Canadian International Development Agency
Agence canadienne de développement international

Water and Sanitation

CIDA Development Issues Paper

Professional Services Branch

May 1988

Canadian International Development Agency
Agence canadienne de developpement international

Water and Sanitation

CIDA Development Issues Paper

Professional Services Branch

May 1988

Canadian International Development Agency

Professional Services Branch

WATER AND SANITATION SECTOR DEVELOPMENT ISSUES PAPER

May 1988

WATER AND SANITATION SECTOR

DEVELOPMENT ISSUES PAPER

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF BOXES

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
AQTE	Association Quebecoise des Techniques de l'Eau, Canada
AsDB	Asian Development Bank
AWWA	American Water Works Association
CANCID	Canadian Committee on Irrigation and Drainage, CWRA
CDB	Caribbean Development Bank
CEA	Canadian executing agency
CESI	Country External Support Information System, WHO
CFTC	Commonwealth Fund for Technical Cooperation
CIDA	Canadian International Development Agency
CPPF	Canadian Project Preparation Facility, Industrial Cooperation Division, CIDA
CRIQ	Centre de Recherche Industrielle du Quebec, Canada
CWRA	Canadian Water Resources Association
CWS	Community Water Supply, WHO
CWWA	Canadian Water and Wastewater Association
DAC	Development Assistance Committee, OECD
DANIDA	Danish International Development Agency
EEC	European Economic Community
EPR	end-of-project report
ESA	external support agency
EWRA	Ethiopian Water Resources Board
FAO	Food and Agriculture Organization
FCM	Federation of Canadian Municipalities
GDP	gross domestic product
GTZ	German Agency for Technical Assistance, Federal Republic of Germany
HRD	human resources development
IBRD	International Bank of Reconstruction and Development
ICDS	Institutional Cooperation and Development Services Division, CIDA
ICOD	International Centre for Ocean Development, Canada
IDA	International Development Association
IDRC	International Development Research Centre, Canada
IDWSSD	International Drinking Water Supply and Sanitation Decade 1981-1990
IIED	International Institute for Environmental Development
INC	Industrial Cooperation Division, CIDA
INGO	international non-governmental organization
INSTRAW	Institute for Studies, Training and Research for the Advancement of Women
IPF	International Planning Framework, UN
IRD	integrated rural development

ISSER	Institute for Statistical, Social & Economic Research, Ghana
ITN	International Training Network, World Bank
IWRA	International Water Resources Association
JICA	Japan International Cooperation Agency
KfW	Reconstruction Loan Corporation, Federal Republic of Germany
KMC	Karachi Municipal Corporation, Pakistan
KWAHO	Kenya Water for Health Organization
LLDC	least-developed countries
LRTAP	long-range transportation of atmospheric pollutants
MISA	Municipal and Industrial Strategy for Abatement, Canada
MOWD	Ministry of Water Development, Kenya
NGO	non-governmental organization
NORAD	Norwegian Agency for International Development
ODA	Official Development Assistance, Canada
ODA/UK	Overseas Development Administration, U.K.
OECD	Organisation for Economic Cooperation and Development
OWMA	Ontario Waste Management Association, Canada
PAHO	Pan-American Health Organization
PCIAC	Petrol-Canada International Assistance Corporation
PDA	Population and Community Development Association, Thailand
PFRA	Prairie Farm Rehabilitation Administration, Canada
PROWWESS	Promotion of the Role of Women in Water Supply and Environmental Sanitation Services
RWSB	Rural Water Supply Board, Swaziland
SADCC	Southern African Development Coordination Conference
SARAR	self-esteem, associate strengths, resourcefulness, action planning, and responsibility
SDC	Swiss Development Cooperation
SCEAIT	Standing Committee on External Affairs and International Trade, House of Commons, Canada
SIDA	Swedish International Development Authority
TAG	Technical Advisory Group, World Bank
TCDC	Technical Cooperation Among Developing Countries
TSG	Technical Support Group, UNDP/World Bank
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
UNDTCD	United Nations Department of Technical Cooperation & Development
UNEP	United Nations Environment Programme

UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VITA	Volunteers in Technical Assistance, U.S.A.
WASH	Water and Sanitation for Health Project, U.S.A.
WCED	World Commission on Environment and Development
WFP	World Food Program
WHO	World Health Organization
WID	women in development
WMO	World Meteorological Organization
WPCF	Water Pollution Control Federation, U.S.A.
WRI	World Resources Institute
WTC	Wastewater Technology Centre, Environment Canada
WUSC	World University Services of Canada

PREFACE

This paper is one of a series prepared by CIDA. Each development issues paper concentrates on one of the sectors in which the Professional Services Branch provides technical advice to other branches of CIDA on development projects and programs.

Within CIDA the Water and Sanitation Sector within the Professional Services Branch is mandated to provide advice on two sub-sectors:

a) Water Supply and Sanitation Services including water for people and industry, and the disposal of liquid and solid wastes:

   - the provision of drinking water from ground and surface water to people in rural and urban areas;

   - the disposal of liquid and solid wastes affecting people in rural and urban areas, including storm water drainage and resource recycling;

   - water supply and disposal of liquid and solid wastes, including resource recycling, for industrial and commercial enterprises.

b) Water Resources Management including overall planning of water resources and the development of multi-purpose water projects:

   - conducting inventories and assessments of surface and ground water resources;

   - flood hazard reduction and flood control projects;

   - comprehensive development of water resource projects serving multiple purposes;

   - conservation and protection of water quantity and quality, including carrying out environmental studies where required.

Other sectors within CIDA also deal with projects which involve water components because water is such a vital ingredient in national development. Irrigation projects are within the Agriculture Sector, for example, hydroelectric projects within the Energy Sector, and water transport projects within the Transportation Sector. Projects in the Health and Environment Sectors may also include a water and/or sanitation component. Separate development issues papers are being prepared for each of these related sectors. This paper concentrates on the water and sanitation sector as defined above.

The purpose of this development issues paper is to:

- respond in a meaningful way to the needs and priorities of the developing world;
- take maximum advantage of Canadian experience and capability;
- support the overall thrust of the Canadian Government and of CIDA; and
- inform both general and professional publics of CIDA's past experience and future trends in the sector.

This issues paper is intended to serve as a reference document, mainly for use by staff within the various branches of CIDA. However, it may also be of interest to other audiences, including:

- Canadian development partners active or interested in the sector, including those in the private sector (consultants, manufacturers and contractors), in the public sector (federal, provincial and municipal organizations), in training institutions and in voluntary, non-government organizations;
- partners in developing countries; and
- other external support agencies.

The primary responsibility for preparing this issues paper rests with the Water and Sanitation Sector in the Infrastructure Division within the Professional Services Branch. The large task of assembling the data and writing the issues paper has been delegated to Cowater International Inc. supported by several individual consultants and CIDA staff. The process of preparing the issues paper has been guided by a Steering Committee within CIDA.

Various drafts of the paper have been reviewed by external reviewers. Appendix A describes the process by which this paper has been prepared and indicates the various consultants, Steering Committee members and external reviewers who have assisted.

Chapter 1

THE WATER AND SANITATION SECTOR IN A GLOBAL CONTEXT

Chapter 1
THE WATER AND SANITATION SECTOR IN A GLOBAL CONTEXT

1.1 THE WATER RESOURCE

Life could not exist without water. Crops could not be grown, power could not be generated and industry could not produce essential goods and services without an abundant supply of fresh water. Little wonder that vital water resources - historically regarded as "free" - now face great demands in both availability and quality of supplies. Societies increasingly face conflicting priorities as populations grow and nations industrialize.

The earth is endowed with 1,400 million cubic kilometers of water, but only 14,000 cubic kilometers or one percent of this is available as stable runoff for use each year. The rest is found in the oceans, glaciers or as inaccessible groundwater. The following analogy puts water resources in a global perspective.

> *"If a half-gallon bottle held all the planet's water, the amount of usable freshwater would fill only half a teaspoon; of that amount, a single drop would represent the amount of water in rivers and streams. The remaining half teaspoon would be groundwater. The earth's freshwater is a precious resource. Its uses touch every human need: drinking water and food, cleanliness, electricity, industry, transportation, and recreation. But water is often wasted and mismanaged in many parts of the world." (IIED & WRI, 1987).*[1]

Although the freshwater available globally is proportionately small, it is adequate when it is noted that only 2,600 to 3,500 cubic kilometers is used at present (IIED/WRI, 1987). It is also not expensive, at least in Canada, as demonstrated in Table 1-1 below.

Water is a continuously renewable resource of finite and stable quantity. Unfortunately, it is not evenly distributed throughout the world, either geographically or temporally. Because of the vagaries of climatic and geographical conditions, many areas of the world (e.g. the Sahara) are extremely arid with extended periods of drought. In these areas a net evaporation condition exists. This means that the amount of water lost in evaporation and transpiration exceeds precipitation. In other areas of the world (West Coast of Vancouver Island, for example), rain forests exist where runoff can be as high as 70 percent of precipitation.

Canada, with seven percent of the world's land mass, has nine percent of the world's renewable water. This is a generous amount when we consider that the Canadian population is only one half of one percent of the world's population.

---

[1] Note: All references are listed at the end of this report, beginning on page 155.

Table 1-1
Typical Prices for Popular Beverages in Canada
(1987)

Beverage	Cost ($/cubic meter)
Tap Water	0.43
Cola	920.00
Milk	1,250.00
Mineral Water	2,000.00

Despite such water wealth, Canada also has problems of uneven physical and temporal distribution. In Southern Alberta and Saskatchewan, a combination of low precipitation and high evaporation creates an annual runoff that represents only 10 percent of the annual precipitation. Indeed, parts of the prairie grasslands produce no runoff, except in infrequent wet years. There are other problems in Canada as well. These concern the pollution of natural waters and the inefficient and competing water uses for power, industry and agriculture. In fact, the concerns of the Government of Canada about the management of water resources are such that the Minister of the Environment announced a Federal Water Policy to guide the use of the resource in coming years (Environment Canada, 1987). This policy contains some new initiatives aimed at making water use more efficient and equitable, while at the same time protecting it for the use and enjoyment of future generations.

The world is fortunate to have a perpetual and stable supply of water. However, it must be harnessed, distributed and used effectively and conservatively in the face of growing pressures created by a burgeoning world population.

Unfortunately, many countries of the developing world do not have plentiful supplies of fresh water, indeed shortages are often extremely acute. Furthermore, in countries where the natural supply is adequate, the quality is often so poor, it causes sickness, suffering and death. This paper is mainly about the situation in these countries.

1.2 GLOBAL WATER RESOURCES ISSUES

In the following sections, several of the major issues related to this sector are discussed.

1.2.1 Health Issues

The Director General of the World Health Organization, Dr. Halfdan Mahler, has stated that the number of water taps per 1,000 people is a much better indicator of public health than the number of hospital beds. Chapter 3 outlines the role that safe drinking water and sanitation play in the health-of-people development process, and

indicates that by the late 1930's major epidemics and sicknesses due to contaminated water had been eliminated in many of the developed countries.

But, for over half of the world's people, the majority of whom live in developing countries, clean water (and in some cases, water of any kind) still is more of a wish than a reality. Invariably, basic sanitation is even less available than water supply. The absence of these essential services has caused untold hardship and misery. UNICEF reports that some 12.4 million deaths occur annually from water, feces and dirt-related diseases (UNICEF, 1987). In addition to these 34,000 deaths daily, many more people are sick and incapacitated. The economic loss is immense. In terms of development, these statistics paint a graphic picture of the challenge to a world in which people should be given the opportunity to live productive and fulfilling lives (World Bank, 1986a). In the developing world, meeting both health and economic needs, by providing adequate and safe drinking water through suitably managed community water supplies, is a major challenge.

Between 1985 and 2000, Third World urban populations are expected to increase by some 800 million people. Since many urban residents are presently without service, this suggests that urban centres in the developing world must increase their capacity to develop and manage their water supply and sanitation services by 100 percent (WCED, 1987).

A part of this challenge will be the need to restore and rehabilitate many services that have deteriorated through lack of funds and/or mismanagement. Strengthened sector institutions, supported by a strong cadre of trained technicians, will be required to deal with these issues.

