Canadian
Environmental
Advisory
Council

Report No. 12
March 1983

WATER MANAGEMENT PROBLEMS IN THE THIRD WORLD: LESSONS FOR CANADA

Peter F.M. McLoughlin

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Ce rapport est disponible en français

OTTAWA, CANADA
1983

CANADIAN ENVIRONMENTAL ADVISORY COUNCIL

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- such matters as may specifically be referred to it by the Minister;
- the state of the environment and threats to it;
- the priorities for action by the federal government or by the federal government jointly with the provinces;
- the effectiveness of activities of the Department of the Environment in restoring, preserving or enhancing the quality of the environment.

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FOREWORD

From time to time the Environmental Advisory Council has found the vital issue of water resource management appearing on its agenda in one form or another. Like the element itself, the problem of responsible water management permeates almost every aspect of our environment, whether it concerns water as a transport medium, a carrier of wastes, as a recreational playground, as acidic precipitation, in its use for irrigation purposes, as potable drinking water or as a home for our fisheries resources.

With such a variety of essential uses, it is nothing less than tragic that we have treated water with such cavalier disrespect, and that a country such as Canada with abundant resources of clear water and opportunity to manage them well has not served as a model for others less fortunate.

Peter McLoughlin was a particularly welcome appointment in 1980 for he came to Council with extensive practical experience in water management, especially in Third World countries. The organizers of the 1982 Environment Week symposium in Calgary invited him to discuss the reasons behind the difficulties of coming to grips with wise management of water resources in Canada. In agreeing to do so, Dr. McLoughlin chose to use his experience in developing countries and apply it to the Canadian scene.

This is not an essay on the distribution, quality or availability of water resources. It deals with the shortcomings of planners and those given responsibility for management, with shortsightedness, lack of accountability, inability to learn from experience, and inattention to ecological principles. Furthermore, the observations it contains are not applicable only to the management of water but to the management of our other natural resources.

His insights are keen and practical, and his criticisms pull no punches. The Council is pleased to make his sobering observations and challenging recommendations available to planners and policy-makers by publishing his address as a Council report.

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This is an edited and revised version of a paper presented at the Environment Week symposium in Calgary, Alberta, on June 4, 1982, by Dr. Peter F.M. McLoughlin, President, Peter McLoughlin Associates Ltd., Consulting Development Economists, Comox, B.C., and Vice-Chairman of the Canadian Environmental Advisory Council.

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Edited for publication by Dr. J. Keith Fraser, Ottawa.

LIST OF PUBLICATIONS

Annual Review 1973-74: Part A - Activities 1973-1974 by Arthur Porter; Part B - Problems and Priorities in the Canadian Environment by Pierre Dansereau.

Annual Review 1975: Part A - Activities 1975 by Ian McTaggart-Cowan; Part B - Significant Canadian Environmental Problems by J.P. Nowlan.

Annual Review 1976: Part A - Activities 1976; Part B - The State of the Canadian Environment 1976.

Annual Review 1977-1978: Part A - Activities 1977-1978; Part B - The State of the Canadian Environment.

Annual Review 1979-1980; Activities 1979-1980; A Decade of Environmental Concern: Retrospect and Prospect, by Donald A. Chant; Environmental Assessment and Review Process: Observations and Recommendations.

An Environmental Impact Assessment Process for Canada, Council Report No. 1, February 1974.

An Environmental Ethic - Its Formulation and Implications, Council Report No. 2, January 1975, by Norman H. Morse.

Harmony and Disorder in the Canadian Environment, Occasional Paper No. 1, by Pierre Dansereau, Council Report No. 3, 1975.

Environmental Aspects of Nuclear Power Development in Canada, Occasional Paper No. 2, by H.E. Duckworth, H.W. Duckworth, Arthur Porter and J.S. Rogers, Council Report No. 4, 1977.

Towards an Environmental Ethic, March 1977, by D.A. Chant.

Report of the Second Joint Meeting of Environmental Advisory Councils, May 1977, Fort San, Saskatchewan; Council Report No. 5, March 1978, produced in collaboration with the Saskatchewan Environmental Advisory Council.

The Management of Estuarine Resources in Canada, Council Report No. 6, March 1978, by Irving K. Fox and J.P. Nowlan.

Reports of the First and Second Meetings of Public Interest Groups with the Canadian Environmental Advisory Council, Council Report No. 7, May 1978.

Ecotoxicity: Responsibilities and Opportunities, Council Report No. 8, August 1979, by Ross H. Hall and Donald A. Chant.

List of Publications (Cont'd)

Report of a Meeting between the Public Interest Groups and the Canadian Environmental Advisory Council, May 26-27, 1980, Council Report No. 9, April 1981.

A New Approach to Pest Control in Canada, Council Report No. 10, July 1981, by Ross H. Hall.

Wildlife Conservation Issues in Northern Canada, Council Report No. 11, October 1981, by Ian McTaggart-Cowan.

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ABSTRACT

Problems affecting the management of water resources in developing countries are identified and discussed. These include short-term planning, water rights, inability to learn from experience, planning in isolation, the "think big" syndrome, lack of direct accountability, shortage of resources, lack of socio-economic analysis, the bureaucratic bias, absence of an ecological overview, and the problem of incrementalism. These problems are applied to the Canadian scene and those involved in water policy and management are challenged in a series of searching questions. It is seen that the management of Canadian water resources, in practice, has many shortcomings and would benefit from the hard-won experiences of Third World countries.

