basis of how they might succeed on their own terms, with attention to the specific kinds of solutions they propose; and second, in terms of how they would help to resolve the institutional constraints specified earlier in the report.

Upon reviewing the specific features of each draft Water Code, the authors argue that what is needed in Thailand at the present time is to implement legal and bureaucratic reforms which would couple new market-based instruments to the improved performance of the irrigation, water distribution, and water treatment systems. In their present forms, however, each draft does not specify many of the institutions reforms which are needed to make the drafts work in practice, and thus neither effectively makes the connection between new market instruments and the performance of the water infrastructure. The authors of the NRC draft treat Thailand's water problems as an administrative issue requiring more government coordination to facilitate a "command and control type of solution. The Thammasat draft introduces market incentives, but it does not specify the institutional reforms which would be necessary to improve the performance of specific water agencies and thereby facilitate the introduction of market-based instruments. This shortcoming would prove particularly costly in areas of water management that are run as public utilities, for example irrigation, since the government would remain the supplier of the infrastructure. In the case of irrigation, decentralization of water management could prove a second-best alternative. However, there are severe bureaucratic and political constraints on that alternative as well.

4.1 Institutional Arrangements Proposed

Three aspects of the draft Codes are reviewed -- the definition of property rights to water, the new administrative authorities established, and the new policy instruments which are introduced.

Property Rights in Water

The NRC's draft does not change the "open access" rights to water in Thailand. It defines water as "*sombat phaendin*," which translated means "belonging to the country," but which in the civil law code provides the civil service authority to determine which user groups have actual ownership and utilization rights.²⁵ The text of the draft states that every Thai has a "right" to use water so long as they do not impose any "negative effects" on other users. But it allows the civil service the authority to declare a "crisis" in the event of a shortage and in "crisis" cases to charge all users according to their volume of consumption.

The Thammasat law faculty version is more extreme. In it all water belongs to the State (*khong rat*). The State grants citizens the right to use but not own water. All water users, except households, must obtain their right to water from the State in the form of a permit. These permits are valid for five years, and they specify precisely how much water the user is entitled to consume and where the water must be used. In addition, the Thammasat version creates a market for wastewater by requiring a permit for discharges.

In each draft code, all water users may transfer or sell their water rights to another user (in the NRC version this rule would apply in the event that permits are issued). Wastewater rights in the Thammasat version may also be traded freely in the marketplace.

New Administrative Authorities

The new administrative entities in the NRC version are "Basin Committees" which would oversee water allocation in some 25 major river basins. These committees would report to the National Water Resources Committee, the top policymaking body with regard to water. The National Committee would draft a water "plan" defining national

²⁵. Authors' interviews, Faculty of Law, Chulalongkorn University.

allocation priorities in accordance with Thailand's five-year development plans. Moreover, basin "sub-committees" would report to the Basin Committees about the water situation in each river basin. The Basin Committees would then be empowered to declare a "water shortage zone" in the event of a shortage in the water supply.

The Thammasat version creates similar entities called "Basin Commissions." In each version the Basin Committees (or Commissions) would "coordinate" the decisions of all the various government agencies concerned and would solicit input from user groups about how best to manage and allocate water. The Thammasat version's Commissions also have wider mandates, as they would prepare plans for the development and management of water resources within each river basin. Both drafts propose the creation of a national Water Ministry which would have the legal mandate to implement any of the policies and manage the policy instruments proposed by the basin authorities. A separate bill which proposes to create a Water Ministry has now been submitted to the parliament.

In absence of a new Water Ministry, policy proposals ratified by the National Water Resources Committee would rest with the numerous existing agencies. The authors of the NRC draft cite the existence of too many government agencies and overlapping legal mandates as the key constraints on water management in Thailand. The NRC authors thus perceive the water problem to be a public administration problem. The basin authorities are assigned to coordinate the activities of the various government agencies involved in water management at the basin level (but the basin authorities' legal authority to do so is not clarified, see subsequent discussion). The National Water Resource Committee also has a coordination function, as it would be empowered to impose national allocation priorities on the various other government agencies.

The Thammasat draft is very precise about who would sit on the 25 or so Basin Commissions, whereas the NRC draft is more vague about the representatives seated on its Committees. Each draft suggests that a corps of officials from key water agencies, noted academics, and representatives of various user groups, including industry and agriculture would be included. The Thammasat draft allows only 2 representatives from water user groups for each Basin Commission. These details are not specified in the NRC draft.

Neither draft clarifies how these representatives would be selected. The authors consider this to be a key oversight which could well arouse a similar controversy to that

which surrounded the debates over the creation of the proposed National Agricultural Council during 1992-93.

Policy Instruments Introduced

The policy instruments introduced by each draft feature a water "permit." The permit would be purchased by all water users from the government. In the NRC version, "enterprises" (such as businesses) must always have a permit in their possession, while permits for all other users would be issued by the Basin Committees only in the event of a water "crisis" as announced by the Committees. The Thammasat version authorizes that permits be issued to *all* water users at all times (except household consumers). In both drafts water users have the right to transfer and sell these permits to other users.

In the NRC version the permits do not in themselves determine how much water each user can consume. They merely authorize permission to consume. Water users are then to be monitored by government officials from an unspecified agency and charged for what they consume. The NRC draft authorizes that water charges be based on the local MWA or PWA rates in cases when permits are issued. In the Thammasat draft the permit specifies how much water the user is entitled to consume, but it does not specify how charges would be determined. An additional instrument in the Thammasat draft is a permit for wastewater discharges. That permit, too, is transferable. The NRC draft does not address water quality, leaving the issue instead to be governed by the 1992 Environmental Act.