1.2.2 Economic Issues

The provision of safe water supply and sanitation services, including solid waste or residual disposal systems, is not always recognized as necessary for economic growth and is often not a component in economic development strategy. There is a perception among many economic planners, especially in the present financial climate, that water supply and sanitation improvements do not generate economic activity in the same way as do investments in energy development, agriculture, or resource extraction. For that reason, the water sector is often classed with other service sectors such as health and primary education. Water sector funding by multilateral and bilateral agencies seldom exceeds ten percent of their total program budgets. It is true that the services delivered by the sector cannot be exported, thereby earning foreign exchange. Yet in a domestic economy, the water sector's contribution to GDP is substantial. Economic activities required to improve the standard of living through improved water and sanitation services are outlined in Chapter 2. All of these activities contribute directly to economic development.

1.2.3 Management of Water

The multiple uses of water make effective water management imperative for all economic activity. Water is essential to agriculture for the growth of crops and the care of livestock; to processing and manufacturing industries; for the production of hydro and thermal electric power; and for marine-based transportation systems. In rivers and streams, transportation uses compete with the needs of fisheries, wildlife and related habitats. Tourism and recreation also thrive on clean water. Equitable and optimum uses of water resources, safe storage, flood control, and drought protection are needs that have become obvious to all countries.

Single-purpose uses of water resources create conflicts and reduce the potential for other uses. This results in environmental and economic losses that are sometimes irreparable. Single-purpose misuse of water resources, such as using water to assimilate wastes, results in pollution that can cause illness and death, as well as social and economic hardship, in developing countries.

Water use and the development of land are inextricably linked to one another. Because of a lack of understanding of this interrelationship, tragic errors in human development have occurred. The recent crisis in the Sahel region of Africa is one example. Although the extended drought caused widespread illness and the loss of millions of lives, inadequate water resources management and inappropriate land-use practices were at the root of the problem (WCED, 1987). Another example is the over-cultivation of drier areas in the Canadian Prairies, combined with the use of fertilizers, pesticides, and inappropriate irrigation systems, which increased salinity and resulted in massive soil erosion and land misuse. Runoffs now pollute receiving streams and rivers with sediments and chemicals, threatening their availability as domestic water sources.

1.2.4 Management of Pollutants

Progress has been made in reducing oxygen consuming wastes in some developing countries; however, industrial waste discharges have gone unchecked in most others. Regrettably, pollution control is a necessary cost of industrialization and urbanization with which the developing world has neither the fiscal nor the human resources to contend. This is particularly true of the more exotic chemical pollutants, such as heavy metals and organic pesticides. In China, for example, wastewater severely pollutes seventy percent of the country's 78 monitored rivers; China treats only two percent of its total wastewater. Countries such as China, India and Brazil, which have major industrial development programs, are finding environmental quality control very difficult to justify financially.

1.2.5 Global Perspective

At the international level, few programs exist to deal with environmental issues which have a global impact. Examples include:

- agricultural chemicals spill into the Rhine River in Switzerland, killing millions of fish and threatening the drinking water of Germany and the Netherlands;

- the destablization of the hydrological cycle throughout S.E. Asia from rapid industrialization, runoff from increased use of pesticides and fertilizers, and excessive water withdrawals;

- industrial chemicals, discharged by Canadian and U.S. industry, threaten the environmental stability of Lakes Erie and Ontario;

- major floods and droughts occurring throughout the world, as a result of increasing deforestation and land erosion, stemming from inadequate water/land management programs, the effects of which have international impact.

As described in the report by the World Commission on Environment and Development, the world has reached an interlocking crisis in which water has an intricate role. A situation, where until a few decades ago:

> *"the planet was a large world in which human activities and their effects were neatly compartmentalized within sectors (energy, agriculture, trade), and within broad areas of concern (environmental, economic, social). These compartments have begun to dissolve. This applies in particular to the various global "crises" that have seized public concern. These are not separate crises - the "green house" warming trend, the thinning of the ozone layer, the development crisis, the energy crisis. They are all one."*
>
> *(WCED, 1987)*

1.3 THE CHALLENGE AHEAD

It is apparent that the planet's present water situation is far from satisfactory. However, given human ingenuity and the potential of the earth for renewal, it is reasonable to anticipate improvements for future generations.

The complexities of continued poverty, population growth and economic development require a global agenda for change, if we are to significantly improve the human condition and protect national heritages, as exemplified by their water resources. It is in this light that the World Commission on Environment and Development established its strategy for "sustainable development" which is defined as: development that meets present needs without compromising the ability of future generations to meet their own needs. It contains two key concepts:

- that environmental preservation and the development needs of the poorest people are inextricably linked; specifically that the basic needs of the poorest people must be met, in order that they are able to care for their environment;

- that technological development, as well as social, political and economic organizations, impose limits on the global society's ability to solve its problems; improvements in these areas improve the prospects for successful solutions.

There is encouraging evidence which indicates that we have the capacity to develop solutions to our environmental problems. For example, a massive clean-up of pollutants has occurred in North America and Europe since 1969; regulatory authorities are indicating that rivers and lakes in these regions are now showing a steady improvement. The River Thames in Britain, the Rhine River in Europe and Lake Erie in North America are well-acknowledged achievements in water body restoration through wastewater control.

Chapter 3 describes the efforts launched by the International Drinking Water Supply and Sanitation Decade (IDWSSD) to provide clean water and sanitation for all by 1990. The IDWSSD will not achieve its goals by 1990, mainly because of the continued compounding growth of populations and continued economic stagnation in the developing world. As of 1985 (mid-Decade), there were still an estimated 1.5 billion people without access to clean water. However, in the first half of the Decade, 270 million had been reached with improved supplies; an encouraging achievement, which is resulting in renewed efforts by developing countries and donor agencies alike.

In summary, the challenges of the future for CIDA and other external support agencies include:

- finding solutions to the rising world population acceptable to all;

- accommodating urbanization trends with programs to provide services needed, including managing the resulting wastes;

- increasing international cooperation in planning for those activities with global impacts; and

- increasing cooperation between the scientific, financial and economic communities of the world aimed at finding solutions acceptable to all.

Chapter 2

RELATION OF THE WATER AND SANITATION SECTOR TO CANADA'S OFFICIAL DEVELOPMENT ASSISTANCE OBJECTIVES AND POLICIES

Chapter 2

RELATION OF THE WATER AND SANITATION SECTOR TO CANADA'S OFFICIAL DEVELOPMENT ASSISTANCE OBJECTIVES AND POLICIES

2.1 OBJECTIVES OF DEVELOPMENT ASSISTANCE

The objectives for Canada's Official Development Assistance (ODA) program are clearly stated in "*Sharing Our Future: Canadian International Development Assistance*" (CIDA, 1987c). This document was released in March 1988 by the Minister for External Relations and International Development. It presents a new strategy for Canada's aid program, including the adoption of an ODA charter. This strategy is a statement of the general policies that will be applied to the Canadian development assistance program for the next decade.

The publication of the new CIDA strategy followed a period of intensive review of Canada's involvement in assisting developing countries. In May 1987 the Winegard Committee released its report entitled "*For Whose Benefit?*" (SCEAIT, 1987). The Government's response to this report was given in September, 1987 in the report "*To Benefit a Better World*" (CIDA, 1987b). Both of these reports gave detailed statements on the purposes, objectives and policies of Canada's aid program and endorsed the proposition that "meeting the needs of the poorest countries and people should remain the primary and overriding objective of Canada's development assistance program".

The ODA charter presented in "*Sharing Our Future*" is based on four principles and six development priorities. The four principles are:

1. **Putting poverty first:** the primary purpose of Canadian official development assistance is to help the poorest countries and people of the world.

2. **Helping people to help themselves:** Canadian development assistance aims to strengthen the ability of people and institutions in developing countries to solve their own problems in harmony with the natural environment.

3. **Development priorities must prevail** in setting objectives for the aid program. As long as these priorities are met, aid objectives may take into account other foreign policy goals.

4. **Partnership is the key** to fostering and strengthening the links between Canada's people and institutions and those of the Third World.

The six development priorities or thematic objectives are:

1. Poverty alleviation in rural and urban areas;
2. Structural adjustment of economics;
3. Increased participation of women;
4. Environmentally sound development;
5. Food security; and
6. Energy availability.

"Sharing Our Future" explains that the development of human resources is the key to the development process. Canada's new strategy for development cooperation increases the emphasis on human resource development, making it "the lens through which all of Canada's development efforts are focussed". Moreover, the strategy affirms: "The first priority of human resource development must be to help supply the basics of health: clean water, sanitation and adequate nutrition" (pages 36 and 37).

Thus health-oriented water and sanitation services are regarded by CIDA as a fundamental and basic prerequisite for all other development.

In outlining the dimensions of poverty in developing countries "*Sharing Our Future*" makes numerous references to the role of the water sector, viz:

> "1.4 billion people do not have access to clean water" (p. 24);
>
> "80 percent of all the world's sickness is attributable to the lack of a reliable supply of clean water, and to unsanitary living conditions" (p. 37);
>
> "64 percent of the world's rural population and 23 percent of urban dwellers do not have access to a safe water supply" (p. 37);

Programs and projects in the water and sanitation sector can contribute very strongly to the Government of Canada's development objectives and priorities. Sector projects can respond directly to three priorities (poverty alleviation, increased participation of women and environmentally sound development). Indirectly, water resources management projects support food security (water for crops and livestock) and energy (hydroelectric projects and cooling water for thermal generation). Finally, the structural development priority includes measures to cushion the social and economic effects of adjustment, such as the continuous provision of basic water and sanitation services to the poorest people.

Water supply and sanitation services meet basic needs for living and health. Such projects respond directly in aiding the poorest people, while developing human potential, improving living standards, alleviating poverty and increasing the participation of women. Access to safe drinking water is almost always defined as a basic human need, along with shelter and food. Water is a necessary input to economic activities such as agriculture, food processing and manufacturing. Sanitation includes the hygienic removal and disposal of liquid and solid wastes and is important for basic health and for environmental preservation and, consequently, the sustainability of development.

That the water sector is important in national development is attested to by the new Federal Water Policy endorsed by the Government of Canada (see Box 2.1). In many respects, water sector management is even more important to developing countries since, in most cases, they are not as well endowed with water resources as Canada.

Canada Adopts New Federal Water Policy ***Box 2.1***

In October, 1987, the Minister of the Environment released the government's ***Federal Water Policy.*** *It states that water is Canada's most undervalued and neglected natural resource. The underlying philosophy is that water is a commodity which has real value and better management of it is required for its allocation among increasing and competing uses. One of the thrusts of the policy is to promote realistic pricing of water such that beneficiaries, as well as polluters, pay for its use and abuse, thereby increasing fairness and equity.*

The policy has the overall objective:

To encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generations.

And sets as its goals:

1. *To protect and enhance the quality of the water resource.*
2. *To promote the wise and efficient management and use of water.*

Source: Environment Canada, 1987

Water resources management projects focus on the conservation, protection and use of this precious resource, which is important for social and economic development and critical for agriculture, hydroelectrical energy, drinking water supplies and sustainability of development. Proper management of the resource provides for the protection of water quality and the optimization of multi-purpose water use.

Sound development is also in Canada's own longer term economic interest, since the nation's own well-being depends on a growing international economy. In the shorter term, development helps Canada forge mutually beneficial economic relationships. These trade and economic interests are discussed further in Section 2.3.

Finally, Canada has numerous other foreign policies and political objectives to which the aid program can contribute. Some of these are discussed in Section 2.4.

2.2 AID OBJECTIVES AND THE WATER AND SANITATION SECTOR

Water supply and sanitation services respond strongly to the following aid objectives: better health, improved living standards and poverty alleviation; human resources development; and increased participation of women. Water resources management is important in the following areas: food security; energy availability; flood and drought control. These topics are discussed briefly below. It should be noted that Chapter 3 provides more extensive information on the sector's role in the development process.

Better Health, Improved Living Standards and Poverty Alleviation

Shortages of clean drinking water and sanitation facilities are among the principal causes of poor health and misery in the developing world. These problems in turn contribute to low living standards and poverty. The potential impact of water sector programs to the alleviation of poverty is immense. Few other sectors can contribute as effectively to the alleviation of human distress as can the water sector.

> *"There are no shortcuts to improved public health in developing countries. Vaccination, chemotherapy and insecticides are in most cases of limited value. Lasting results can only be achieved with the general introduction of satisfactory systems of water supply, wastewater disposal and sanitation together with intensive health education campaigns".*
>
> (Schiller & Droste, 1982)

Like food, the consumption of water is vital for human survival. Water is also required for washing, cooking and food preparation. But not any water will do. Unless the water is safe, it can be the channel by which sickness and disease are spread. Similarly, unless human and household wastes are disposed of safely, they also contribute to the spread of disease and illness. Thus water supply and sanitation, together with health education and other health programs, are necessary components of improved public health.