INTRODUCTION

The purpose of this paper is to stimulate discussion on fundamental issues of water management in Canada. Important lessons for the management of this most vital resource can be found in the experiences of Asian, African, Latin American and Middle East countries where, in contrast to Canada, the resource is less abundant and often of lower quality, the social need greater but the ability to pay is less, and the effects of a variety of institutions and customs are more sharply apparent.

This paper does not attempt to review the water resources of Canada or other countries, or to evaluate water management activities or policies in a systematic way. But selected examples of water resource development and management actions, and their consequences, in a number of so-called "Third World" countries help to illustrate a range of problems which Canada shares with other countries, despite differences in settings and institutions. Review of these experiences may help Canadians, as citizens and as governments to improve the management of their own water resources.

Recognizing that the problem pie can be sliced many ways (there are a multitude of aspects to what are complex and many-sided issues), the following aspects are listed, then amplified further:

1. The problem of the wrong scale of technology.
2. The technical/bureaucratic bias in water planning.
3. Water management planning in isolation.
4. Planning only for the short and medium terms, not the longer.
5. Problem of damage to other resources by inappropriate use of water.
6. Problems of jurisdiction and water rights.
7. Problems associated with the dynamics of water supply.
8. Problem of not learning from previous experience.
9. The matter of accountability of water managers and planners.
10. Problem of shortage of resources for water management.
11. Problem of absence of economic and social analysis guiding management decisions.
12. Problem of incrementalism.

WATER MANAGEMENT PROBLEMS IN THE THIRD WORLD

The Problem of the Wrong Scale of Technology

Engineers, historically, when dealing with water control and management projects, tend to think "biggest". A series of small structures is nowhere near as proud an achievement as a massive structure. Sometimes called the "Dam the Ganges" philosophy, this propensity to seek automatically the technically challenging large-scale, if not the largest-scale solution tends to lead naturally to the application of large-scale type technologies in the use of the resources to which the water system is applied or linked. Thus a massive dam intrinsically calls for a massive hydro-electric station, a massive reservoir, a massive irrigation system, etc.

In other words, quite aside from the comparative economics of one-big versus many-small, there is a tendency to have the "think big" philosophy spill even further through its linkages. For example, in the Dez Irrigation Scheme in Iran, the farms in the newly irrigated area were to be large-scale farms (1,000 - 5,000 hectares each) needing large scale machinery and equipment designed by Mid-western Americans, in spite of the fact that such enterprises are rarely successful in developing nations, and rarely successful without enormous subsidies. The successful small-scale traditional irrigation farmers were thrown off their land to become labourers on large farms. Newly reclaimed land in Egypt, for the most part, is being turned over to State-owned and/or State-run production companies for large-scale farming which has already proven disastrous in contiguous areas over the last twenty-five years.

Two other points are worth mentioning in this connection. One is that larger systems tend to carry with them a greater degree of vulnerability. If they break down, more people, more enterprises are affected, and often for longer periods. In some ecologies and economies, this may not be too serious. In others which are drought prone, or which do not have the infrastructural support to keep things running or to fix them quickly once broken, the failure of one large water project can have immensely negative and sustained consequences.

Perhaps more important, the "think big" syndrome of North American and European engineering consulting firms - firms engaged traditionally to assist Third World governments to design and construct their water management systems and to devise 10 and 20 year water management plans - has rubbed off on their engineering counterparts in those countries. The "think big" philosophy has become institutionalized in people, in administrative structures and procedures, and in political systems. Equally unfortunate, the "biggies" remain more attractive to international agencies funding water megaprojects. One can scarcely get money for small projects, and you want your name on the big one.

The Technical/Bureaucratic Bias in Water Planning

Obviously related to the foregoing, the technical/bureaucratic bias simply means that those who initiate water project plans, develop initial designs, build prototypes and models, and conduct initial feasibility work are almost exclusively engineers in government and corporate bureaucracies whose main responsibilities are limited to and focussed on such activities.

This combination of technician and bureaucrat virtually guarantees two things. One is the effective omission, in the earlier stages of project development, of integral feasibility components such as economics, legal/institutional considerations, social matters, and often environmental matters, even though lip service may very well be paid to these issues (as now required by law in many countries).

The second result is that project plans get into a pipeline within an agency, and continue being developed as long as there are budgets to pay staff. A project assumes a life of its own in the system, gaining followers and supporters, and even momentum, over time. Such projects become virtually unstoppable, seldom get properly reviewed and dropped **within** the agency, and rarely get arrested by the outside world since the outside world is usually either ignorant of the activity or incapable of affecting its development. The physical projects then are born, sometimes years after their conception, and often at places and times no longer entirely suitable for them. The problem may have changed significantly, or viable alternatives may have emerged. Even if not gone ahead with, an appreciable amount of public money would have been consumed in the planning.

Water Management Planning in Isolation

In a real sense, planning in isolation almost automatically derives from the previously described feature, the technical/bureaucratic bias in water planning.

To serve its purpose properly, planning for the development of any resource, particularly one in which the entire community has a direct stake (such as water), should begin with the final uses to which people want the resource put. The planner should then work backwards, to the present, identifying what must be done along the way to achieve that particular package of end uses. We know from long observation that a meaningful change brought about by man's influence on any one aspect of a water system will induce, sooner or later, qualitative changes in other, linked, systems.

While some of these matters are discussed later in this paper, what concerns us here is the failure to recognize adequately either the multiplicity of end uses of water, or the pervasive diversity and multiplicity of human needs and impacts. Planning must cater to, indeed

be guided by, these diversities. But bureaucratic planning rarely does so. While one or a few technical uses of water are focussed on - power, irrigation, etc. - the institutional, legal and social aspects of related effects tend to be given minimum attention. Often the technical agency or bureaucracy responsible for project planning has no authority, as well as no desire or capability, to consider the full range of social and economic issues.