4.2 Evaluation of the Draft Codes

Since each draft proposes a different brand of solution, the questions for each can be framed specifically as follows:

(a) For the NRC draft, since it proposes the introduction of economic instruments only in special circumstances, is the legislation likely to correct the demand-side inefficiencies associated with Thailand's present "open access" property rights regime in water? Moreover, are the draft Code's new administrative entities likely to improve supply-side management through an upgrading of the water infrastructure?

(b) For the Thammasat draft, which introduces a market in surface and waste water, are the policy instruments and incentives introduced likely to be successfully implemented and enforced within the existing institutional framework? Alternatively, would the introduction of the economic instruments proposed in this legislation encourage the public sector to carry out the appropriate institutional reforms to support a shift to market-based water allocation?

Property Rights and Incentives

The precedent that water should be provided virtually free of charge in Thailand creates certain cultural and political constraints that will not be overcome easily. The draft Codes have presented essentially two extreme views with regard to property rights.

The NRC version retains the "open access" type of property rights which has prevailed in Thailand, except for designated "crisis" periods as determined by a Basin Committee. In this regard, the NRC draft is perhaps more politically acceptable with regard to the property rights issue than the Thammasat version. Because most water users have historically used water freely in absence of effective monitoring or control by the State, the introduction of comprehensive permits and the enforcement of charges on everyone at once is not likely to be achieved without incurring severely high administrative and political costs. The potential implementation problems should be borne in mind when designing strategies for implementing either of the draft's proposals. The Thammasat version would require a very large public bureaucracy capable of allocating permits and monitoring of water use effectively and efficiently.

The key drawback of the NRC code is that the existing incentive structure which leads to overuse, hoarding, and other forms of rent-seeking behavior would not change. The enforcement of permits during "crisis" periods would thus depend almost entirely on the enforcement capacities of the State, since the incentives facing water users would not be effectively altered. In practice, the NRC permits represent a command and control solution. In this regard, the monitoring of all water users and the enforcement of quotas during crisis periods would need require a quantum departure from previous government practices of lax enforcement of the law.

The Thammasat draft introduces comprehensive property rights, designating the State as the owner of all water in Thailand. Since the State would be responsible for

assessing how much water is available and for allocating quotas in the form of permits, the State would need to develop the capacities to determine just how much water it owns. These capacities would be subject to severe constraints for at least three reasons.

First, for the State to allocate rights and quotas to all users, the stock of water must be relatively predictable and reliable. However, the unreliability of Thailand's water supply, which is typical of a monsoon climate with unstable hydrology, encourages hoarding rather than conservation.²⁶ Even basic knowledge about supply availability in most water basins throughout Thailand is extremely limited. And among those experts and government agencies who claim to have command of such knowledge, there is enough disagreement and bureaucratic inertia to delay the creation of a reliable data base.

Second, the State, as the authority in charge of water, should have at its disposal an efficient and relatively complete supply infrastructure in order to assess the water supply with any certainty. Only a few of the 25 river basins in the country have any kind of modernized irrigation system at all (refer to section 3.2, table 3), and most of those basin systems are incomplete. The Chao Phraya's is perhaps the most complete, though again, as noted earlier, the supply instabilities associated with monsoon hydrology bring even the Central delivery systems under stress.

Third, in much of Thailand the monitoring of water use is difficult and expensive because of topographical constraints. Small-scale agriculture, prevalent throughout most of Thailand, further raises monitoring costs. The State's typically *laissez-faire*, arms-lengths approach to regulating the economic behavior of the rural population will not suffice. But there are very high costs involved with more direct monitoring and surveillance of water use in the rural areas, particularly in areas outside of RID project boundaries.

A redeeming feature of the Thammasat draft is the creation of comprehensive property rights for wastewater. Problems, however, could arise in the enforcement of those property rights. Current experience is instructive. While the 1992 Environmental Act introduces the polluter-pays-principle, the Department of Pollution Control and the Department of Industrial Works have not been able to achieve the coordination necessary to enforce the law. There is a lingering dispute between these agencies over specific

²⁶ Burns, 1993.

agency mandates. The DIW has often cited the 1992 Factory Act as the basis for its authority in the area of wastewater management, and even then the new Factory Act has hardly been enforced in practice.²⁷

The Thammasat draft assigns the Department of Pollution Control to issue wastewater licenses and collect effluent fees from factories. The enforcement of effluent controls, however, would rest with the DIW in the Ministry of Industry. Since the DIW would lack a hard incentive to enforce the rules, the DIW's behavior would depend on the capacity of the National Committee to solicit the agency's cooperation. Since the DIW would not collect the revenues from enforcement, it would be deprived of a key reward for changing its practices of typically lax enforcement. An obvious drawback of this sort of system, however, is that the DIW would be tempted to enforce emissions controls arbitrarily, according to the revenue needs of its officials.

This drawback does not necessarily spell doom. In absence of a direct monetary incentive accruing from permit fees, the creation of a public-private joint venture in wastewater processing, such as that proposed for the Samut Prakan area by the DIW, could plausibly give the DIW more incentive to monitor discharges. In that case the agency would profit directly from improved monitoring.