As may be seen in Table 3-3, life expectancy in 1980-85 in North America is 71.1 years, whereas in Africa it is only 49.7 years. Similarly, the infant mortality rate is 27 per 1000 live births in North America compared with 114 for Africa. The same Table shows the considerable progress that has been made in improving these figures in Africa and other developing regions over the past generation. Much of this improvement has been due to improved water and sanitation services.

More than 12 million people die annually from diseases related to unsafe water supplies and unsanitary environmental conditions. Furthermore, about five million children die each year in developing countries from acute diarrhea and related causes. It has been clearly demonstrated that poor environmental sanitation is the critical link (UNICEF, 1987). The extent of the need for improved water supplies and sanitation is shown by the population data presented in Table 3-4. They show for example, that the majority of people in Africa are without adequate water supply and sanitation services. Figures for other areas of the developing world are somewhat better, but similar.

Projects in the water and sanitation sector respond directly to CIDA's basic objectives. The development of human potential is only possible if people are healthy. Data presented in Chapter 3 demonstrate that preventable disease and sickness are still all too common in the developing world. Most people, especially the rural and urban poor, are still are without adequate water and sanitation services. Similarly, improvements in water and sanitation have the potential of making strong contributions to improving living standards and economic development activities.

CIDA's commitment to direct assistance to the poorest peoples is also strongly supported by the water supply and sanitation subsector, since it is the rural and urban poor who suffer most from the absence of these services.

Human Resources Development

The education and training requirements of the water and sanitation sector are very acute and are one of its major bottlenecks. Trained and skilled people are required at all levels, including operators, maintenance personnel, mechanics, engineers and managers. In recent surveys of the needs of the sector, the lack of adequate numbers of trained and experienced personnel is always very high on the list of constraints (IDWSSD, 1987). Canadian expertise and capacities for training in this sector are very strong, as outlined in Chapter 4.

Within the water resources management subsector, the need for improving local capabilities to assess and manage water resources is perhaps even greater than for water supply and sanitation. This is often because the need for the best possible management of water resources has not yet been adequately recognized. Environmental considerations, sustainability of development and optimum resource allocation are only beginning to be recognized as being critical to the development process. These concepts are at the heart of water resources management. Developing countries simply do not have the trained personnel they need in these areas.

Increased Participation of Women

It is often stated that "water is a women's issue". This is because women play such an important role in the domestic use of water and, in most parts of the world, hauling water is mostly done by women. Few other sectors offer such a wealth of opportunities for involvement by women as water and sanitation. Since women are direct beneficiaries of water and sanitation improvements, they can and should be involved in the planning, implementation, operation and maintenance of the systems. The roles of women are further discussed in Chapters 3 and 7.

Economic Growth and Productivity

Water and sanitation sector projects contribute to economic growth and productivity in several important ways.

Improving the health of the population improves their productivity by reducing time lost because of illness and increases their energy and alertness levels. Sick people cannot contribute as effectively as well people.

Reducing sickness and disease reduces the costs of medical treatment. Over the past decade, developing countries have realized that they must follow preventative rather than curative health care policies. Improved water and sanitation is one of the most effective means to implement preventative health care policies.

Finally, projects and programs in water resources management and in water supply and sanitation make substantial and direct contributions to employment and economic development in Third World countries. The project cycle in the water and sanitation sector normally includes a number of stages: fact-finding, inventory and data analysis, planning and design, implementation, management, and operation and maintenance. The first stages create employment and training opportunities in the short-term, which culminate in the construction phase. In the long-term, through institution building and human resource development, jobs are created in management, administration, engineering and technical services for the operation and maintenance of the facilities. These are permanent and important jobs. Proper emphasis and commitment to provide

adequately staffed, and funded organizations to manage, operate and maintain the utilities means that a considerable increase in local employment will take place.

Flood/Drought Control

One of the major humanitarian benefits to be achieved through appropriate water resources management is the amelioration of the devastating consequences of floods and droughts. These two extremes have become major issues in all parts of the world, forcing examination of forest exploitation and over-cultivation of agricultural lands. This increase the intensity of flooding and desertification in many regions of the developing world. Good water resources management policies and projects, implemented in coordination with the agriculture and forestry sectors, can go a long way to prevent these disasters.

Food Security and Energy Availability

The water sector is important to both of these objectives because agriculture, hydroelectricity generation and fuelwood are all in a balanced relationship with each other and with the water resources of a region. Over-extension of agriculture into areas which are not suitable for agriculture, such as steep slopes, has a negative effect on fuelwood availability and stream flows. Good water resources management involves not only the conservation of surface and ground water to maximize water availability, but also the judicious allocation of the resources to the various uses, including irrigation, hydroelectric power generation, domestic and industrial uses.

2.3 TRADE POLICY AND THE WATER AND SANITATION SECTOR

The water and sanitation sector offers a number of opportunities for increased Canadian participation in trade with developing countries. Many countries which are now poor and are aid recipients will one day be in an improved position to purchase goods and services. This has already happened in countries such as Nigeria, Korea, Taiwan, and Indonesia. Canadians and Canadian companies have benefitted from these opportunities in the past, and even greater ones will present themselves in the future. Canadians, with the relevant experience and capability, can and do obtain contracts for goods and services for projects funded by agencies such as the World Bank and the Asian Development Bank. The opportunity to gain experience through CIDA-funded projects is an important way to permit companies to grow in international experience.

Canada has an international image of having vast, clean water resources and clean, well managed cities. This image affords Canada an opportunity to establish a presence in the water and sanitation sector in the developing world trade market. Canada's economy depends heavily on its export trade and, therefore, has a vital stake in the stability and economic growth of other countries, rich and poor alike. The water industry in Canada is large, employing more than 100,000 people. Further information on the domestic water industry is provided in Chapter 4.

More than 200 firms in Canada, representing 4,000 employees, are involved in the production of water or sanitation-related services (DRIE, 1985). Export opportunities provide the facility to expand that base and permit the industry to grow, as well as to transfer its technology to counterpart firms and government officials, thereby improving self-reliance in the developing countries.

The overseas export of Canadian services in the water sector is primarily concentrated in the consulting engineering industry. Thirteen Canadian firms were listed in the top 200 international consulting firms, with their foreign billings totalling $363 million in 1983 (DRIE, 1985). Canadian firms have about seven percent of the international consulting service market, ranking behind U.S.A., Britain and France. Fifteen firms are consistent overseas exporters with the water sector representing approximately eight percent of their earnings.

Opportunities exist for Canada to strengthen its trade with the developing world by introducing its water sector capability, not only through the Bilateral program but also through the Multilateral and Business Cooperation programs of CIDA.

Export opportunities are greatest for trade in the service/consulting sector. These are followed by export opportunities for hard goods such as water and sewer pipes, package treatment plants, pumps and pressure vessels and certain specialty items, as well as construction contracts. There are also opportunities for firms to enter joint venture and turnkey projects. These allow Canadian excellence in technology and management to combine with local capabilities to carry out projects. This trend is already quite strong in a number of areas.

Sometimes the question is asked, "*By exporting our skills and technology, are we not gradually putting ourselves out of business?*". In fact, the contrary is the case. The need for assistance in the water and sanitation sector in the developing world is immense; so much remains to be done that the opportunities available are many. In this sector, the absorptive capacity of recipient countries is very large, both in terms of human resource development and the need for physical plant and infrastructure. The water sector is an area where the ODA effort can be increased for the economic benefit of both Canada and the recipient countries.

2.4 POLITICAL OBJECTIVES AND THE WATER AND SANITATION SECTOR

Canada's political objectives for the aid program are that its efforts should contribute to overall foreign policy objectives, particularly in the areas of global peace and security, including emergency assistance; improvements in human rights, including poverty alleviation; and, in strengthening international cooperation (CIDA, 1987b). The following sections comment on the role of the water and sanitation sector in relation to these objectives.

Global Peace and Security

Peace and security may be threatened in a number of ways which are related to the water and sanitation sector. Mass poverty, sickness and disease among rural and slum dwelling peoples provides ripe ground for revolutionary ferment aimed at redressing the balance in a world where so much affluence exists alongside misery and poverty. Conflicts may arise over the right to control and manage water resources both within national boundaries and between countries. Environmental degradation and pollution is increasingly recognized as a pending global crisis. By assisting countries to develop in this sector, Canada can make a strong contribution to global peace.

By helping countries to improve their water supply and sanitation services, Canada can make clear and visible contributions to the improvement of the living conditions of the poorest segments of these societies and thereby assist them to strengthen their sense of partnership in the development process. This process is aided by the fact that projects normally include not only the contribution of physical amenities, but also the developing of institutional arrangements between the communities and their governments. As outlined in Chapter 4, Canada has excellent technical capabilities among its consultants, NGOs and institutions to carry out this assistance at the community level for both rural and urban societies.

India and Pakistan Solve Water Sharing Problem **Box 2.2**

After the Indian sub-continent achieved independence in 1946-7 and the two countries of Pakistan and India were formed, it wasn't long before a conflict of interest over the sharing of the waters of the five rivers of the Punjab took place. Fortunately the World Bank, supported financially by Canada, United States, India, Britain, Australia, New Zealand and West Germany, was able to devise a massive and dramatic solution which led to the construction of the great "link canals" in Pakistan. These carrier canals supply water to the irrigation systems which had previously depended on rivers whose flow is now completely used in India. Thus was a war over water averted.

Source: Hodges, R.C. (1957)

The problems of water rights and control in the developing world are immense. In most cases, political jurisdictions do not follow water basin boundaries. Boundaries are quite arbitrary, or tend to follow rivers. As organized development proceeds, water demands increase and environmental concerns become more pressing. Problems in the area of water rights and control are bound to intensify.

Human Rights

The respect for human rights is regarded by Canada as one of the most important conditions for development and an integral part of foreign policy. Entrenched poverty and denial of access to shelter, health, nutrition, education and employment are considered barriers to the attainment of human rights. Similarly the denial of equal opportunities for women is a denial of human rights (CIDA, 1987b).

The provision of safe drinking water, the removal of wastewater and the collection and disposal of garbage are among the most effective and direct means to alleviate poverty and misery and thereby improve the lot of the poorest people. These improvements also impact most directly on women and children. Not only are women major beneficiaries, but they can also participate in the planning, construction, operation, maintenance and management of the facilities. This is especially true of the basic systems that are required for the rural and squatter settlements of the developing world. It is less true for large urban systems which need to be centrally organized and managed.

A barrier to integration is often the lack of communication between community groups or with the government. Water and sanitation projects are excellent vehicles for breaking down these barriers because they involve a great deal of community participation. Often, they are the first activities undertaken which force communities to organize themselves, to communicate with other communities and with governments.

Orangi Residents Build Own Sewerage and Drainage Systems in Pakistan **Box 2.3**

In Karachi's poor suburbs, the government does not function. That is one reason for the riots which have killed several hundred people in this sprawling Pakistani city in the past six months. The bright side is that the inhabitants have started taking over the functions of government themselves. Mr. Akhtar Hameed Khan, the man behind the widely admired co-operative movement in East Pakistan (now Bangladesh) in the 1960's, is showing them the way.

In the past five years people have begun doing things for themselves. Mr. Khan provided the example with his Orangi Pilot Project. Orangi, which is home to nearly one million people, is Karachi's biggest and most chaotic township. The project has got its residents to build themselves a proper sewerage system with no help from the authorities.

The Orangi project in Karachi remains wholly independent. Mr. Khan, who had gone to Pakistan after Bangladesh was created, started talking to people in Orangi in 1979 about building a drainage and sewerage system for themselves; it was clear the government was not going to provide them with one at a price they could afford. The idea slowly gained ground. Street committees were formed, the pilot project gave technical advice and sold materials at cost, and the people provided or hired the labour. Half of Orangi has now been hooked up. No charity is involved. The idea is that people should pay for what they get, because then they will look after it properly. The cost of being hooked up is around 1,000 rupees ($60) a house – one month's average wages. The municipal development authority would charge five times as much.

Source: *The Economist*, April 1987

In refugee camps around the world and in disaster-struck areas, basic living conditions are often deplorable. Assistance with the provision of water and sanitation in those cases is a strong support for human rights because the people are usually in an extremely poor position to help themselves.

Strengthening International Cooperation

This sector offers many opportunities to respond to this objective of Canada's foreign policy. The International Drinking Water Supply and Sanitation Decade (IDWSSD) is drawing to a close. It is now clear that its goals cannot be reached. Nevertheless, there has been a considerable strengthening of international cooperation and awareness, which will improve effectiveness of future efforts in this sector. Cooperation has resulted in increased funding, sharing of methodologies and technologies for the sector, as well as strategies for the future. Canada has played an active role in the IDWSSD up to this time. Opportunities exist to increase this role even further during the remainder of the Decade and on into the future.