These impacts burst upon the project later in the form of emergencies or unsuspected side effects, or the development of situations which are costly to modify and for which we often do not have the institutional machinery. There are many examples in the Third World of deltas and estuaries damaged almost or entirely beyond repair or recovery, of major fisheries ruined for the foreseeable future, of soil fertility destroyed by salt migration, and the like simply because the planning was conducted without reference to these linked matters.

Planning for the Short and Medium Terms, not the Longer

The problems of short-term water management planning are evident. In drawing attention to mistakes in this area, however, one must be much more judicious about throwing stones. The real enemy here is not just the tyranny of man. It is as much the tyranny of ignorance of the affected physical and biological systems and of their behaviour over the long-term if parts of the system are changed.

Perhaps we should have added this matter of ignorance to our list of features of planning for water use. Proper planning for water management requires long-term awareness of meteorological and hydrological regimes, the nature and dynamics of groundwater systems, the dynamics of water quality, and the dynamics of aquatic and terrestrial biology related to changes in water systems. These have been studied only haphazardously and briefly in most water systems of the Third World. In any case, the understanding gained has often been ignored by the planners and decision-makers. Tragically, the innate understanding of the long-term behaviour of natural systems acquired by local people through generations of experience has also been ignored by technical planners concerned only with short-term results.

How then does one build models of 50, 100, 200 years into the future with any reliability? One cannot. Planners can only do their best to act within conservative limits based on all the information and experience available. They can endeavour to construct models that will be able to accommodate and adjust to new information and experience as they become available.

Two other elements are relevant here. One is that it is critical to build into both the normal recording and reporting systems, usually of government and project authorities, the types of data which are needed for

planning, to ensure that the information base builds up over time. All new projects in Third World countries should be required to contain a significant and relevant recording and research component, so that each new project serves to increase the knowledge upon which the next one can be planned and carried out.

The second element is less determinable. While every care can be paid to assessing longer term implications of major water projects (though the 50-100 year view tends to be related strictly to engineering matters such as sedimentation, flood probabilities, etc.), virtually all small projects are decided by more local authorities. Quite often these decisions are made without due recourse to either the wider picture (e.g., who else is using the river, the ground water reservoir, etc.), or to the longer run dynamics of that resource (keep the farmers happy now, settle people in this area now).

Short-term solutions, made locally, may add further stress to an already strained natural system, so that in 10-15 years the system collapses and those involved are worse off than ever. The local politicians and functionaries who made the decisions are, of course, long since gone. A major problem in water resource planning is how to ensure that developments and management decisions are made in awareness of the behaviour of the system as a whole and the broader consequences of any single decision. At the same time, local agencies should be given the authority to take action to solve local problems.

Problem of Damage to other Resources by the Wrong Use of Water

This is yet another way of looking at a complex of issues, some of which have already been mentioned. In nature, water does not exist by itself. Virtually every water system is affected by human actions. There are, of course, water systems in which the water is not yet actively used by people, such as some of those in the Arctic, and a few in isolated areas with no significant human populations. But even in these the quality of the water and its long-term regime are becoming affected by human activities in other parts of the world, for example, through meteorological systems.

In the context of man's active or planned use of water resources, however, water exists in conjunction with soil, rock, air, vegetation, aquatic and terrestrial life; and with man-made resources such as settlements, farms, ports, highways, railways, recreation facilities and the like. Partly as a result of the technical bias, the planning in isolation, the short-term perspective and the ignorance of the longer term physical and biological impacts, most water management projects, even those of modest size, have carried with them negative implications for some of the other resources to which they relate.

Possibly the most widespread of these negative impacts, affecting many hundreds of millions of people, is the salinization of agricultural land. Important parts of the world's historically most densely settled regions have been rendered less productive or non-productive -- the Tigris and Euphrates valleys, the Indus valley, many reaches of the Nile valley, major irrigated areas in Southeast Asia - the list is long. At a guess, at least half or perhaps more of the many billions of dollars currently going into irrigation system investments are devoted to rehabilitation of formerly highly productive lands.

There are two other areas of longer term concern in the Third World. The first is the impairment of groundwater systems, usually by the abuse of the systems which recharge them. Pollution and salinization are now beginning in an increasing number of places to render ground water systems either unusable, or, more usually, less usable than heretofore. Given the widespread ignorance of the dynamics of such systems, these sorts of damages tend to be permanent.

Of longer standing, the second concern is the mismanagement of water systems in the Third World's major estuaries and deltas. Agricultural salts and chemicals, and more recently industrial effluents, petroleum products and toxic chemicals, have poisoned estuaries and virtually eliminated the delicate food chains which historically supported networks of aquatic and terrestrial flora and fauna. Man's physical structures - land fills, dams and weirs, docks and wharves, dykes and training walls, dredging, etc. - have altered sediment deposition, water levels, temperatures, shore habitats, rates and timing of water flows and other physical features.

In combination, these elements have just about ruined the biological productivity of most of the major estuaries of the Third World beyond any hope of economic recovery. As an economist, one must be quick to add that in many instances the commercial benefits of some interventions are clearly greater than the losses, and certainly so in the shorter and medium-term contexts in which planning generally occurs. At best, the medium-term cost/benefit relationship is usually unclear, and destroyed biological productivity leaves people vulnerable and exposed. In the longer term (50-100 years and more) the cost/benefit relationship must be negative since there are then no alternatives.

Perhaps one example will illustrate this point. Without any question the Aswan Dam literally "saved" Egypt for a period from hard economic times and from being left behind as her population increased quickly. Aside from electric power (two-thirds of the national supply), the dam made possible a rapid near tripling of agricultural output, and has prevented major floods which, while they helped maintain the fertility of the valley, caused much financial damage and social hardship when they occurred.