Apart from the DIW's entry into wastewater processing, in our view it makes much more sense for factory licenses, industrial effluent permits, and enforcement of wastewater standards to all be handled by the same agency. Housing these functions in one agency avoids duplication and circumvents the ever-present problem of insufficient bureaucratic coordination. The DPC could then concentrate on monitoring the quality of the water stream and setting ambient and effluent standards, and it would not have to expend administrative resources on devising permit allocation schemes.

Basin Management

There are at least four related problems with the draft Codes that could arise at the level of basin management. These problems could impair the ability of the Basin Committees (or Commissions in the Thammasat version) to improve water management and encourage more efficient water use.

²⁷. Authors' interviews, Faculty of Law, Thammasat University.

One problem evident in both drafts arises from the collection of fees for water use, and the related incentives the Basin Committees would face in carrying out their responsibilities.

Although the Basin Committees are charged with enforcing water allocation criteria, they are not entitled to retain the fees which would be collected from issuing permits. In the case of the NRC version's Basin Committees, there is very little in their mandate which would make them anything more than a convention site for various officials and water user representatives to voice their opinions about the state of the water supply and to hash out allocation priorities for a given river basin. In the Thammasat version, the Basin Commissions would oversee the allocation of permits, but the draft does not specify precisely who would retain the fees. Each draft proposes that the national Water Ministry collect fees, but neither identifies which entity would collect fees in the event a ministry would not be established.

If the Basin Committees were (a) given rights to retain water-use fees, and (b) given authority over part or all of the water infrastructure in a given river basin, then the Committees may have a strong incentive to improve the efficiency of the water infrastructure and so increase their revenue. We therefore recommend that careful consideration is given to the collection and use of the fees by public agencies. There is an opportunity here to tie the introduction of economic instruments to improvements in the efficiency of public water utilities, notably in the irrigation sub-sector.

A second problem extends directly from the first arises from the fact that the Basin Committees (or Commissions) have only limited authority in their domains. The Basin Committees would oversee water distribution problems and the allocation of permits, but they would not have any effective authority over the water distribution infrastructure. The drafts do not specify, moreover, precisely how much authority the Basin Committees would have over the other water allocation departments which manage projects within each river basin.

While the basin entities would be empowered in the NRC version to determine basin-wide allocation criteria, it is not apparent whether they would have the authority to enforce any institutional adjustments upon the agencies managing the water infrastructure. Without a mandate to improve supply-side management, the Basin Committees in the NRC version could only address the negative effects of user behavior in a quasi-command

and control fashion, but they could not have a role in repairing inefficiencies in the water distribution systems that give rise to overuse.

In either the NRC or the Thammasat version, these constraints could plausibly be overcome. The lack of perfect water infrastructure now does not mean that appropriate investments could not be made in the future. The issue, though, centers precisely on the incentives which would encourage such investments, since they are not to be found when reading into the draft legislation. Earlier in the report (section 3.2) we emphasized the prevailing disincentives to improving the water infrastructure, notably the irrigation infrastructure. Owing to the problems thus identified in the areas of incentives and enforcement, we are very sceptical about the potential for the policy instruments introduced by the draft Codes to correct the institutional constraints on public sector capacities to repair the inefficiencies in existing water distribution systems.

It would be beneficial to the water sub-sector if the accompanying legislation were drafted that mandated bureaucratic reforms in the agencies overseeing the water infrastructure. Currently there is a drive to privatize some urban water and sewerage services. Reforms are also needed in the irrigation sub-sector to alleviate the increasingly acute surface water allocation problems in Thailand.

A third concern which could raise problems in the area of basin management involves the authority of the basin authorities to impose allocation priorities. The NRC draft does not allow price signals to determine water allocations. Instead it places allocation decisions in the hands of new bureaucratic entities -- the Basin Committees -- which would report to a higher bureaucracy, the National Water Resources Committee (or a Water Ministry).

The burden of proof for such an initiative is to show that command and control could result in better water allocations and less market failure. We believe the draft Codes fail this test for reasons cited above. To summarize, in the NRC version, the Basin Committees would lack the incentives and the authority to enforce policies which could effectively encourage less inefficiency in water use and curb the level of pollution in the water stream. In the Thammasat version, the feasibility of allocating permits for all users would depend on the Basin Commissions' ability to obtain accurate information about the water supplies within a basin.

A fourth problem which may arise is political. The NRC draft gives the Basin Committees wide-ranging discretion to declare a water "crisis" and "shortage zones" within their domains. It is not at all evident in the NRC version whether a given Basin Committee's perception of a crisis would coincide with the perceptions of water users. Many users in a given basin, in particular small farmers, already face supply constraints which constitute a "crisis" in their view. The draft as it stands does not specify how the Basin Committees are to distinguish among the behavior and needs of different users. The command and control solution could generate hostility from user groups, notably farmer, so long as water supplies continue to dwindle.

It is here that officials must be sensitive to the very diverse hydrology existing in any one basin; there must be a clear understanding of the effects of different types of water distribution systems on the behavior of different water users and their concept of property rights to water; and officials must be more sensitive to the allocation conflicts between highland and lowland agriculturalists, particularly in basins where lowland irrigators depend on sideflow running from the hills into an irrigated valley (e.g. the Chao Phraya Basin, and the Ping River Basin in the Chiang Mai valley).

Our random interviews with both upland and lowland farmers in Chiang Mai province and the Central region found that not all farmers are opposed to paying for the water they consume. Farmers are well aware not only of their own supply constraints, but also of regional and national constraints. They understand the various institutional and hydraulic problems with the RID's maintenance of the water infrastructure, and they know that the rapid increase in urban demand imposes further constraints on their own consumption.