A great deal of cooperation will be required in the future among nations sharing river basins, in order to arrive at clear and equitable sharing of water resources and environmental control measures. The African continent is particularly sensitive to this problem since most of its river systems spill across national boundaries. There is a need for river basin authorities to be set up among the countries affected. A measure of the need is seen by comparing the European and African situations. In 1972, Africa had only 34 international water treaties although it has 56 international river basins, of which 12 are shared by four or more countries. Europe had 175 treaties covering 48 river basins, of which four are shared by four or more countries (IIED & WRI, 1986). The problem in this area is compounded for African countries by the fact that their expertise and available data on the water resources are woefully inadequate. This will present numerous opportunities for Canada to demonstrate its commitments to strengthening international cooperation by assisting countries in this area.

Building Public Support

The Government in its new strategy has decided to place new emphasis on public education concerning international development programs in order to stimulate public awareness. Projects and programs in the water and sanitation sector are ideal to focus the attention of Canadians on CIDA's international development activity. Every Canadian uses water supply and sanitation systems every day.

Furthermore, Canadians are becoming increasingly aware of the importance of their water resources and how they need to be effectively managed and protected. The Federal Water Policy adopted in November 1987 is dedicated to preserving and enhancing this resource (Environment Canada, 1987).

The water and sanitation needs of developing countries are relatively easy to analyze and communicate. This sector has received support from the onset of Canadian international development programs. Information exists on results already achieved, but much remains to be done. For these reasons, development assistance in this sector is a splendid candidate in CIDA's strategy for public information and awareness about international development.

Chapter 3

THE SECTOR IN TERMS OF DEVELOPMENT AND CROSS-SECTORAL LINKAGES

Chapter 3

THE SECTOR IN TERMS OF DEVELOPMENT AND CROSS-SECTORAL LINKAGES

3.1 THE NEED FOR WATER SUPPLY AND SANITATION SERVICES

3.1.1 Water Supply, Sanitation and Development

The provision of clean drinking water and safe waste disposal, combined with improved personal hygiene, leads to a reduction in sickness and death and in the percentage of people rendered less productive by disease. The International Institute for Environment and Development quotes World Health Organization estimates that 80 percent of all sickness and disease in the world is attributable to inadequate water or sanitation (IIED, 1981).

The terrible toll of water-related diseases is well understood by UNICEF, whose analyses include the following statements:

> *"Poor environmental sanitation is a critical link in the chain of diarrheal disease which entraps young children of developing countries and claims the majority of deaths in the 0-5 age group. Contributing factors are unsafe and insufficient water supplies, the lack of safe means of human waste disposal and inadequate personal and household hygiene, including poor food handling practices." (UNICEF, 1987).*

> *"About five million children under five in developing countries die each year from acute diarrhoea and related causes, the largest single cause of death of young children." (UNICEF, 1986).*

> *"Each year an estimated 12.4 million deaths occur from water-, feces-, and dirt-related diseases." (UNICEF, 1987).*

The linkages between bad water, poor sanitation and disease were first understood in the 19th Century. Snow's classic epidemiological study of an 1854 outbreak of cholera in London, England related 700 deaths over a 17 week period to the use of water from handpumps. The source of water for the pumps had been contaminated by a leaky drain carrying wastewater from the house that was the site of the original cholera case. Remarkably, Snow's discovery predated Pasteur's germ theory of disease by a decade and Koch's identification of the causative organism by three decades.

By the end of the 19th century, the "portal of entry" theory of infection had been postulated. This theory stated that micro-organisms entering the human body through the mouth via water, or food, caused diseases. It was conclusively demonstrated for cholera and typhoid, as well as for a host of other diseases, that fecal-oral routes were predominant in the transmission of disease, and that any intervention which broke the fecal-oral cycle could be effective in disease control.

Water-borne diseases were widely prevalent in North America during the later part of the 19th and early 20th century and were then among the leading causes of death and illness. However, the decline of water-borne diseases closely parallelled the establishment of public water supplies and sewerage and, it should be noted, economic development. Correlations were especially strong for communities taking their water supply from protected watersheds or from underground sources. A decline in disease followed, firstly with filtration, and then with chlorination of water supplies (McJunkin, 1982). By the late 1930's, many countries in the developed world greatly reduced water-borne diseases by providing safe water supplies. Sanitation followed rapidly, although pollution of the aquatic environment remains as a problem. Chapter 4 provides further comments on the Canadian experience in this area.

Table 3.1 provides information on the impacts of diseases associated with water and sanitation on a global basis. Some of these are water-borne while others are water-related in other ways. The statistics confirm diarrhea as, by far, the most lethal disease, accounting for five to ten million deaths annually, most of these being children, and up to five billion people infected annually.

Although control of epidemics in the developing world is important, the ongoing daily monitoring and control of the prevalent diseases in a community is more important in the aggregate. Endemic disease is not clear-cut in its relation to water supply; for many diseases there are alternative routes of transmission. However, over 100 published studies support the relationship of water supply to health. Indeed an extensive World Bank review found that:

> *"Other things being equal, a safe and adequate water supply is generally associated with a healthier population. This has been unequivocally demonstrated for urban areas and in varying degrees for rural situations. The difficulty lies in measurement rather than qualitative trends." (Saunders & Warford, 1976).*

A WHO review of 67 studies from 28 countries indicates that improvements in water quality and availability are especially effective in reducing sickness and death due to diarrhea. Table 3.2 provides the results of these reviews.

Table 3-3 provides an indication of the improvement in life expectancy and infant mortality rates in recent years, much of which is due to improved water supply and sanitation services. Improvements in developing regions are particularly striking.

Table 3-1
Global Impacts of Diseases Associated with Water Supply and Sanitation

	Infection	Infections thousands /year	Deaths thousands /year	Average no. of days lost per case	Relative disability*
Water-Borne Diseases	Amebiasis	400,000	30	7-10	3
	Diarrheas	3-5,000,000	5-10,000	3-5	2
	Polio	80,000	10-20	3,000+	2
	Typhoid	1,000	25	14-28	2
Water-Related Diseases	Ascariasis (roundworm)	800,000-1,000,000	20	7-10	3
	Leprosy	12,000	Very low	500-3,000	2-3
	Trichuriasis (whipworm)	500,000	Low	7-10	3
Water-Based Diseases	Schistosomiasis (bilharzia)	200,000	500-1,000	600-1,000	3-4
Diseases With Water-Related Vectors	African trypanosomiasis (sleeping sickness)	1,000	5	150	1
	Malaria	800,000	1,200	3-5	2
	Onchocerciasis (river blindness)	30,000	20-50	3,000	1-2
Fecal Disposal Diseases	Hookworm	7-9,000,000	50-60	100	4

* 1 means the sufferer is bedridden
2 able to function to some extent
3 able to work
4 experiences minor effects

Source: Decade Dossier, UNDP (1978).

Table 3.2
Percentage Reductions in Diarrheal Morbidity Rates Attributed to Water Supply or Excreta Disposal Improvements

Type of Intervention	Number of Results	Percentage Reduction Median	Range
All interventions	53	22	0-100
Improvements in water quality	9	16	0-90
Improvements in water availability	17	25	0-100
Improvements in water quality and availability	8	37	0-82
Improvements in excreta disposal	10	22	0-48

Source: Estey *et al.*, 1985.

Table 3-3
Changes in Health Indicators

Region	Life Expectancy At Birth in Years 1950-1955	1980-1985	Infant Mortality Rates by Deaths per 1,000 Live Births 1960-1965	1980-1985
World	49.9	64.6	117	81
Africa	37.5	49.7	157	114
Asia	41.2	57.9	133	87
South America	52.3	64.0	101	64
North America	64.4	71.1	43	27
Europe	65.3	73.2	37	16
USSR	61.7	70.9	32	25
Oceania	61.0	67.6	55	39

Source: WCED (1987).

3.1.2 The International Drinking Water Supply and Sanitation Decade (IDWSSD)

The IDWSSD commenced in 1981 as a direct outcome of the 1977 World Water Conference held in Mar del Plata, Argentina. The Decade was formally proclaimed at the General Assembly of the United Nations on November 10, 1980.

The basic goal of the Decade is to provide access for all people to safe drinking water and adequate sanitation by the year 1990. Governments are expected to prepare national action plans to meet their own goals.

The IDWSSD has encouraged cooperation among donors and has advocated the development of common strategies. Several meetings and conferences have been held between bilateral and multilateral donors to discuss the progress during the IDWSSD, as well as approaches, strategies, and development policies. After Mar Del Plata, Canada has strongly supported the aims of the IDWSSD, and the Water Sector in CIDA has actively participated in, and contributed to, the major donor conferences and meetings. For example, at the World Health Assembly in 1982, Canada announced that it would contribute approximately $300 million to reach IDWSSD goals (CIDA, 1985).

The IDWSSD (See Box 3.1 and Box 3.2) has undoubtedly given an impetus to global improvements in water supply and sanitation services. It has encouraged developing countries and ESAs to actively promote the sector and to recognize the needs and rewards to be realized by providing water and sanitation services.

The Decade Approach for Water Supply and Sanitation ***Box 3.1***

Development thinking has been steadily evolving over the past three decades. Though debate continues, it is now generally agreed that, without neglecting growth, development should promote structural and institutional change to ensure more equitable distribution of benefits and wider popular participation.

Development strategies, it is advocated, need to be:

- *"Broadbased", providing for wide distribution of benefits and services such as health care, education and training, productive employment, credit, marketing, fuel, water, sanitation and protection against environmental degradation; and*
- *"People-oriented", enabling people to use their labour, creativity and enterprise in working to improve their own lives.*

The UNDP Decade approach is in harmony with these principles. Its basic elements are:

1. *Regarding water supply and sanitation as complementary;*
2. *Focus on underserved populations, rural and urban;*
3. *Generation of replicable, self-reliant and self-sustaining programs;*
4. *Development of socially relevant systems which can be afforded now;*
5. *Association of communities at all stages of projects;*
6. *Linking water supply and sanitation with other health improvements; and*
7. *Integration of water supply and sanitation programs with other development sectors.*

Source: UNDP (1978) "Decade Dossier".

FIVE-POINT PLAN FOR AFRICA
AGREED BY 30 COUNTRIES AT ABIDJAN **Box 3.2**

Representatives of 30 African countries and 15 external support agencies met in Cote d'Ivoire in October 1986 to review progress of the first half of the IDWSSD and to lay plans for the future. They noted that 30 million people have been given improved water supplies in the first half of the Decade, raising the coverage level. However, 200 million of Africa's rural and urban-fringe people are still without basic services, and too many projects are abandoned or functioning well below capacity because of poor maintenance. They endorsed a five-point plan which they believe will provide substantial improvements in the future.

1. *Governments should develop institutional framework for decentralizing responsibility. Government's role should be to facilitate training, set policies and organize distribution facilities for spare parts and materials.*
2. *Communities - with women having a vital role - are to be responsible for planning, constructing, operating and maintaining their facilities including the collection and management of funds.*
3. *An integrated approach to incorporate sanitation improvements and health and hygiene education is to be promoted to maximize benefits.*
4. *Technology choice to match the latest low-cost technologies with community resources will be promoted.*
5. *Maintenance by the community will reduce costs and increase reliability.*

Source: World Water, November 1986.

Table 3.4 provides a summary of the water supply and sanitation needs in developing world regions at the end of 1985, based on national data provided to WHO. Out of a total of 3.4 billion people, fully 1.5 billion are without water supply and 2.0 billion are without sanitation. These data probably understate the problem because:

- national governments tend to provide coverage statistics which often overestimate the number of people being served;
- people receiving water a few hours per day or a few days per week, from unreliable systems, are included in such data, but really are not well served.

Estimates of progress during the first half of the Decade are that 270 million more people have water supplies and 180 million more have sanitation. This progress varies greatly from country to country, with the urban areas receiving the greatest amount of the improvements, even though there are about twice as many rural as urban residents in developing countries (Kalbermatten and McGarry, 1987).

Table 3-4
Estimated Statistics of Water Supply & Sanitation Coverage (1985)

CIDA Branch	Population ('000)	Population without Water Supply ('000) % of Total	Population without Sanitation ('000) % of Total
Asia	2,449,300	1,100,000 (45%)	1,500,000 (61%)
Anglophone Africa	391,000	226,000 (58%)	243,000 (62%)
Francophone Africa	179,000	97,000 (54%)	115,000 (64%)
Americas	359,100	97,200 (27%)	139,500 (39%)
Total	3,378,400	1,520,200	1,997,500
Percentage without Service		45%	59%

Source: Compiled from data presented in Tables C-1 to C-4 in Appendix C.