One negative impact now becoming clear, however, is on the Nile delta. The grossly altered flows, in both timing and volumes, have resulted in a lower degree of natural protection of the Mediterranean edge of the delta. That edge is now receding at an appreciably rapid rate, gradually intruding on deltaic agricultural land, and bringing a salt water wedge into the groundwater system. The benefits of added energy and medium-term increase in productivity may have been bought at the price of a permanent and progressive crippling of the productive base of part of the delta.

Jurisdiction and Water Rights

Most of the areas subject to water management activities and projects in the Third World have had fairly dense populations for some time. Water development usually takes several forms. One is the bringing of irrigation to more traditional agricultural rain-fed systems to assist in securing at least one guaranteed crop each year, or perhaps a second or third crop in the dry season. This is accomplished through tubewells as often as by reservoir/surface systems.

A second form of development is the large capital-intensive project, normally designed for extensive irrigation, plus hydro-electric power, plus flood control. On occasion, major works can be for one purpose only, e.g., the Jonglei Canal in Southern Sudan to drain immense swamps and permit more water to flow down the Nile. The third form is the development or improvement of normally smaller scale systems (wells and small surface supplies) to provide potable water to settlements and to scattered rural populations.

Each of these "modern" activities carries with it its own package of problems related to water rights and jurisdiction. Where water has been used for a long time, where rivers and sub-surface supplies have been critical to the subsistence of extensive populations, detailed and rigorous systems of rights to water have developed over millennia. Because to control water is to have power, the jurisdiction over these systems has become enmeshed in power structures and religious systems, Islamic law for example. The older water-using areas have complicated networks of rights, obligations, taxes and duties, sharing arrangements, etc. The more completely used the water system, and the longer the settlement, the more these rules and customs are binding not only in the legal and property sense, but in the attitudes, behaviour and morality of the people. Fishermen on the Volta River system in Ghana have very carefully delineated rights and obligations which could not be changed quickly by political or legal action.

It is not difficult therefore to envision the sorts of rights and jurisdictional issues which can arise when a modern project is implemented. If the project is a reservoir or anti-flood structure well removed on an isolated mountain, there may be few problems at the site (though problems

may result when the water itself moves downstream to where it can be used). Also, there may be few unsolvable problems with rural water supplies because long-standing traditional uses and rights generally allow equitable distribution. Even there, however, someone must have responsibility and jurisdiction, several villages may have rights to the one facility, or animal owners may have rights to some of the villagers' water. In drought prone regions, and all regions with a long dry season (four to seven months), the establishment of rights can be an intense and continuing process, inseparable from the societal structure of the region.

Larger projects, however, generally must extinguish many customary rights and, simultaneously, establish a new system of rights within the modern system. Other than fishing rights, and perhaps traditional rights of passage on a water body, most prerogatives to water are entwined with rights to the land on which the water will be used. With large projects, requiring national level funding and organization, jurisdiction and overall control tend to move from the more local to the national level: a power authority, an irrigation authority, or some similar agency. Quite aside from any administrative or organizational reason for this move upwards in jurisdiction, most large projects involve some degree of foreign borrowing and contracting, and these normally are national-level matters. The conditions of investment or foreign aid usually require that the project cannot be distorted or aborted because of local problems of water rights or uses, or of rights to the land affected by the new water use.

The authority then determines what the new rights will be to the candidate users of the developed water resource. These are not always easy decisions and typically the studies are conducted too late. For irrigation, efficient management of water generally means commandeering land rights as well, often depriving traditional users of their most fundamental resources. Consistently botched are the problems of relocation of the people flooded out of reservoir areas; their rights are literally drowned and relocation planning is chronically last-minute. In some cases, such as parts of already crowded northern Nigeria, these flooded-out refugees have nowhere to go, and they are joined by thousands more who have lost their traditional holdings which have been confiscated for irrigated agriculture. Contrary to some expectations, new production systems do not necessarily absorb more people than the systems they replace. Confounding jurisdictional matters further, some larger nations such as India and Nigeria have regional or state or provincial governments large and powerful enough to plan and implement their own water management systems. When a watershed spans more than one such state or province, jurisdictional problems proliferate, as they do on international systems.

Problems Associated with the Dynamics of Water Supply

Water management planners in the Third World are increasingly required to cope with changing patterns of water supply. There are, of course, well recognized fluctuations in rainfall and snowmelt from year to year due to

natural climatic or weather variations. These fluctuations in amounts and timing, and therefore their impacts, must be accommodated in the design and operation of water management activities. Statistically, it is possible to identify variations in temperature and precipitation that appear to repeat themselves, more or less, at intervals of 6-8 years, 20-25 years, 50-60 years, 100-150 years, and even longer. The serious droughts in many parts of the tropics over the late 1960's and into the mid-1970's brought forth once again a spate of climatological and meteorological discussion regarding the nature of these apparent cycles. Opinions differ widely, because the underlying mechanisms determining variations in weather patterns and moisture transport are complex and only partly understood, and because an inadequate data base leads naturally to ranges of interpretation.

What is agreed is that the planet has passed through a century or two of comparative climatic stability and that for the next decade or two at least, it is likely that large variations in weather will become the norm, rather than the exception. Large regions are vulnerable to very serious droughts or floods when the peaks or the troughs of two or more of these apparent cycles coincide. As our information grows, however, planners are realizing that these dynamics must play a far greater role in guiding the design and operation of projects, including those based upon sub-surface water supplies.