While many farmers are not opposed to paying user charges, they do raise concerns about the precise *methods* by which any fees or government monitoring of water use would be conducted. Irrigators within the RID's projects tend to adhere more consistently to the view that the RID ought to provide them with water as a birthright. This constraint has been cited above and its implications noted. But outside of the RID's projects there is a greater diversity of opinions. In most areas village communities have created their own institutions for managing water allocations. These institutions are typically governed by a *gae fai* (irrigation chief, or "head of the weir") who imposes village charges in cash or kind on local irrigators. Many communities prefer to retain these

systems of authority should pricing be introduced by the State.²⁸

Thailand's water authorities should be aware of the potentially disruptive impacts the imposition of permits nation-wide would have on local community institutions. In many villages, mostly outside the RID's project boundaries, communities have already devised informal markets for paying for and conserving water, for example in the valleys of the Northern region. It would be unfortunate if the application of new policy instruments destroyed these institutions and created the wrong incentives, i.e incentives which may lead to more uncertainty, hoarding, and increased conflict between highland and lowland communities.

Institutional diversity and uneven water infrastructure characterize the allocation systems in each and every river basin throughout the country. The fact that the draft Codes do not specify the criteria and conditions for Basin Committee decisions creates an opportunity to incorporate that diversity into strategies for water management in each basin. The process of selecting user representatives for each basin entity and the relationships which would be established between the basin entities and the various user groups are therefore critical ingredients in the potential effectiveness of the new Basin Committees (or Commissions) and their administrative actions.

Because none of these issues are specified in either version of the draft legislation, it would be wise for each basin entity to be informed of the potentially disruptive impacts the application of exogenously-determined administrative procedures could have on user behavior and water allocations within each basin.

Authority Relationships Between Basins

It is striking that neither draft addresses the conflicts that would inevitably arise between basins. Presumably the various basin authorities would be obliged to follow the country priorities laid down by the National Committee, or the Water Ministry if one is

²⁸. These institutions should not be confused with "common property" ownership. Members of one village irrigation committee in Mae Rim district, Chiang Mai, argued in favor of a system of individual property rights for *every irrigator* and stated they would be willing to pay the State for water. Their conditions, however, were that their community be allotted a lump quota of water, and that payments for all irrigators in the community be made to the State in one sum by their *gae fai*. They preferred that the State not intervene by allocating permits to each water user in their community, and that the allocation of water and property rights within their community be left to existing village institutions and allocation mechanisms.

created. If so, each basin entity would lack the authority to sell water to another basin. This national constraint could plausibly act as an impetus for improvement in demand-side management within a basin. By forcing a given basin to maintain a required flow downstream, the basin entities might be encouraged to improve demand-side management within its domain. But given the limited authority of the basin entities, it is hard to imagine where the incentives to economize within a basin would arise.

To restate the point, improved demand-side management, which on the basis of our evaluation appears essential to relieving water allocation constraints (particularly if irrigation demand remains constant or rises), would require adjustments in existing irrigation practices and water infrastructure management. Improving demand-side management would also demand that the policy enforcement bottlenecks with regard to groundwater pumping and S&WM outlined earlier in the report be addressed independently of the new legislation. As noted earlier, the only adjustment suggested in this area is the introduction of discharge permits (in the Thammasat version). However, there is, at best, only a weak connection drawn between that policy instrument and the behavior of the overseeing agencies.

5. CONCLUSION

Our analysis of the institutional framework for water management in Thailand finds that administrative reforms in the agencies overseeing the water infrastructure and water policy enforcement are needed to support the introduction of market-based policy instruments. Although both draft Water Codes propose various new policy measures that are necessary to begin addressing water problems, there is a serious threat of government failure. Current administrative style tends toward a "command and control" type of solution to water allocation problems, a solution which in itself is fraught with trouble because the public sector often lacks the coordination and coherence necessary to make such an approach succeed. Moreover, this type of solution is clearly not favorable to the introduction of market incentives. Finally, since neither draft introduces the more critical institutional reforms to shift to a market-based allocation system, it would be unfortunate if the passage of any new legislation would distract from the institutional problems at hand.

Institutional reforms which would address the stresses in the water management system identified above would also go long way toward repairing the inefficiencies in the water infrastructure. Improvements are in particularly dire need in the urban piped water system and the irrigation system, notably in the Chao Phraya Basin. The introduction of new policy instruments, such as pricing for irrigation, could provide incentives for the improvement of public water services. But these new instruments must be paired with agency reforms -- in the case of irrigation what is needed is a revamping of the operations & maintenance apparatus and investments in human resource development within the RID. Similar investments are in dire need in the Department of Pollution Control to facilitate the management of an appropriate data base. Reforms such as these are not specified in the draft legislation.