Table 3.5 shows a list of 25 CIDA eligible countries ranked according to percentage without a safe water supply. From this data it may be noted that the situation is extremely variable, country by country. Two countries (Ethiopia and Mozambique) show 86 percent of the population without clean water supplies. On the sanitation side, the situation is even worse. Nepal, for example, shows 98 percent without sanitation. Table 3-6 presents data on the 25 countries most in need of water supply and sanitation services in terms of the absolute numbers of people. Approximately one billion of the people needing services - twenty percent of the global population - live in five Asian countries: China, India, Indonesia, Bangladesh and Pakistan. Two of the most populous countries in Africa: Nigeria and Ethiopia, are next on the list.

Figures C-1 and C-2 in Appendix C show the correlation between the percentage of population served and the GNP per capita. It is clear that the poorest countries have the least services. The other extreme of this situation is the developed countries, where the level of wealth and services are so high that people typically have abundant supplies of water available for any use, with several washrooms in each dwelling.

3.1.3 Technological Choices

In many cases, the technologies selected have been too complex and sophisticated for developing countries. As a result, in the late 60's and early 70's, a revolution in technology selection was spearheaded by the World Bank, with the participation of various other agencies, including IDRC. It was realized that many projects were failing, especially in the rural areas, because the technology being used was too sophisticated for the developing countries to maintain and operate over the long term. Also, it was clear that developing countries simply could not afford these high-cost, conventional technologies if they hoped to serve a large and growing population with water supply and sanitation services.

Emphasis was accordingly directed to developing low-cost, appropriate technology solutions which were affordable by the local people and could be operated and maintained by them. In the water supply field, these technologies include: handpumps and shallow wells, gravity-fed water systems, rainwater catchments, slow sand filtration, ram pumps, and a great number of other more specialized low-cost alternatives. In the sanitation field, on-site options (the ventilated improved pit latrine or "VIP" and the pour-flush latrine in particular) were emphasized along with waste stabilization ponds and small-bore sewers.

The point has been stressed that the first half of the IDWSSD has seen the successful perfecting of many appropriate low-cost technology solutions. It has also been advocated that, for the remainder of the IDWSSD and beyond, there must be an increasing emphasis on management issues. In future, greater emphasis must be given to developing and implementing viable projects in which community participation, institution building, cost recovery, and human resources development play key roles. If this is not done, projects employing low-cost appropriate technologies will record failures just as high as in programs using sophisticated conventional technologies.

3.1.4 Practical Problems

Developing countries have experienced many difficulties in obtaining lasting benefits from investments in water supply and sanitation services.

The amount of funding available from the central governments for water and sanitation projects has not been anywhere near sufficient to meet the needs. In many cases, funds have not even been available for spare parts and maintenance of systems already constructed, especially during times of economic difficulties. The result is that a large percentage of systems have gone out of service. Even when the systems operate, the experience is that water supplies alone have not led to the expected improvements in health because basic hygiene and water use practices were not improved.

To counteract these problems, many countries are now moving to incorporate two concepts into the approach. The first is decentralization for rural situations in which communities take responsibility for some concepts of planning, constructing, operating and maintaining the systems. When given responsibilities, communities often are able to collect user fees for operation and maintenance costs as well as most capital costs; thus relieving central governments of this immense burden. Furthermore, some countries report big savings and increased reliability when rural communities take direct responsibilities for their own systems.

Table 3.5

25 CIDA-ELLIGIBLE COUNTRIES MOST IN NEED OF WATER SUPPLY AND SANITATION SERVICES (1985)

(Ranked by percentage of population without safe water supply)

Rank	Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
				Water Supply			Sanitation				
				Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sanitation
1	Mozambique	13,810	NA	1,550	10,310	11,860	1,170	9,910	11,080	86	80
2	Ethiopia	44,517	140	1,302	36,775	38,077	168	NA	NA	86	NA
3	Mali	7,914	142	861	5,692	6,553	155	6,135	6,290	83	79
4	Guinea	5,780	310	937	3,687	4,624	NA	NA	NA	80	NA
5	Uganda	14,680	220	1,194	10,526	11,720	1,294	9,040	10,334	80	70
6	Guinea Bissau	880	150	157	540	697	135	563	698	79	79
7	Swaziland	650	810	0	513	513	0	415	415	79	64
8	Paraguay	3,681	1,526	670	2,204	2,874	444	1,441	1,885	78	51
9	Maldives	181	524	19	119	138	0	133	133	76	73
10	Papua New Guinea	3,343	649	22	2,472	2,494	4	1,890	1,894	75	57
11	Sierra Leone	3,700	200	355	2,401	2,756	443	2,331	2,774	74	75
12	Burundi	4,782	230	6	3,522	3,528	50	1,972	2,022	74	42
13	Burma	37,115	188	5,702	21,400	27,102	5,995	22,370	28,365	73	76
14	Nepal	16,680	165	400	11,547	11,947	1,118	15,304	16,422	72	98
15	Cameroon	10,000	810	1,710	5,320	7,030	0	6,900	6,900	70	69
16	Somalia	5,515	200	586	3,216	3,802	779	3,924	4,703	69	85
17	Madagascar	9,986	232	408	6,447	6,855	NA	NA	NA	69	NA
18	Angola	8,573	560	258	5,623	5,881	1,401	5,545	6,946	69	81
19	Yemen Arab Rep.	9,274	471	0	6,301	6,301	157	NA	NA	68	NA
20	Zaire	30,500	271	5,600	14,900	20,500	NA	17,150	NA	67	NA
21	Lesotho	1,496	484	66	913	979	146	1,128	1,274	65	85
22	Haiti	5,269	320	579	2,698	3,277	813	3,349	4,162	62	79
23	Indonesia	165,000	586	33,630	67,800	101,430	39,997	66,000	105,997	61	64
24	Sri Lanka	15,860	340	528	8,840	9,368	1,192	7,620	8,812	59	56
25	Nigeria	97,090	760	0	57,115	57,115	NA	NA	NA	59	NA
	TOTAL FROM AVAILABLE DATA	516,276				347,421			221,106		
	PERCENTAGE FROM AVAILABLE DATA					67			43		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Table 3.6

25 CIDA-ELLIGIBLE COUNTRIES MOST IN NEED OF WATER SUPPLY AND SANITATION SERVICES (1985)

(Ranked by number of people without safe water supply)

Rank	Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
				Water Supply			Sanitation				
				Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sanitation
1	China	1,034,750	310	NA	NA	434,595	NA	NA	413,900	42	40
2	India	763,930	250	46,899	282,066	328,965	135,893	555,643	691,536	43	91
3	Indonesia	165,000	586	33,630	67,800	101,430	39,997	66,000	105,997	61	64
4	Nigeria	97,090	760	0	57,115	57,115	NA	NA	NA	59	NA
5	Bangladesh	100,000	136	13,676	42,142	55,818	13,650	79,540	93,190	56	93
6	Pakistan	93,800	390	4,618	48,806	53,424	13,100	62,880	75,980	57	81
7	Ethiopia	44,517	140	1,302	36,775	38,077	168	NA	NA	86	NA
8	Burma	37,115	188	5,702	21,400	27,102	5,995	22,370	28,365	73	76
9	Philippines	55,336	585	11,443	15,388	26,831	3,878	14,574	18,452	48	33
10	Mexico	77,900	1,095	11,112	12,258	23,370	15,693	24,037	39,730	30	51
11	Zaire	30,500	271	5,600	14,900	20,500	NA	17,150	NA	67	NA
12	Brazil	127,942	1,640	9,812	10,227	20,039	13,374	20,732	34,106	16	27
13	Thailand	51,796	729	5,678	13,218	18,896	2,878	21,918	24,796	36	48
14	Argentina	30,564	1,929	9,062	4,138	13,200	6,266	3,248	9,514	43	31
15	Nepal	16,680	165	400	11,547	11,947	1,118	15,304	16,422	72	98
16	Mozambique	13,810	NA	1,550	10,310	11,860	1,170	9,910	11,080	86	80
17	Uganda	14,680	220	1,194	10,526	11,720	1,294	9,040	10,334	80	70
18	Tanzania	21,940	197	355	10,730	11,085	246	7,741	7,987	51	36
19	Korea, Rep.	41,056	2,032	2,581	7,195	9,776	0	0	0	24	0
20	Sri Lanka	15,860	340	528	8,840	9,368	1,192	7,620	8,812	59	56
21	Peru	19,698	585	3,398	5,956	9,354	4,138	6,261	10,399	47	53
22	Cameroon	10,000	810	1,710	5,320	7,030	0	6,900	6,900	70	69
23	Madagascar	9,986	232	408	6,447	6,855	NA	NA	NA	69	NA
24	Mali	7,914	142	861	5,692	6,553	155	6,135	6,290	83	79
25	Yemen Arab Rep.	9,274	471	0	6,301	6,301	157	NA	NA	68	NA
	TOTAL FROM AVAILABLE DATA	2,891,138				1,321,211			1,613,790		
	PERCENTAGE FROM AVAILABLE DATA					46			56		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

In order to obtain maximum health and economic benefits from investments in water supply projects, countries are finding that an integrated approach is effective. Thus, complementary activities in sanitation and education (health, hygiene, and water use practices) are effective and will enhance the benefits to all concerned.

3.2 THE NEED FOR WATER RESOURCES MANAGEMENT

3.2.1 General

Water is a natural resource which is essential for almost all types of economic development. Water, therefore, merits consideration in many sectors. Water for people has already been discussed in the context of water supply and sanitation services.

Partly because water is so important an ingredient in virtually all development, the management of water resources is invariably complex. The subject simply does not lend itself to easy analysis. Nevertheless, there are a number of basic points to review when considering CIDA's development assistance in the water sector.

3.2.2 Political Jurisdictions

Water resources management is inevitably dependent on political boundaries and systems. Water is not static; it is always flowing downhill. So this mobile resource cannot be managed without first taking account of who is responsible for its management.

Surface water resources can conveniently be assessed, developed and managed in terms of the drainage basin or watershed by which rainwater flows from the highest point in the area to sea level. Small rivers may lie entirely within the boundaries of a single country; but most countries, Canada included, have rivers whose watersheds involve other countries. Thus water resources management frequently demands an international political perspective.

Canada and CIDA can hardly be involved in development activities on rivers unless a minimum degree of cooperation exists between the riparian countries. Competition for water, or other conflicts between neighboring countries, can sometimes preclude any meaningful international cooperation. The Euphrates River Basin, involving Turkey, Syria and Iraq, is one such example of negligible cooperation.

The need to cooperate on river developments can also provide opportunities to promote international cooperation. The Niger, Senegal, Zambesi and Nile Rivers in Africa offer examples of such international cooperation.

Within any given country there can also be political and administrative boundaries which need to be understood and respected in the context of water resources. In Canada, for example, individual provinces have the essential responsibilities for water development, but the federal government is involved with international and inter-provincial questions and with fisheries.

Other questions arise with respect to the various responsibilities for developing water resources. There are invariably project components in different water sectors such as agriculture, industry, energy and communities; as well as the overall responsibility for conserving and protecting the basic resource. These responsibilities are often unclear and/or complicated. And yet no sensible system for managing water can be contemplated, and little practical assistance can be provided, until such fundamental jurisdictional questions are resolved. This is another area where Canadian experience and willingness to assist can be extremely valuable.

An emerging issue - in Canada and elsewhere - concerns groundwater. Unlike surface waters, which are visible to all and relatively easy to assess and understand, groundwater is out of sight and more difficult to analyze and manage. Groundwater also flows, though usually much slower than surface water, and the three dimensional boundaries of groundwater systems are less easily understood. Jurisdictional questions concerning groundwater, which can provide safe drinking water for the majority of people in developing countries, are issues which cannot be overlooked.

3.2.3 Data on Water Availability: The Resource Base

Development and management of water resources can only be rational and systematic when planners have good knowledge about the overall resource. Developing countries seldom have adequate information about their water resources. Canada has struggled with this issue for generations and has much experience and expertise to offer in this field.

To obtain an accurate picture of a country's overall water resources is, unfortunately, a slow and expensive process which is usually not given high priority. Water quantities and qualities are continuously changing, so a review of available resources at one point in time is not enough. Long-term and systematic efforts are required to obtain and analyze the data. The real art is to know how to set reasonable limits to this information-gathering process; this is again a Canadian strength.