Another critical factor relates to the effect of human activities on water supply. The most important of these is the cumulative impact of accelerating run-off. Throughout the tropics and sub-tropics, the expansion of populations has meant the increased utilization of heretofore lightly used areas for intensive cultivation and grazing. Since nearly all good flat lands have been occupied for some time, expansion has been onto slopes, hills and mountain sides. The need for more and more charcoal and firewood has added to the denudation of naturally forested land.

The result has been a marked increase in the percentage of rainfall which runs rapidly off the surface. Large regions which for centuries had a fairly stable water supply now experience a rapid peaking of runoff and a subsequent tailing off of flows, and a major increase in slope erosion and downstream sedimentation. Thus, for any given volume of desired captured or stored water over a year, man-made physical structures must be larger and stronger as a much larger share of the annual supply comes in only a few months, the weight of sedimentation is immense, and reservoirs sand up more quickly, shortening their effective life.

If a drought period accelerates denudation even further, the results can be particularly damaging. After the late 1960's-early 1970's drought in the Sahel, barrages and dams were popping like corks with the first heavy rains, river beds shifted overnight, groundwater tables were altered, and many have not recovered to their former levels and patterns. Floods are more frequent, now that the vegetative cover is destroyed and the groundwater recharge disturbed. Planners are still trying to cope with these sorts of dynamics, but with extremely modest success.

Problem of Not Learning from Previous Experience

This feature of water management planning in the Third World speaks for itself. It is a characteristic not only of water development but of many other resource development areas as well.

One can only be dumfounded at the alacrity and dedication devoted to "re-inventing the wheel" in planning water activities and programmes. Project after project repeats the same mistakes that brought previous projects to grief, even when only a few kilometres apart!

Many of the important reasons for this failure to adapt based on experience have already been discussed: technical biases, planning in isolation, etc. To these must be added the fact that the engineers who build are not usually the people who implement or who must make a living off the result, especially in agriculture. Another handicap to learning from experience is that the designers and builders are usually not called upon at a later date to review and assess the performance of their creation.

The international consulting and financing communities are not exempt from the failure to learn from experience. Information on project performance, especially mediocre or poor performance, is not widely distributed. Failures are not popular subjects for reports in the international literature. Those reported in the English press are rarely read by francophones, and neither of these read the German or Soviet accounts, let alone the news directly from Asia or Africa. In addition, many failures, perhaps innocently, become covered up by throwing yet more resources into the project: what becomes news is more jobs and increased spending, not that planning was faulty, estimates unrealistic, and the project not working out as intended because important factors were not taken into account.

Nor does such learning occur for smaller, micro-level projects. A particular type of hand pump will be put on a new set of village wells, even though experience elsewhere has shown that 60% of them, say, are broken down in 6-12 months. A given kind of equipment will be used on a municipal water supply because that was what was ordered before and the specifications were available, even though it failed to do the job the first time. Mistakes are institutionalized and there are no penalties. Unrealistic assumptions continue to be made by both suppliers and receivers about the availability of servicing and repair systems which almost always are, in fact, grossly inadequate in Third World or rural areas. We put people on the moon, but so far have failed to design and manufacture a hand-pump which withstands the punishment of village women and small girls.

The Matter of Accountability of Managers and Planners

Given this package of ills, a clear inference is that those who make these mistakes, who fail to keep themselves aware of past experience, who are wasting valuable and scarce developmental resources in poor countries, clearly are not accountable for their failures or inefficiencies. There is no censure, no effective penalty for those who plan badly or who continue to perpetrate these design and implementation errors. In any case, how does one censure an international or national professional community? These same mistakes occur in other developmental fields too, of course, but rarely at these large economic, social and long-term environmental costs.

The failure to make water management planners responsible for their actions is in large part due to factors already described: planning tends to be undertaken in a closed shop, almost an "old boy" network; mistakes are not publicized; and the layman cannot secure all the data, nor understand them when he does.

But there is another major reason. Many important people tend to get involved in any reasonably sized project over a 4-10 year period. Project investment decisions are, in the final analysis, made by politicians who are living from election to election, coup to coup; their bureaucrats are living from budget to budget, five year plan to five year plan. Water management projects tend to go fast, go slow, start or stop depending on what body of leaders is in power (and they can change quickly), and depending on what part of the country they come from. Financing or development approval is arranged to meet the political exigencies of the moment. This "staying alive by staying in power" process is particularly acute in areas of deep poverty and rapid population growth. Worry about a resource endowment left for great-great-grandchildren is an unreal luxury when survival each day and each week is a major accomplishment. Under these sorts of circumstances, accountability for the end result of a decision or a design becomes almost irrelevant.

Shortage of Resources for Water Management

Permeating the problems of water development in most Third World countries is the chronic shortage of appropriately skilled manpower, domestic financial resources, and foreign exchange resources. In countries like Egypt and Sudan, qualified personnel at all levels of skill have emigrated by the hundreds of thousands to Saudi Arabia, the Gulf States and other North African countries. In the Sudan, for every two men trained in engineering skills at all levels, in drilling, in equipment maintenance and repair, and the like, only one stays home.

These manpower shortages show up particularly at the operational level. In Ghana's Upper Region and Northern Region, the planning and implementation of well drilling and well maintenance programmes are severely

hampered by the shortages of skilled technicians and engineers. There are thousands of Ghanaians so qualified, but most are working in Nigeria, and in any case prefer to work elsewhere in Ghana where water supplies are more reliable! Hiring expatriates not only presumes the availability of an aid programme of some kind; it also has its own well known problems.