ANNEX A: Supporting Tables and Graphs

Chart A.1

Growth in irrigation water use and actual irrigated area

Cumulative Increase (1980-1989)

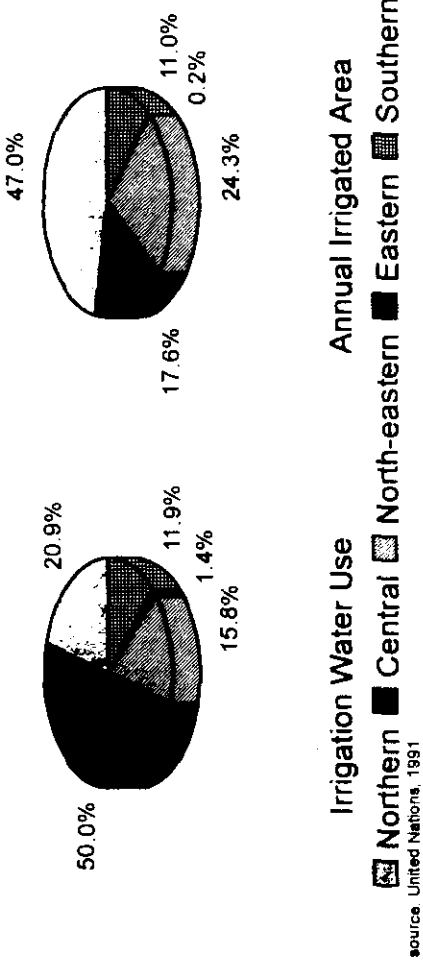
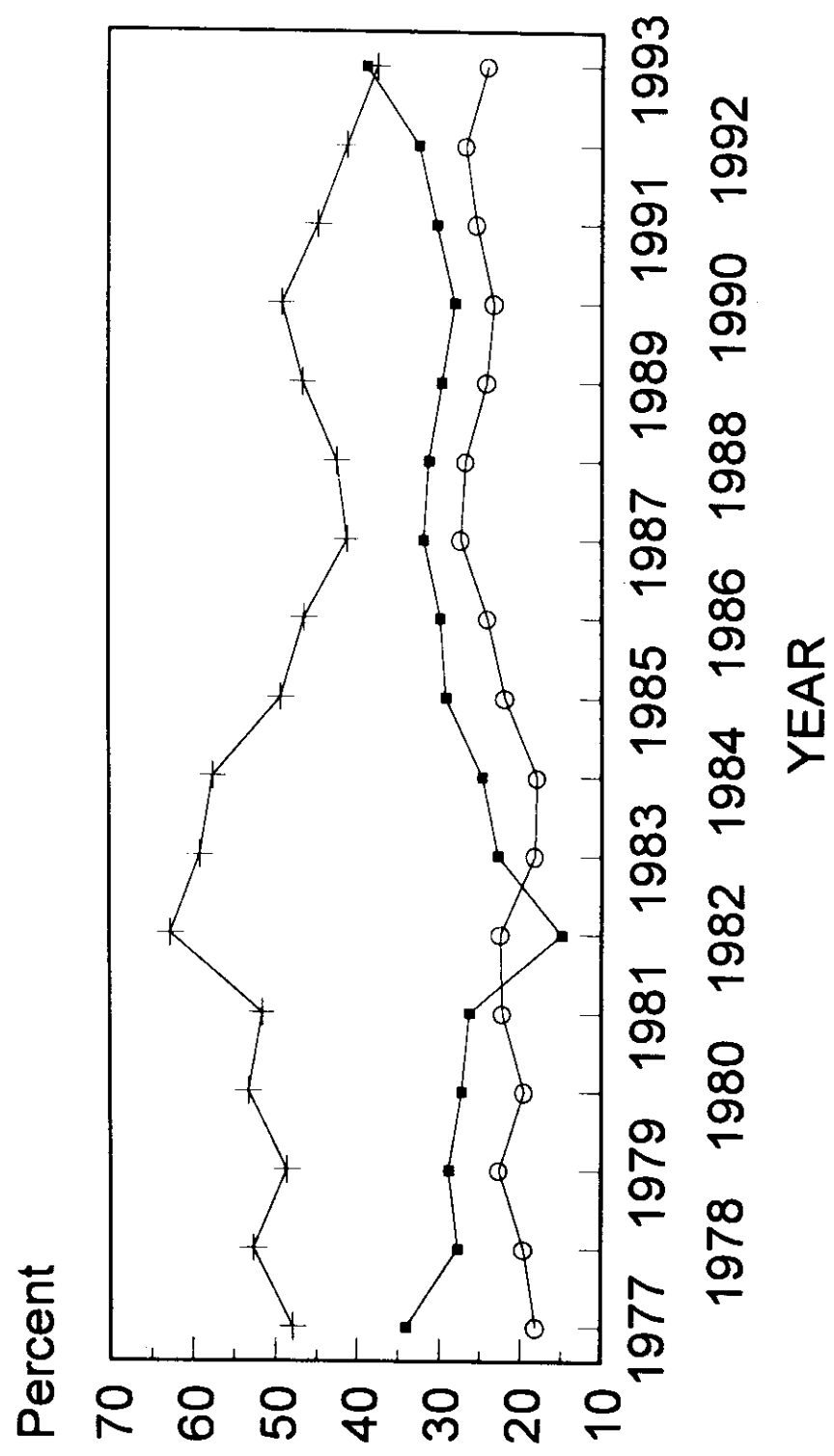