Several different perspectives are required on the resource base. Groundwater should be assessed as well as surface water, since accessible groundwater underlies more than three quarters of the earth's land surface. Water quantity data are necessary to estimate the available supply, but no less important are data on the quality of the water, particularly when the water is to be used for people, animals and crops. Water resources are dynamic, so seasonal and annual patterns in the supply have to be determined.

Water availability in any region is directly affected by land-use practices, a basic fact of critical significance in many developing countries. Trees and forests reduce the rate of runoff and indirectly augment the volume of rainwater which can be exploited in a watershed. Deforestation for urban growth, agriculture and firewood collection, all directly affect water resources.

Forests in the developing countries have generally been reduced by nearly 50 percent in this century (World Resources Institute, 1986). Ethiopia's forest cover, involving perhaps 40 percent of the land in early times, has suffered more. It was down to 15 percent at the start of the century and is now down to three percent. Ethiopia's current water problems are thus directly related to its land-use patterns, which are in turn affected by demographic measures and energy needs. Obviously, water resources cannot be considered in isolation.

Although the acquisition of basic information on water resources can be expensive, the costs of not having sufficient data can be even greater. Reservoirs which do not fill, or dams which are topped by unexpected floods, are two costly examples. Groundwater development programs for water supplies must update the hydrogeology of the resource on a regular basis.

3.2.4 Water Demands

Proper planning for water resources requires a good appreciation of present and probable future demands for the water. The various groups of water users must plan their developments so the cumulative effects of the developments are understood by all parties.

The greatest consumptive use of water, globally, is for irrigation which comprises 74 percent of all water uses, according to UNEP (World Resources Institute, 1986). This use is bound to increase as developing countries increase their agricultural activities. Irrigation runoff flows, in the form of drainage, can degrade water quality by adding fertilizers and pesticides to the receiving waters.

Hydroelectric plants use very large quantities of water, but these are in-stream uses which hardly affect the volume available for other purposes. The creation of reservoirs, however, changes flow patterns and can have a major impact on water quality. Cooling water used by thermal generating plants also impacts on water quality.

Water for people and industries is often accorded high priority by planners, in situations where there is a competition for water, partly because such uses generally have a modest total effect on the overall availability of water. But wastewater flows, particularly from industry, can jeopardize water quality. So runoff, wastewater treatment, and water reuse, are obvious environmental issues when considering water demands.

3.2.5 Water Management

Stated simply, the challenge is to match available resources to existing and anticipated future demands, while conserving and protecting the water resource for future use. Water, after all, is a renewable resource, so today's water users, if sensible, can utilize existing water resources without jeopardizing the prospects for future generations.

Water cannot be drunk or used to grow food if its quality is abused. Water quality degradation is a growing threat and the protection of the resource is essential. Strategies to minimize water contamination are not easy but must be implemented. Of particular concern, perhaps less in developing countries than in more industrialized countries, are the toxic contaminants emanating from industrial processes. Solid and liquid wastes from urban areas are another potential pollution source, as is agricultural runoff, from livestock as well as from cropland. Canadian assistance can help the Third World in these areas of water resources management.

Water is a commodity. Like other commodities, the quantity demanded is related to the price charged. It is increasingly accepted that water pricing is an essential tool in demand management, yet this is frequently a very difficult issue for governments to address. Canadian assistance must stress the need to consider water pricing as an essential ingredient in water management.

Planning methodologies aided by computers have become more sophisticated, but they have to consider many inter-related aspects of water resources. Economies are sought in the management of existing projects, and in the development of new projects, by emphasizing comprehensive basin planning and management. Simulation and other mathematical models are used to compare the social, economic, and environmental impacts of proposed courses of action, as well as for assessing the physical resources. Comprehensive planning now seeks to provide a basis for setting priorities in water use, resolving conflicts, and seeking public support and participation in strategic planning for long-term development.

The foregoing procedures require the establishment and nurturing of new institutional arrangements and management skills to undertake surveys, analyses, planning, and priority development. Here there is often need for outside agency assistance to train personnel and provide organizational and operational guidance. This requirement reflects on both scientific and engineering capability as well as social, economic and resource planning, not only in the technical development of the program, but also in the regulation of the resource. The examples of basin planning and management, undertaken under the Canada Water Act, in most provinces and with the Prairie Provinces Water Board, attest to Canadian expertise in this area.

Within the water resources management field, three different types of projects can be identified. These are:

- data collection and resource inventories;
- planning studies; and
- construction projects, particularly in flood control, pollution abatement, and water quality improvement.

Canadians are qualified to assist in all of these types of projects.

3.3 INTER-SECTORAL AND CROSS-SECTORAL LINKAGES

3.3.1 Introduction

Developments do not occur in a vacuum. Developments in the water sector often have major effects on other sectors. Similarly, developments in other sectors may profoundly affect the water sector. The highly successful processing industry which pollutes the local water supply, which spoils the tourism and fishing industries and which requires large efforts to make the water fit for human use, may not be as successful as it appears if all costs are considered. Similarly dams, irrigation schemes and other projects which affect the water sector, usually have ramifications in several sectors, all of which need to be considered.

Inter-sectoral linkages relate to the water and sanitation sector's relationship to other major economic sectors which are themselves the subject of analysis, planning and investments.

Cross-sectoral linkages refer to linkages which cut across sectors so are common concerns for the major economic sectors.

3.3.2 Inter-Sectoral Linkages

The three most important uses of water are agriculture, hydro-electric power generation, and domestic/municipal/industrial water supplies. This trilogy of water-related sectors is almost inseparable and nearly all large water resource development schemes involve all three. Of these sectors, energy production is an in-stream use while the other two are extractive uses. Municipal/industrial uses generally return 85 percent or more of their withdrawals, but irrigation has a high consumptive character and can return less than 10 percent. Other important in-stream uses are fisheries, transportation and recreation/tourism. Another kind of non-withdrawal use, in a category by itself, is the carrying of waste discharges; the degradation of water quality through pollution is a growing world-wide concern. Clearly it is of critical importance that great care and attention must be given to the planning and management of water resources in order to maximize the benefits to society and the environment by these various uses.

Energy

Hydroelectric power generation and energy from firewood directly impact on the water sector.

Hydroelectric use is in-stream; however, it must be carefully planned so that the quantities of water and the timing of the withdrawals are compatible with other uses. Ultimately there must be compromises in arriving at the best use of the resource. Integrated planning with the other users is mandatory for optimum use, both in the short as well as the long-term.

Fuelwood represents the energy source for most of the developing world. Its supply is very strictly limited. In recent years, this resource has been over-exploited, with the result that serious deforestation has occurred in many parts of the world. One of the effects of deforestation is heavy increases in soil erosion and consequent impacts on the water-retaining abilities of the soils, with resultant increases in runoff. In the interests of sustainability of development, it is critical that this problem be brought under control.

Agriculture and Land Use

Agriculture represents one of the main uses of water by human beings. This includes the growing of crops in fields, paddies, gardens, forests and orchards. It also includes watering and caring for livestock as well as the growing of fish in ponds, lakes, streams and rivers.

The linkages of agriculture with water are extremely close and symbiotic. Indeed, it is true to say that without water there could be no agriculture. The extent, productivity, and value of the agriculture sector depends, to a large degree, on the water resources available for its use, as the following examples illustrate:

- The availability of water for irrigation has permitted human beings to make deserts bloom in a manner which many would consider miraculous. Examples can be seen in California, Texas, Israel, Alberta and hundreds of other locations in the developed and developing world. Even in cases where rain-fed agriculture is possible, irrigation projects which permit supplying additional water at critical times result in enormous increases in agricultural productivity.

- Groundwater is used by farmers and ranchers in most countries for livestock watering purposes and support of animal husbandry in areas with little or no available fresh surface water (e.g. Texas, the Sahel).

The quantity and quality of water available (for agriculture as well as other purposes) can be profoundly affected by the extent and type of agriculture practiced:

- In St. Vincent, a small island in the Caribbean, the flow of mountain streams and rivers is being dramatically altered by agricultural practices whereby small farmers in search of land are climbing higher and higher up the steep slopes of their volcanic mountains, cutting trees, planting cash crops and thereby eliminating the vital forest ground cover protecting the fragile soils. The results include heavy soil erosion, mud-filled streams, and water supply systems that are seriously reduced by dry weather stream flows. This pattern is repeated in many parts of the world.

- The increasing use of agricultural chemicals such as fertilizers and pesticides poses lethal hazards for fish and other aquatic life dependent upon a non-polluted habitat for survival. Already many cases have been documented where aquatic life has been decimated by the pollution caused in part by agricultural chemicals being washed into water courses by runoff. Not only is the water polluted, but often additional resources must be expended to clean up these waters.

These examples demonstrate that the linkages between agriculture and the water sector are many, varied and work in both directions. Planning and management for water resources need to be sensitive to and reflect these many and varied inter-relationships.

Forestry

The problems with deforestation because of fuelwood cutting have already been mentioned. The largest single cause of forest destruction, however, is the conversion of forests to farmland in order to provide more food. An alternative way to achieve food security is to improve existing agriculture, sometimes by increasing yields through irrigation.

Forestry exploitation often has negative effects on water resources. On the other hand, well-managed forests and reforestation programs have the potential to contribute very positively to water supplies. There is a strong need for effective coordination of policies and programs among the various sectors concerned to ensure that the environment is preserved for the benefit of present and future generations.

Transportation

The regulation of stream-flow to ameliorate the devastation of floods and lessen the effects of drought is also of great benefit to navigation. Rivers and lakes throughout the world are major transportation systems of great economic value. Thus, activities which improve the regime of rivers, for whatever initial purpose, can benefit many other users.

Fisheries, Wildlife and Tourism

No matter where one travels, in developed and developing countries alike, there are always people fishing. It is a widespread recreational pursuit in addition to its obvious importance as a producer of food. The value of the fishery resource must never be ignored and means to enhance that value need to be incorporated in water resource development projects. Although water-based recreation is not of great significance in developing countries when compared to the developed countries, tourism has become of immense economic importance to many of them. In this context, clean water for drinking and for recreation is essential. Sanitation services are equally necessary.

Health

Much is said in other parts of this report about the close relationship between water and sanitation and health. The major benefits of water and sanitation projects is in the health area, but without close cooperation between the sectors, much of the health benefit is not attained. For example the shortage of fuelwood or other energy sources makes the boiling of drinking water difficult, with resultant effects on the spread of diseases. Similarly health programs without water and sanitation also do not achieve their potential.

Industrial/Commercial

The majority of industrial enterprises require water for uses such as mining, manufacturing processes, and for cooling. Some, like steel making, food processing or pulp and paper production, need large quantities. Many large enterprises use water directly from rivers or lakes; indeed, large water users tend to locate near a dependable water source. However, most industrial and commercial enterprises draw their water from municipal supplies. Technological progress is being made in the conservation of water and the elimination of pollution. In the mining and ore-processing industry, recycling and reclamation from tailings ponds has not only reduced pollution, but also permitted water requirements to be reduced by 40 percent, and enabled the reclamation of valuable minerals. The capture of heated water discharges from thermal power plants has given birth to aqua-culture for fish raising and hydro-culture for fruit and vegetable growing. Canadian capability in developing closed-cycle technology in the food-processing industry has cut water demand and reduced pollution.

3.3.3 Cross-Sectoral Linkages

Women and Water

In developing countries, the domestic supply and use of water is a women's issue. In the overwhelming majority of rural and urban-fringe societies, women are the primary drawers, carriers, and users of water. They are also the managers of household water resources and the principal influence on family hygiene habits and health.

The traditional role of women in water supply and sanitation points to their potential roles in this sector. They are acting agents who can and should participate in project planning, construction, operations and maintenance, management, as well as in complementary health education programs. Women's involvement can contribute to reaching project objectives of improved water quantity, quality, and health. Thus, the active support of women can translate into real benefits to the sector.

But women should be involved throughout water supply and sanitation projects, not just for the benefit of the project, but as beneficiaries themselves. Women will benefit from cleaner and safer water. They will gain time, better health for themselves and their children, and they will gain experience, knowledge and confidence which will allow them to contribute to other community projects.

Examples from a number of African, Asian and Latin American countries demonstrate that women's effective involvement can result in benefits both for the water project and for the women themselves. The following three examples are illustrative of the benefits of involving women in sector projects.

(a) In Pakistan, women sanitation promoters in the Baldia slum, near Karachi, mobilized women and other community groups for self-help efforts which resulted in 70 percent of the households building latrines.