In any case, a vast range of imported items is needed to support water development, including construction equipment and materials, transportation equipment, pumping equipment and piping, and fuel and spares to keep it all going. Electrical systems are also often needed just to run the pumps. Who pays for all this, and how do the local funds get squeezed from tight budgets to meet payrolls and other operating costs? A typical successful 120'-140' well in a village, cased, with a hand-pump, costs $15,000-$20,000 to construct. In Ghana's Northern Region, if external donors are willing, it is planned to construct some 1,500 such wells over the next seven years or so to service about 280,000 rural people. That will cost at least $10 million in foreign exchange, about $35 per capita and some $300 per family, and to this must be added maintenance costs over time. Where are the returns to this investment? On humanitarian grounds, developed countries presumably must support the investment. But is it the best use of resources? To gain that increase, the farm family's output would have to nearly double over 5-10 years through better health (e.g., fewer guinea worms) and time saved for women collecting water. But if the additional water supply results in a marked increase in population, the individual benefit per family may be lost, and there are yet more people exposed to the vagaries of climate change, failed water supply, and marginal land the fertility of which is being exhausted.

The United Nations has now endorsed the "International Drinking Water Supply and Sanitation Decade 1981-1990". In many ways this is yet another "pie in the sky" concept which no doubt has cost international agencies many many dollars in meetings and travel to put together, and will cost more in programmes for the next several years. The aim is to provide basic water and sanitation facilities to everyone in the world by 1990. Designed to cost $6-10 billion annually (about one month's military spending), its complete realization is simply not possible; in 1980 and 1981, spending was barely one-third of that needed, and there are few prospects for which even this funding level will continue. This clearly demonstrates a shortage of resources for water development! While the idea is laudatory, the programmes will probably fall far short of the goal.

But the main purpose has been to focus attention, in both the developed and developing world, at both the political and ordinary citizen level, on drinking water and sanitation problems. If this can be done together with a wider awareness of the realities of water systems and water management problems, then the "Decade" programme will have been useful. One must remember, too, that no such goal, even if achieved, could be satisfied for long. The population of the Third World will double in the next 25-30

years, and every single person needs water, however filthy, stinking and full of bugs; and many of these persons will be without enough fuel even to boil what water they can get.

The Absence of Economic and Social Analysis in Water Management Decisions

The foregoing discussion highlights the problem of economic choice. There never have been enough skilled manpower and financial resources to do all that is needed in water resource development; there are not enough now; and doubtless there never will be. Poor nations, in principle, should be deciding on resource allocations which give them the most rapid increases in production and productivity, and an improvement in the security of their welfare. Any given country will have mixes of priorities different from its neighbours, and the position of water development on any given national list obviously will vary.

The reality is that the paramount and over-riding need to maintain the day-to-day operation of each developing nation consumes virtually all important resources -- the military, basic transportation, production and import of food, and the exploitation of a generally swollen and inefficient civil service structure to help solve the unemployment problem. In Third World countries there is often very little left over for water management projects unless these are associated directly with food production. Water projects to improve social conditions or facilitate local industries, etc., usually have low priority. New or continuing water management activities will be included in national activities, however, when an acceptable foreign donor shows an interest.

Nevertheless, even under these circumstances, there is usually a multitude of options regarding water development. Major authorities and boards concerned with water might have hundreds of projects in their portfolio; even a regional department could identify dozens highly desirable to implement or continue.

What is needed in most developing countries is a national water development plan, where all likely and useful activities, projects and programmes are listed, subject to some form of socio-economic benefit/cost analysis. For any given volume of manpower and financial resources, those activities which will contribute most to national productivity and economic health can be identified.

This is not as "pie in the sky" as might first appear. At least ten major developing countries such as Mexico and Thailand have actively begun this process. The author has been involved in such efforts in Bangladesh and Egypt. Much grief, political embarrassment and waste could have been avoided with even a modicum of economic analysis, even the analysis of the two or three options for doing the same thing. As indicated earlier, unless such analysis is undertaken, the politically popular but usually

more uneconomic large turn-key project tends to win the day over the less glamorous but often more productive smaller project packages typically implemented with local resources.

Problem of Incrementalism

Finally, let us address the matter of incrementalism. The concept of working at the edge of something, looking at the margin, is a favourite analytical device of economists. In the matter of the water management/ environment relationship, it has been called "creeping catastrophe".

Basically, this is the notion of adding on, piece by insignificant piece, to the uses and controls in the management of a water resource. Nowhere in the developing world, to my knowledge, is there a case where an entire system (other than tiny ones) is addressed and managed all at once. Indeed, uses evolve as communities grow and water needs expand and deepen, for potable supplies, irrigation, transport, sewage or effluent disposal, and the like. Thus, maximum or very full use of a water system may be a process spreading over 20, 50 even 200 years.

Each new addition does something to the system by changing its flow, temperature, quality or appearance. Each new increment in use may or may not preclude another use of the same resource, there or downstream. In the usual situation, no one increment, generally fairly small in the overall context, may appear prejudicial to the entire system for it may be only a little bit of saline water from a small project, only a small amount of toxic chemical from a single tannery, only a small diversion of water which will not find its way back to the system for reuse downstream. And the bigger the natural system, the longer these creeping nickel and dime additions can go on without apparent ill effects. Coupled with an absent or meagre monitoring system, decades go by, with small changes, almost always deleterious, adding to one another, until the whole system is altered. Like a string of ecological dominoes, one linked element in the system after another, usually with some speed, come tumbling down. The more unstable or naturally variable the system, the more the human-caused changes are overlooked or blamed on "natural" causes.