Chart A.2

RID BUDGET 1977 - 1993



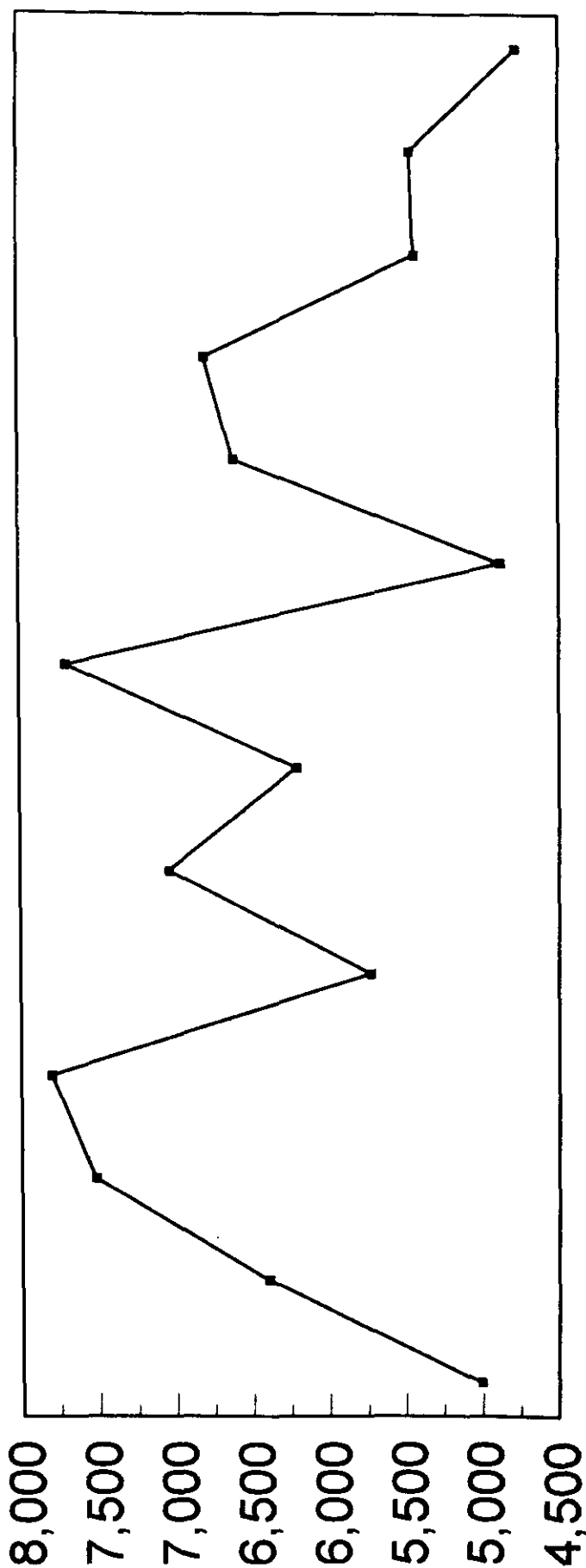
SOURCE: RID 1993

November-May Water Release from SR&BH Reservoirs

Chart A.3

1979 - 1993

Million Cubic Meter



YEAR	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93
→	5,007	6,396	7,518	7,802	7,039	6,207	7,702	4,883	6,611	6,799	5,437	5,466	4,783	

SOURCE: RID 1993

Table A.1

The differences Between the Decadal Annual Mean Rainfall and the 40-Year Period Mean During 1951-1990 of Each Region

Region	-40-Year Annual Mea (N)	Difference			
		(D1-N)	(D2-N)	(D3-N)	(D4-N)
North	1262	43	24	16	-84 ^{3/}
Northeast	1416	-11	82 ^{3/}	-26	-46
Central	1273	99 ^{3/}	1	-55	-45
East	2122	276 ^{4/}	31	-117	-190 ^{4/}
Southeast	1802	56	128	6	-190 ^{4/}
Southwest	2837	170 ^{3/}	29	-53	-146

1/ "N" represents the average of the 40-year period mean annual rainfall during 1951-1990

2/ "D_i" represents annual mean rainfall of the (ith) decade

3/ statistical significance at 0.05 level

4/ statistical significance at 0.01 level

5/ "i" means decadal annual mean rainfall is lower than the average of the 40-year period

source: TDRI

Water Quality of Thailand's Major Rivers

Table A.2

	Standard	1987	1988	1989
Chao Phraya				
Upper	1.5	1.60	1.70	1.00
Middle	2.0	1.80	1.80	2.40
Lower	4.0	4.00	3.80	2.80
Tachin				
Upper	1.5	2.70	2.00	2.90
Middle	2.0	2.40	2.80	2.60
Lower	4.0	4.00	3.60	2.70
Mae Klong	2.0	2.20	1.80	2.20
Bang Pakong	2.0	1.30	1.70	1.20

Units:mg/l of BOD (Biochemical Oxygen Demand)

Source:Office of the National Environment Board

ANNEX B: Primary Legal Arrangements in Water Management

Water Allocation and Consumption

Agriculture

People's Irrigation Act of 1939
State Irrigation Act of 1942 (as amended)
Dykes and Ditches Act of 1962
Agricultural Land Consolidation Act of 1974

Domestic and Industrial Use

Provincial Water Works Authority Act of 1979
Groundwater Act of 1985 (1977)

Sewage and Wastewater Management

Enhancement and Conservation of National Environmental
Quality Act of 1992 (1979, 1975)
(a/k/a The Environmental Act of 1992)
Factory Act of 1992 (1979, 1969)
Public Health Act of 1979 (1941)
Control of Construction of Buildings Act of 1979 (1936)
(a/k/a The Building Code of 1979)
Navigation in Thai Waters Act of 1972 (1913)
City Planning Act of 1975

ANNEX C: Major Government Agencies Involved with Water Management

Office of the Prime Minister

National Economic and Social Development Board (NESDB)

Office of the Minister to the Prime Minister's Office

Bureau of the Budget (BOB)

Office of the National Water Resources Committee

Royal Projects Development Board

Electricity Generating Authority of Thailand (EGAT)

Description and Authority with Regard to Water:

National Economic and Social Development Board: This agency develops and prepares Thailand's five-year development plans. When established in 1959, the agency was designed to identify development goals for providing a basis for planning public sector spending over consecutive five-year periods. It was not given any implementation capacities. However, during the 1980s, primarily as a means to implement the Eastern Seaboard Development Program, the agency created the "Center for Integrated Operations," which was charged with coordinating sector-specific policy implementation. The agency recently acquired a water expert from the Royal Irrigation Department to assist the agency with water policy planning and to enable the agency to advise the prime minister's office regarding water issues.