(b) The Kwale Project in Kenya (run by KWAHO, the Kenya Water for Health Organization) is creating a village-based maintenance capability for its handpumps. In Kwale, women are trained in the repair and maintenance of handpumps which are designed and manufactured in Kenya with women's specific requirements in mind. Three or four women are able to lift the entire pump out of the well and repair it themselves. Within the user community, Kwale women have proven to be more reliable, consistent, and effective than their male counterparts in maintaining the water facilities.

(c) Data from studies on women's time budgets indicate that women have used savings in time and increased access to water for both domestic and economic purposes. In projects in Thailand, the Philippines, Honduras, Peru, Zambia, and Botswana, women reported using time gains to grow vegetables and flowers for market, to tend livestock, and to make homecrafts.

The recognition by national governments and international aid agencies of women's potential contribution to water supply and sanitation has been a slow process. Indeed, during the 1970's women continued to make their daily trudge to the wells and water holes while government officials and water project personnel discussed the problems of domestic water supply with the male village leaders.

In the early 1980's, most international and local planners came to recognize that the active help and support of women must be sought and gained in order to achieve success in rural and urban-fringe water supply and sanitation projects. The challenge now is to establish exactly how to promote and achieve women's optimal participation.

Several international organizations are presently involved in dealing with this challenge. These organizations include CIDA, UNDP/PROWWESS (the UNDP Project for the Promotion of the Role of Women in Water and Environmental Sanitation Services), INSTRAW (Institute for Studies, Training, and Research for the Advancement of Women), and IDRC.

Environment

Reference has been made in previous chapters to the rapid deterioration of the earth's environment. No better vehicle serves to focus on this issue than the recent report "Our Common Future" (WCED, 1987). That report clearly indicates that the life-threatening challenges in the developing world relate to desertification, deforestation, and pollution, and that Third World countries endure most of the poverty associated with environmental degradation.

The WCED report states six major proposals to stem the loss of our environmental and water resources:

- governments must make key agencies responsible for ensuring sustainable development;
- governments should give the needed powers to its environmental regulating and resource development agencies;
- UNEP's Earthwatch program should be developed to identify and assess risks of irreversible damage to natural systems and threats to survival;
- the public should be informed of the real risks and involve them in developing solutions;
- international and national laws should be developed to ensure future generations an adequate environment; and
- all bilateral and multilateral agencies and development banks should incorporate a commitment to sustainable development in their planning and programming.

An important underlying assumption for the recommendations presented in this paper is that environmental improvements and preservation are only possible in the Third World in the context of improving the standard of living of the poorest people (See Box 3.3).

Integrated Rural Development

Integrated rural development (IRD) projects or programs are multi-sectoral by definition. They usually comprise activities in agricultural development. The main justification for IRD is to capitalize on the multiplier effects of mutually supportive activities. IRD projects almost always contain numerous projects in the water sector such as water resources development for irrigation or drinking, sanitation and solid waste disposal. These projects have strong linkages to other sectors such as agriculture, forestry, fisheries, health and education.

Groundwater development, wells and pumps are common components of rural development programs. Where appropriate, the provision of surface water supplies may contribute directly to the IRD program's objectives, or indirectly by contributing to health and welfare purposes. Few health projects in rural areas leave out water supply as an element.

Larger IRD programs carried out on a regional basis often require river basin planning, development and management in order to provide flood control, irrigation and industrial water supplies as well as municipal supplies.

Global Trends in Human Settlements **Box 3.3**

In 1800, some 50 million people - about 5 percent of the total population- lived in urban areas throughout the world. By 1985, more than 2 billion people - about 42 percent of the total population - lived in urban areas.

Urban population growth has also been more rapid in many Third World nations in recent decades because of rapid economic, social and political changes since 1950. These changes have generally led to a concentration of new employment and educational opportunities in urban areas. In turn, these opportunities have stimulated large-scale population movements from rural areas and frequently from smaller urban centers as well.

During 1950-85, the level of urbanization (ie. the proportion of the population living in urban areas) increased in all regions of the world. U.N. figures indicate that in Africa the urban population increased from 15 to 32 percent of the total population.

In Asia, the level of urbanization increased from 17 percent to 28 percent.

Health surveys in squatter communities or other city districts with a high proportion of low-income residents often show higher infant mortality rates than surveys made in rural areas, even if the city average is lower than the rural average. An example is the slums of Haiti's capital, Port-au-Prince, where the infant mortality rate was 200 deaths per 1,000 live births, with another 1000 deaths of children between the ages of 1 and 2 years, nearly three times the mortality rates in rural areas. In Manila, the infant mortality rate in the squatter communities was three times that of the city.

The pattern of a higher proportion of urban then rural populations with access to piped water and sanitation is consistent across a wide spectrum of countries and regions. However, some care must be taken in interpreting these data; access to piped water includes people living within 100 meters of a piped supply, not just those who have running water.

In addition, piped water is not guaranteed safe. The water supply in many cities is contaminated, often from sewage seeping into the pipes of the water distribution system when water pressure drops because of overloading or poor maintenance.

The statistics on access to toilets and latrines can also be misleading. Many poorly designed and maintained latrines are a major cause of infection, especially in high-density settlements and where they are shared by many. Even relatively sophisticated flush toilets can be centers of infection when, as is common in tenements or cheap boarding houses, 30 or more people share a facility.

Source: IIED/WRI (1987) "World Resources" p.26-30

Human Resources Development and Education

Human resource development has always been recognized as a key fundamental to the development of the Third World. For this reason Canada has, from the beginning of its aid program, emphasized education and training. No other activity has as much potential to help the people of developing countries to help themselves as assisting them with the development of their human resources. The lack of effective institutions and the lack of technical and managerial skills are major constraints affecting the progress of these countries. These constraints cut across all sectors as a common problem. To a very large degree the solutions are also common. In the first place, many of the personnel can work effectively in many sectors. This applies, for example, to managers, accountants, economists and support staff. It is a common experience that personnel trained for service in one sector - say agriculture - end up in another - say banking. Also, problems of training and development of skills are common to all sectors and the programs undertaken to solve them are also common to all sectors. There is, therefore, a need for external support agencies and developing countries' governments to work closely together in the human resources development field so that progress can be made across all sectors. Furthermore, many issues, such as environmental concerns, require the support of the general population and, so, the education and awareness of the general public becomes important.

Urbanization

The phenomenon of accelerating urbanization in developing countries is one of the most difficult challenges facing development planners and practitioners worldwide. Two-thirds of the population growth in developing countries from 1985 to 2000 is expected to occur in the urban areas.

The United Nations' projections of world populations from 1985 to 2025 (See Table 3-7 and Figure 3-1) indicate that the total world population will increase from 4.84 billion (1985) to 8.18 billion (2025), a total increase of 3.34 billion people in 40 years. Of this increase, 93 percent (over three billion) are estimated to be in the developing world, including an additional 2.75 billion people who will be living in the urban developing world. The rural population in the developing world is expected to increase from 2.5 billion in 1985 to a maximum of about three billion shortly after the turn of the century, and then slowly decrease over the next 20 years. The urban population in the developing world, however, will continue to increase from 1.16 billion in 1985 to a projected population of four billion by the year 2025.

These figures indicate the growing need for urban, as well as rural services, that will be required over the next several decades. It will require a global effort of all communities, governments, aid agencies and NGOs to meet these needs - particularly for water and sanitation, as these needs are so basic to human life and dignity.

The challenges for the water and sanitation sector are similar to those in other sectors such as housing, education, employment and health. The numbers of people arriving in cities and living in the urban-fringe areas outstrips the capability of governments to serve them in an organized and traditional way. Recently, there has been some progress in communities organizing services for themselves - with limited assistance from governments or aid agencies.

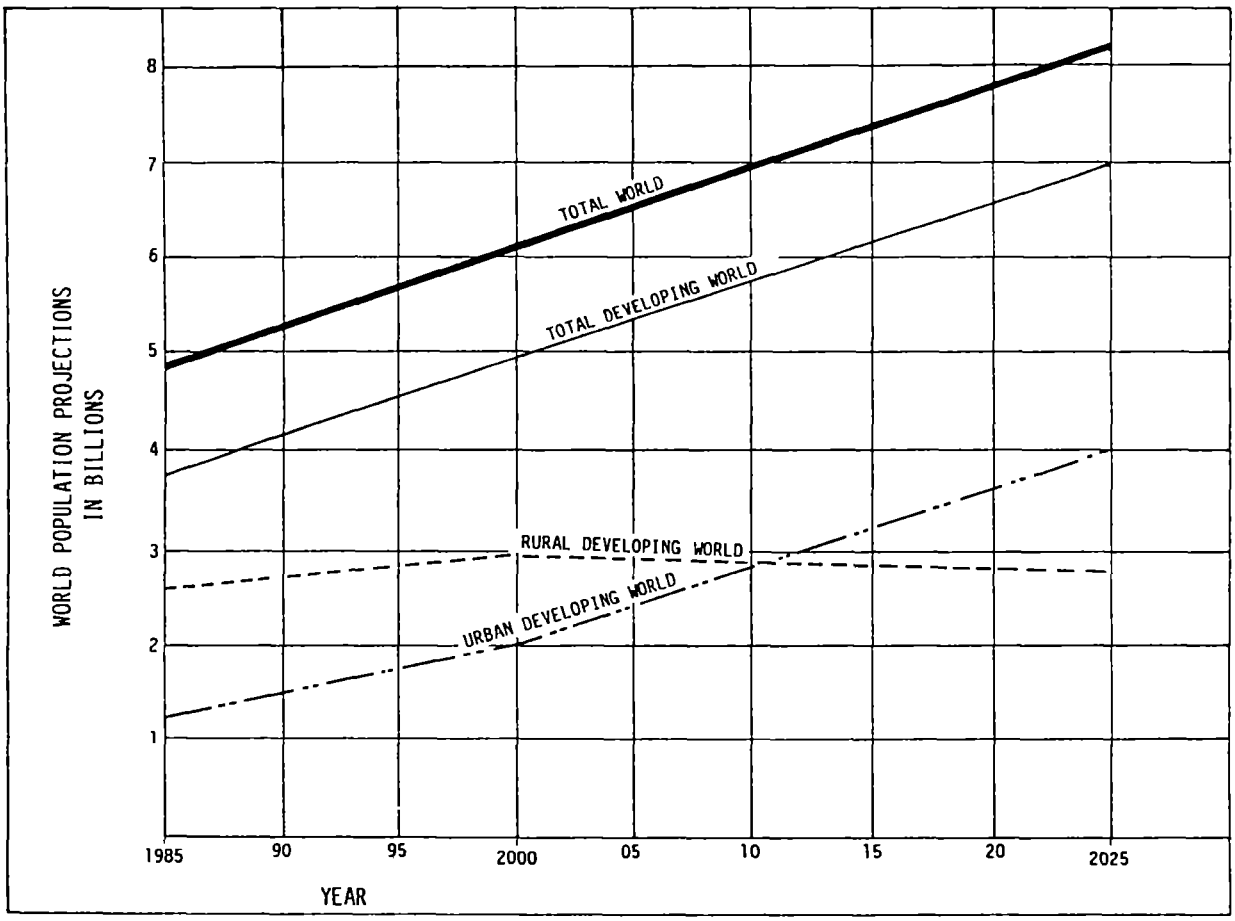
Massive efforts by all segments of society will be required to supply water and sanitation services for these large increases in world populations, particularly in urban areas. The urban population growth in the developing world is projected to be 82 percent of the total increase in world population from 1985 to the year 2025.

Table 3-7
UN Projections of World Populations
(millions)

Year	Developing Countries			World
	Urban	Rural	Total	Total
1985	1,164	2,505	3,669	4,842
1990	1,390	2,650	4,040	5,248
2000	1,959	2,892	4,851	6,127
2010	2,681	2,983	5,664	6,995
2020	3,496	2,933	6,429	7,806
2025	3,915	2,865	6,780	8,177

Source: UN (1985b).

Figure 3-1
UN Projections of World Populations



Source: UN Publication ST/ESA/SER.R./58, New York, 1985.

Chapter 4

CANADIAN EXPERIENCE AND CAPABILITY IN WATER AND SANITATION

Chapter 4

CANADIAN EXPERIENCE AND CAPABILITY IN WATER AND SANITATION

4.1 BACKGROUND

Canada has an international reputation for clean water, clean cities and good management of water resources. It may be overlooked that this was not always so. Canada has made, and continues to make, significant progress in this area as the following examples illustrate.