The point here is that the individual components of the physical and biological worlds affected by this cumulative process have their own individual degrees of response to this abuse. The apparent tolerance often seems surprisingly high. But no change, no matter how small, can fail to have an effect. With each increment in stress on the environment, such as temperature change, the addition of toxic chemicals, accelerated sedimentation, and so on, a number of elements are pushed closer to their survival or functioning thresholds, and one by one they may pass them. It might be years before it is apparent that something at the end of the chain has disappeared, that seeds do not germinate, or young are born deformed, or wells are almost always dry because the aquifer recharge

area, a hundred kilometres away, has silted over. Then it is too late; the system has been fundamentally altered, and resurrection becomes politically, administratively and financially impossible or impractical.

Many parts of the Third World have been blessed by the absence of sophisticated manufacturing and processing industries, especially those using chemicals. These nations cannot afford complex technical waste disposal and effluent treatment systems. Except for the effects of agricultural salts and chemicals, and sedimentation problems, their relentless creep toward an artificially altered environment generally has until now been fairly slow. The exception is of course the larger cities, of which there are now dozens with populations of four to five million people. In such cases, incrementalism proceeds apace, especially where unregulated private enterprise is responsible for most of these increments.

LESSONS FOR CANADA

As with so many other resources, Canada is blessed with immense volumes of water. On a per capita basis, we have more water than any other country, one-quarter of the world's liquid fresh water and nine percent of the river flow. And we have generally dealt with it with the same carelessness that we have used in dealing with our other resources; we have treated water as if there was always more, the supply virtually limitless; indeed, a free good.

Historically, given our small population, its modest rate of growth, and its dispersion over half a continent, the demands from industry, cities, agriculture, etc. have had little noticeable effect on quantities and qualities available. Our approach has been strongly conditioned by this long-standing surfeit of availability over demand. There has been so much water - in fact, we have treated it like other common property resources - that no one individual or group has until recently felt any particular responsibility for its management.

The days when we could act safely in this way are past. In populated areas, our use of water systems and their watersheds - dam by dam, city by city, mine by mine, chemical by chemical, has now caught up with us. Logging, industrial pollution, agricultural pollution, power generation, etc. have now put in jeopardy the medium and longer term quantity and quality of this resource. Simultaneously, the demand for water of any quality continues to grow, almost exponentially in some areas.

Clearly, Canada would be prudent to avoid the obvious mistakes in water management and water planning which characterize the recent history of Third World countries described above. More positively, we should profit from them.

Note that this is the usual process in reverse; that is the "learning" movement is normally thought by most people in developed countries to be in the other direction. For a very long time, but with vigour since World War II, the normal question has been "How can we apply the goodies of the developed world to the less developed?". Since that flow, by and large, has at best had modest short-term benefits and in so many instances has been economically, politically and institutionally disastrous, let us hope that some good may come from this particular deliberate reversal in direction of education. Our only major and continuing success in the Third World seems to have been in making possible the proliferation and use of modern weapons.

What then are the points emerging from this review of water management problems in the Third World which are relevant to Canadian water management policies and planning? Let us review the more important points, more or less in order of earlier presentation, and see just how relevant they are. Each one warrants extensive treatment in its own right.

Canada has a "megaproject" psychology - our land is vast, our mountains are grand, our resources are immense; we are big all over, except perhaps in our view of where we are going, or in our political/economic cleverness regarding resource development. This "mega" syndrome has rather naturally been applied to our management of water systems - we love the large scale technology.

But is it really true that we must only build enormous dams with massive horizontal reservoirs to turn our turbines? Can't we do more, as in Europe, with getting the same net energy using more vertical head?

Are much smaller dams using smaller water sources that much less economical per KwH of generating capacity, especially if market demand and distribution systems are tailored to decentralized sources?

Are twenty smaller water supply or sewage treatment systems in an urban area indeed less economically and ecologically effective than one large combined system concentrated in one place?

Is it true that we have made ourselves technologically vulnerable with our eggs in so few large baskets?

Is our engineering sector, public and private really geared only to thinking big, not small or smaller? Need it be that engineers are not encouraged to provide smaller scale options to legislatures, government departments or private sector clients?

Is it legitimate to assume that international interest in our water is really concentrated on only big projects - creating power for cheap processing (of aluminum for example), or for export? Ask British Columbia, Québec, New Brunswick, or the promoters of Fundy Tidal power. After all, if one plans and builds excess capacity, one can then do these sorts of things.

And what about our planners themselves in federal and provincial governments, Crown Corporations, and the private sector? Is the technical/bureaucratic bias situation different in Canada to that in developing countries?

Is it really true in Canada that most water planners are engineering bureaucrats working in agencies created for and dedicated to water resource projects?

Do engineering projects stay in the pipeline a long time, and develop lives of their own, largely unaffected by changes in the world around them?

Is the suspicion correct that such engineering projects rarely get adequate economic, political, social and environmental screening and analysis in their earlier stages?

Is it true that the outside world doesn't know much about such planning anyway? Are the planning decisions in the back rooms of federal and provincial agencies and crown corporations - hydro, public works, port authorities, etc. - open to public scrutiny and review?

Do water planning utilities or provincial or territorial agencies take full account of the multiplicity of needs and uses of a given water system? Is it not true that hydro-electric utilities plan water development for power, agriculture departments plan water management for agriculture, municipalities for urban use and industry, the federal government for flood control, and so on?

Is it fair to say that, in Canada, the whole range of impacts on linked resources is not taken into account fully at any time? That the downstream or side effects are considered only when they become apparent or serious after the development has been in place, and then are usually dealt with by a different agency than the one responsible for the development? What agency was responsible for design, and what agency for dealing with later effects of the Bennett Dam on the Peace River, for example? Who looked at the multiple effects of navigation improvements and airport construction on the Fraser estuary? Surely it was true that the fisheries agencies' analyses of the effect on fish production in the Gulf of St. Lawrence was incorporated into the design of the St. Lawrence Seaway?