Office of the Minister to the Prime Minister's Office: Currently (1993) one of the Ministers to the Prime Minister's Office is promoting an industrial decentralization strategy that features the provision of industrial infrastructure and industrial estate facilities in the Board of Investment (BOI) Zone #3, which includes most provincial areas outside of the Bangkok Metropolitan Region (BMR). The office to this Minister has recruited water resource experts to assist the Prime Minister's office with incorporating water issues into the government's industrial decentralization strategy.

Bureau of the Budget: This agency has authority to appropriate and approve funds for the government's annual budget. While technically the Bureau is required to design its appropriations in line with the NESDB's five-year development plans, it works very closely with the departments in the various ministries who request their own funds from the Bureau. Until recently the Bureau did not have an information capacity regarding water quality issues, which has caused some constraints for the implementation of water quality standards as mandated in the 1992 Environmental Act.

Office of the National Water Resources Committee: This office has two functions -- one is to advise and act as the secretariat for the National Water Resources Committee, the other is to advise the prime minister's office regarding national water policies. As an advisory body it has no policy implementation authority. But as an arm of the prime minister's office it does have input into the design national water allocation priorities through consultation with the NESDB and the Minister to the Prime Minister who oversees industrial decentralization policies.

Royal Projects Development Board: This is a regular government agency established in 1981 to promote better coordination of water projects among the various government agencies concerned. The focus of the Board's projects has been small-scale irrigation. Currently the office is located in the NESDB, pending a move to its permanent home in the Prime Minister's Office. The Board submits spending proposals to the Bureau of the Budget, just as all other government agencies do. The difference with other agencies, though, is that the Royal Projects Board uses these funds to reallocate to other government agencies to support priority projects which the Board and/or His Majesty have deemed need urgent attention. In this fashion the Board plays the role of coordinator, producer of feasibility studies, screening agency, and allocator of funds especially for small-scale projects. The Board sees its role as providing seed money for other agencies to get projects started. It supports these projects for only one year. Approximately 65% of the Board's funds are directed toward the RID. The Board is also reputed to conduct frequent rigorous evaluations of existing projects, thereby giving the recipient agencies an incentive to perform.

Electricity Generating Authority of Thailand: This is a state enterprise which is

responsible for Thailand's electrical power production and management of hydro-electric dams. It also oversees the construction of all hydro-electric dams. While there is no law which permits the enterprise control over water in the reservoirs, EGAT has a mandate to keep power generation at sufficient levels and to determine how much water is released through the dams it oversees.

Ministry of Agriculture and Cooperatives

Royal Irrigation Department (RID)

Royal Forestry Department (RFD)

Department of Land Development (DLD)

Department of Fisheries (DOF)

Department of Livestock Development (DLD)

Description and Authority with Regard to Water:

Royal Irrigation Department (RID): This agency is the principal authority with regard to water allocation. In its legal mandate, the agency is charged with making water available to all water users in the country. While it does not have direct authority over hydroelectric dams, this agency works with EGAT to locate dam sites and plan for their construction. Most importantly, the RID constructs and maintains all large- and medium-scale irrigation infrastructure in the country. It manages most of the small-scale irrigation infrastructure. Although the agency has the legal authority to impose charges on water users, it has almost without exception refrained from doing so. This is partly due to the fact that the agency secures the largest budget allocation in the Ministry of Agriculture, and it enjoys partial discretion in negotiating foreign loans for irrigation projects, in consultation with the Ministry of Finance.

Royal Forestry Department (RFD): The RFD's authority in water is limited to the management watersheds. The agency is charged with maintaining forests in watershed areas and has the authority to authorize the relocation of citizens who are deemed to be a threat to watershed areas.

Department of Land Development (DLD): This Department has the authority to designate areas for agricultural projects and to manage the development of the

land. It coordinates with the RID in the management of areas targetted for land consolidation in preparation for the construction of tertiary canal systems (such as those relating to the various "ditches and dykes" projects).

Department of Fisheries: The Fisheries Department is responsible for the development of projects in fisheries and aquaculture, both in inland and coastal waters.

Department of Livestock Development: With responsibilities for livestock projects and the promotion of commercial livestock ventures, this agency has the authority to develop relevant water resources to support these endeavors.

Ministry of Interior

Department of Public Works

Department of Local Administration (DOLA)

Department of Town and Country Planning

Department of Lands

Office of Accelerated Rural Development (ARD)

Metropolitan Water Works Authority

Provincial Water Works Authority

Description and Authority with Regard to Water:

Department of Public Works (PWD): This is a technical support agency for the Interior Ministry in the area of numerous types of infrastructure, especially water supply, sanitation, and other engineering works. This agency is responsible for designing, supervising the construction, and advising the operation and maintenance of sewerage and drainage systems. It is the key technical agency for the development of wastewater treatment capabilities for municipalities and other local governments. The Department controls some 600 engineering and technical staff who are responsible for the implementation of projects for a variety of other government agencies.

Department of Local Administration (DOLA): This large department is responsible for all activities involved in the operation of the provinces and

municipalities outside of Bangkok, including but not limited to budgeting and local government finance. The Local Administration Division administers department activities, while the Office of Urban Development coordinates external finance for the municipalities.

Department of Town and Country Planning: The agency is responsible for preparing land use plans for urban and other specified areas.

Department of Lands: This is the principal land titling agency in the government. It issues land titles and licenses for land development in most all areas of the country, except for public forest reserves and land owned by other government agencies.

Office of Accelerated Rural Development (OARD): This agency oversees the Accelerated Rural Development program, a program which began in the 1960s as a road-building and counterinsurgency operation, but which expanded into a larger array of rural employment and development functions during the 1970s and 80s. The agency is responsible for developing on-farm and off-farm employment options for farm laborers, particularly during the dry season. Within its mandate is can authorize and manage the construction of small-scale irrigation projects. The poor quality of these projects and the lack of coordination with the irrigation infrastructure of the RID has been a source of criticism of this program.

Metropolitan Waterworks Authority (MWA): This state enterprise was incorporated in 1967 to supply piped water services for Bangkok and the adjacent provinces of Nonthaburi and Samut Prakan. While the MWA is mandated to supply piped water to an area covering a total of 3,080 km sq., by the end of 1991 its services covered only 740 km sq. The MWA employs 12 mobile tap-water producing units to reduce shortfalls in the dry season. The MWA is now implementing the fourth Bangkok Water Supply Improvement Project Masterplan (1991-1995) with an aim of increasing tap water production by 400,000 cu. m/day. Overall investment during this period is estimated at Baht 7.5 billion, marking a 95% increase on the previous five-year period. The MWA recently announced it would invite bidding for Bangkok's first private water processing facility.

Provincial Waterworks Authority (PWA): This state enterprise was incorporated

in 1979 to operate and maintain the water supply systems outside the areas falling under the jurisdiction of the MWA. The enterprise is charged with finding water resources, constructing treatment plants, providing operations and maintenance services, and collecting user fees for all provinces other than the three which comprise the Bangkok metro area. To date the PWA has supervised the planning, design, and construction of 800 village and small town treatment plants which are then handed over to local governments. The PWA has designed and now operates 215 other provincial treatment plants, usually serving population centers of 5,000 people or more, from which it depends largely on user fees for revenue. The PWA's 1992-93 construction budget is Baht 3,500 million, with Baht 300 million allocated for leakage detection programs. The central government provides about 30% of the funding for the PWA; the remaining 70% is derived from user fees, loans, and bond issues. The PWA has allocated a budget of Baht 12.8 billion for the privatization of five major water supply projects over the period 1991-1996.

Ministry of Industry

Department of Industrial Works

Department of Mineral Resources

Industrial Estate Authority of Thailand

Description and Authority with Regard to Water:

Department of Industrial Works: This is the major authority in the government for regulating and monitoring factories. It is responsible for control of industrial effluent standards. The agency requires that factories install wastewater treatment facilities and maintain their effluent discharge below a standard (set previously by the agency) in order to obtain a license to operate. It also manages factory inspections and has the authority to levy penalties on factories that breach effluent standards.

Department of Mineral Resources: This is the key agency for managing and monitoring groundwater use throughout the country. The agency is responsible for issuing groundwater permits and enforcing charges consistent with the Groundwater Act of 1985 (1977).

Industrial Estate Authority of Thailand: A state enterprise responsible for providing treatment of industrial wastewater within industrial estate boundaries. The agency has no monitoring or enforcement mandates.

Ministry of Science, Technology, and Industry (MOSTE)

Department of Pollution Control
Office of the National Environment Board
National Energy Administration

Description and Authority with Regard to Water

Department of Pollution Control (DPC): The DPC is one of three new environmental-related departments established within MOSTE in June of 1992, following the passage of the new Environmental Quality Act of that year. The department's primary responsibility is to set a broad range of environmental standards. It also works with other agencies, in particular the Department of Industrial Works, to develop and implement a standards enforcement system. One of the chief efforts of the agency is to test the ambient level of the water stream around the country. On the basis of that data the agency is revising effluent standards for factories, hotels, restaurants, and residences. The department is also breaking down effluent standards further by industry in hopes of identifying major "source points" of pollution. Initially its industrial standards are aimed at pig farms, aquaculture, and other agro-industrial plants.

Office of the National Environment Board (ONEB): This is a national agency which serves as the operating arm for the National Environment Board. It primarily provides advisory services on the state of the environment in different subsectors of the economy, and it suggests directions for environmental legislation and policy.

National Energy Administration: This agency is responsible for developing national energy resources. Its legal mandates include the authority to locate and oversee the construction of dams for hydroelectric purposes.

Ministry of Public Health

Department of Health

Description and Authority with Regard to Water:

Department of Health: The Ministry is responsible for monitoring the disposal of hospital wastes, in addition to a broad range of other activities affecting health. The Department of Health provides technical services for the installation and operation of wastewater treatment facilities, flood protection and storm water drainage, and hazardous waste disposal.

ANNEX D: Major Committees

National Level

National Water Resources Committee
National Rural Development Committee
National Environment Board

Ministerial Level

Committee on Agricultural Policy (Ministry of Agriculture and Cooperatives)
Committee on Irrigation and Agricultural Development (Ministry of Agriculture and Cooperatives)
Environmental Committee on Water (Ministry of Science, Technology, and Environment)

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