Are we really building up our data base and research experience and results to permit more accurate long-term planning? If we are, where are these data and who is responsible for them?

Is it true that we are letting our water users, such as cities and towns, make short-term decisions with respect to pollution, ground water use, etc.? Do we really intend to let short-lived political decision systems have final control over long-term resource use?

Given our history of law and of rights - public, private and eminent domain - can we avoid the rights and jurisdictional problems of Third World water projects? Surely these jurisdictional issues arise to a serious degree only in situations of conflicts and shortages and will not be major problems in a country blessed with a water surplus?

In Canada, conflicts over water use, alternatives and jurisdictions demand decisions. We have legislation and a management system in place to deal with water systems that cross provincial boundaries. Are they effective? The Canada Water Act is specifically designed to enable many jurisdictions and agencies to develop integrated water management on a watershed basis. This Act is often admired by other countries as an example of enlightened and forward-thinking comprehensive watershed management. Yet, the number of times it has been used in Canada to achieve integrated interjurisdictional management since it was passed, fifteen years ago, can be counted on the fingers of one hand. Why? Need the legitimate demands for use of the same water by industry, urban waste disposal systems, potable water

needs, fisheries and recreationists cause "rights" problems? And surely, unlike in so many developing countries, Canada can make fair and just use of the well accepted machinery for settling the rights of those displaced or otherwise injured by water management projects?

And are we justified in assuming that, unlike in poor nations, Canadian water planners are well aware of, and applying methodologies and designs which can cope with the best and most reasonably accurate information on shorter and longer term variations in rainfall and other climatic behaviour affecting water supply, such as drier/colder trends in some areas and warmer/moister trends in others?

And is it really true that Canadians do not learn from experience, either our own or that of others, with respect to the nature and design of water management projects, just as it seems that people in developing countries keep on making known mistakes? Is not every new sewage disposal project discharging effluent into our lakes, the St. Lawrence River, or the Strait of Georgia, an improvement over the previous one? Surely there is adequate publicity of our planning mistakes, regardless of how costly they have been? And surely we take measures to render incapable of further damage the politicians, bureaucrats and consultants who made the obvious wrong decisions? Or do we have a habit of protecting our politicians and bureaucrats in this respect?

Is it legitimate to state that Canada is devoting sufficient manpower and financial resources to water management planning, to the maintenance of relevant control and monitoring systems, to ensure effective implementation of activities affecting the quantity and quality of our water resources? Many countries, after all, simply cannot afford to give proper attention to these matters, even if they so wished. But Canada is wealthy by comparison. Surely we have sufficient resources to control and manage our watersheds, to deal with sedimentation, salinization and pollution. Are not our public agencies properly funded, and do they not include appropriate multi-disciplinary planning, monitoring and research staff?

A growing number of developing countries have a water management or development plan with watersheds and systems analyzed as to their potential, and the host of candidate, often competing, projects and programmes are examined and ranked using economic criteria such as the net contribution of each to value added, employment, etc. Surely Canada has a plan just as advanced, with the national plan synthesized with provincial plans. At the provincial level, have we apparently been clever enough, and sufficiently concerned about our water future, to integrate plans of electric utilities, port authorities, fisheries and urban needs? The rest of the world, if not Canadians, has a right to expect this because is not Canada a rich, developed, educated nation?

Finally, ending the list, one would like to be confident that, unlike less privileged nations, Canada must be well on the way to conceptualizing and implementing a political/administrative process for overcoming the

incrementalism described. Surely we do not approve, condone, licence or otherwise allow piece-meal additions or changes of water use without reference to an overall development plan for that particular system? Undoubtedly we naturally recognize, even in our environmental impact studies of projects affecting water, that the whole is bigger than the sum of the parts, that ten marginally acceptable projects, combined in their interactions, can be disastrous to the whole system? As a matter of principle, in a progressive and responsible country like Canada, we would not permit mining and smelting firms, logging and pulp companies, farmers, chemical manufacturers and the like each to nibble independently away at the quality of our water resource and preclude other economic uses of that water?

CONCLUSION

The foregoing may have appeared particularly hard on our government bureaucracies, our engineering consultants, and our planners in general. The sarcasm is intended to be constructive, to make the point that we are not doing nearly enough to manage our water resources responsibly. By the very nature of its history of entrepreneurial economic development, the federal/provincial jurisdictional structure, and its ample resource endowment, Canada has fallen into habits which it must change. New approaches must be developed to come to grips with resource problems which have been decades in the making. Our problems, which only now are being recognized as serious, have generally resulted from activities of the formerly nearly inviolate and unregulated private sector, which has used common natural resources as if they were free goods without planning or consideration of the long-term or related consequences, and from our political/bureaucratic system of divided and compartmentalized responsibilities.

Preservation of the ability to sustain yields, never mind increase them, in other renewable resources such as forestry, agriculture and fisheries is now being recognized as a matter of crisis proportions; nobody has been minding the store effectively. Nor has anyone been minding the water supply. The degree of irresponsibility toward the future approaches the criminal. It is a crime against the present and future generations of Canadians; it is a tragedy for peoples of other nations who also rely on the wealth that Canada could generate from these resources, if they were to be properly managed for the future.

Except for fossil carbon, perhaps, and some of our soils, water is our last remaining major natural resource which is not yet irretrievably abused or which will not need decades of improved management to recover its health and useful potential. Let Canadians, in the name of common sense, economics, and our grandchildren, learn from and avoid the water management problems of <u>other</u> poor nations.