From 1903 to 1913, the typhoid death rate in Ontario was 24.4 per 100,000 people (44.2 in Toronto in 1910) which was three times the rate prevailing in Europe. Ottawa suffered two major outbreaks between 1910 and 1913. As late as 1923, the town of Cochrane, Ontario, suffered 800 typhoid cases in a population of 2,900. The marked improvement in conditions of child mortality and the reduction of cases of typhoid by the late 1920s is attributable to improved provision of safe, clean water supplies and environmental improvements by the proper disposal of liquid and solid wastes.

The major population centres in the province of Quebec are located on the shores of the St. Lawrence River. These include Quebec City and Montreal. Until recently, many Quebec towns and cities discharged untreated sewage into the St. Lawrence River. This situation is about to change dramatically in the next few years as the treatment plants and systems now under construction or in the planning stage come into operation. Montreal recently completed a huge sewage treatment facility. The last few years have seen the growth of a strong commitment by Quebec to implement pollution controls. Planning and design studies have been done and construction is underway on an $8 billion program which should result, by 1993, in all major centres operating sewage treatment plants.

In the Prairie Provinces, a number of rivers rise in Alberta and subsequently flow through Saskatchewan and Manitoba on their way to the sea. These rivers provide water for domestic, agricultural and industrial uses on the prairies. Prior to 1948, there were many inequities in the use and control of these waters. In that year, the Prairie Provinces Water Board was formed, with the mandate to plan and regulate the management of water between the provinces. This Board has functioned very effectively in the area of water quantities since its creation and has more recently concerned itself with water quality as well.

The three cases quoted above demonstrate Canadian experience in water sector management which, until recently, was not greatly different from present-day conditions in a number of developing countries. Canadian experience in improving water and waste management is, therefore, recent and relevant and contains many elements of technology and management that can be usefully transferred to developing countries.

The last 40 years have been marked by population growth, economic development, and urbanization throughout the world. With this transition has come the desire for an enhanced standard of living. Canada has sustained this pace of change and growth, and its services have kept pace with the public desire for improvements in national well-being. In particular, Canada's management of water and wastes has been remarkably successful in comparison with most developing countries. The reason for Canada's fortunate position is often attributed to its national wealth, but this is too facile an answer. The fact that Canada's urban services are well developed stems from a close and effective working relationship between the population, governments and the private sector. The governments' role has been to define the regulations and service standards, as well as making funding available to meet public health requirements and to reflect the population's desire for the additional convenience associated with improving lifestyles. The private sector - engineers, architects, manufacturers and construction companies - have been adept at economically translating both the regulations and perceptions of improved well-being, into the hardware and services required by the water and waste disposal industries.

This skillful working combination of organization, management and technical ability in the public and private sectors' expertise is the core of the evolutionary process of improving water and sanitation services. It is this combination in which Canada excels and which it can effectively transfer to other nations, especially in the conduct of large or small urban projects.

Canadian expenditures on sophisticated urban systems should not divert attention from the fact that many rural homes and cottages in Canada are fully and adequately served by properly sited and maintained wells, pit privies or septic tank systems. More importantly, these expenditures should not conceal the fact that Canada moved to its present position in stages, each step in the advance reflecting its growth in wealth.

Yet another dimension to the challenge faced by Canadians in the water and sanitation sector has been to provide adequate services to the native communities in remote and northern locations. Often these have presented very difficult and novel challenges (permafrost, mobile populations). In some cases, the services are still inadequate and appropriate solutions are still being sought. There is a clear parallel here to the situation in developing countries where solutions need to be innovative and tailored to the individual case. Experience in Canada with the simpler systems is, therefore, recent and ongoing and successfully demonstrates the competence to design, manage water and waste services and meet basic public health requirements in an economical manner.

In the area of water resources management, the story is a similar one. Canada is blessed with a disproportionate share of the total fresh water available on the earth. In the past, this rich blessing sometimes meant that water could be used with little or no thought to its preservation and management. Cases of abuse, mismanagement and pollution were many, with resultant effects on environmental conditions which interfered (and in some cases continue to interfere) with fisheries, recreation, and wildlife. However, over the years, a strong and effective capability has grown in this country. This capability has been driven by public pressure and effective technical inputs from government and private sector expertise which has been supported by a strong and flourishing economy. Canada's water resources management capability and programs are now among the best in the world. This capability is rich and varied. On the policy side, it includes numerous government and non-government agencies which make contributions to the sector through research, studies and public education. On

the program implementation side, a great deal of technical expertise and capability exists in government departments as well as in private companies.

Canada's capability in the water and sanitation sector is strong and vibrant, based on the Canadian experience of providing service and managing the resource. During the last 30 years or so, this experience and capability has been developed and deepened by involvement overseas, including work in many developing countries. Thousands of Canadian individuals and dozens of Canadian consultants, construction and supply companies have worked abroad on water-related projects in the Third World and have successfully demonstrated the capability and relevance of the Canadian experience. This involvement has been diverse: large companies working on multi-million dollar projects in integrated water resources management; small companies on limited assignments; individuals on contract to CIDA, other agencies, governments and NGOs working at the grass roots level.

A number of Canadian private sector firms have developed a strong international reputation for work in this sector. This group includes a number of consulting firms which, over the years, have gone from small to larger projects. It also includes a number of firms specializing in construction management and procurement (See Box 4.1).

At the grass roots level of promoting the requisite organization, management and appropriate technology for smaller projects in rural areas of developing countries, the evidence shows that Canadian private companies, as well as voluntary, non-government organizations, have been very successful. The combination of managerial skill, a working knowledge of appropriate solutions to water and sanitation problems, and enthusiasm has demonstrated an enviable record of achievement. The long experience and success of NGOs suggest that they will have an important role to play in larger and urban projects, helping to resolve the human problems which are at the root of all water and sanitation projects.

Solid waste management, as with water and sanitation services, is an area ripe for managerial assistance from Canada because it commands a disproportionate fraction of municipal taxes in developing countries. It often absorbs 20 to 40 percent of municipal taxation (e.g. 37 percent in Abidjan), compared with approximately 10 percent in Toronto. Without careful planning, further increases could readily introduce unacceptable municipal fiscal stress or diminish other essential municipal services. For example, the city of Karachi collects only one-third of its urban solid wastes. While it seeks to improve the service by the addition of extra collection vehicles, the implicit question is the rate at which municipal revenue can be reasonably increased to pay for additional services. What is required is sensitive management by government, and private sector firms, to ensure that improvements undertaken have support and financing by the population. Canadians have demonstrated, both at home and abroad, that they are up to this task and are well able to provide the assistance required.

WESTERN CANADIAN CONSULTANT APPLIES DOMESTIC EXPERIENCE INTERNATIONALLY **Box 4.1**

In Alberta, the number of water and sewer systems grew from about 20 at the end of World War II to several hundred within the next 30 years. Consulting engineers who promoted, designed and supervised these schemes had to understand peoples' needs, work with community groups and provide facilities which were both effective and which afforded appropriate technical solutions.

Stanley Associates Engineering Ltd. was formed in 1954. In the 1960's, the firm began to work internationally, initially as a sub-consultant, and in 1968 Dr. Stanley undertook a direct assignment in Malaysia for WHO. Stanley's first job for CIDA was in Jamaica (1970-72) where the firm worked on water supplies for four towns. The successful completion of this CIDA project led to the firm being chosen by the Jamaican authorities for other assignments, financed by multilateral institutions.

Stanley's Asian experience began in 1968 on a pollution control study in the Philippines financed by UNDP. Shortly afterwards, the firm began working on projects in Korea financed by the World Bank and ADB. They have now designed water supply systems to serve over eight million persons in that country alone, and have completed projects in Vietnam, Malaysia, several of the Caribbean Islands and in Anglophone Africa. Today the firm has about 500 staff and operates successfully internationally, earning about 20 percent of its revenues from foreign work. National and provincial awards have been received for export performance.

The way forward seems clear. Canada has the special skills, knowledge and recent experience in rapid development in the private and public sectors, and in voluntary NGOs. These assets can greatly assist developing countries in the provision of efficient water and sanitation management systems.

4.2 PERSONNEL ENGAGED IN THE WATER AND SANITATION SECTOR

This section presents an overall picture of the estimated number of people working in the sector, together with a brief commentary, including the source of information for the estimates. Detailed descriptions of the capability and experience for the various categories of personnel is provided in Section 4.3.

The human resources involved in the management of Canada's water sector number over 100,000 and are located in three levels of government, crown corporations, private companies, educational institutions and non-governmental organizations. To complicate the definition of personnel servicing the water sector, these persons are located, in part, in the agricultural, power, health sciences, fisheries and manufacturing sectors of the economy, as well as in the environmental field.

Table 4.1 provides, by sector of the economy and regions of the country, an estimate of the equivalent personnel working in this sector in Canada. These personnel estimates have been divided into three divisions - water supply and sanitation services, water resources management and solid waste management. No effort has been made within the Table to define the various levels of expertise and types of professionals and trades available.

One important group of personnel which is not reflected in Table 4.1 are people experienced in community motivation and education, including personnel working for non-government organizations. The capability and experience of NGOs is discussed in Section 4.3. Unfortunately, data on personnel in these organizations are not readily available.

According to the figures in Table 4.1, there are just over 100,000 people working in the water and sanitation sector in Canada. The methods used to arrive at the estimates varied from actual tabulation of personnel to deriving them by applying factors to overall budget figures. The figures for Construction Services were derived by applying factors for labour to the construction volume. Similarly, the figures for Municipal governments were obtained by applying factors for personnel costs to the Municipal budget figures for the three subsectors. Between them, these two categories account for well over half of the total personnel. The next two large groups of personnel are located in Manufacturing and Industrial Systems and between them account for about 25 percent of total employment in the sector. These figures too were derived, as opposed to counted. The remaining categories are all less than 5,000 for any category. It is interesting, but not unexpected, to note that the smaller categories are comprised mostly of professional staff, whereas the larger categories include professional, technical and labour in their composition.

In terms of the three subsectors, 69 percent are in water/sanitation, around 22 percent in solid wastes and nine percent in water resources management. The relatively small figure for water resources management is understandable when it is realized that the operational aspects of this subsector are much smaller than those in water/sanitation and solid wastes. It must be remembered that hydro plants, irrigation and water transportation systems are excluded from this category.

4.2.1 Federal Government

More than 22 federal departments and agencies can be identified with a significant interest in water. Environment Canada, Fisheries and Oceans, Indian Affairs and Northern Development, Agriculture, Transport, Health and Welfare and the International Joint Commission are the major ones. Information on the number of personnel and their employment was gathered from "Currents of Change - The Report of the Enquiry on Federal Water Policy", 1985 and the Regional Directory of Environment Canada for July 1987. Figures were interpreted with the assistance of a number of personal contacts in various ministries.

Table 4.1 : Estimated Number of Personnel in the Water and Sanitation Sector

Region/ Sector	Government			Private Sector				Training & Educational Institutions	TOTAL
	Federal	Provincial	Municipal	Consultants	Construction Services	Manufacturing	Industrial Systems		
ATLANTIC CANADA									
Water/Sanitation	120	210	1,090	70	2,320	170	630	40	4,650
Water Resources	60	80	10	10	210	20	0	20	410
Solid Wastes	20	100	1,000	20	200	20	130	0	1,490
QUEBEC									
Water/Sanitation	370	340	3,240	980	4,000	2,370	2,700	110	14,110
Water Resources	510	190	80	570	500	260	0	110	2,220
Solid Wastes	180	60	1,500	60	1,200	1,400	900	10	5,310
ONTARIO									
Water/Sanitation	280	1,180	7,730	760	8,960	6,300	5,250	220	30,680
Water Resources	180	380	330	110	790	700	0	110	2,600
Solid Wastes	40	100	7,400	220	790	1,580	1,750	0	11,880
WESTERN CANADA									
Water/Sanitation	170	460	5,780	860	7,840	3,170	2,250	190	20,720
Water Resources	590	1,210	40	550	1,120	350	0	180	4,040
Solid Wastes	60	200	1,420	320	1,000	80	750	30	3,860
TOTAL	2,580	4,510	29,620	4,530	28,930	16,420	14,360	1,020	101,970
ALL CANADA									
Water/Sanitation	940	2,190	17,840	2,670	23,120	12,010	10,830	560	70,160
Water Resources	1,340	1,860	460	1,240	2,620	1,330	0	420	9,270
Solid Wastes	300	460	11,320	620	3,190	3,080	3,530	40	22,540
TOTAL	2,580	4,510	29,620	4,530	28,930	16,420	14,360	1,020	101,970

(See text of Section 4.2 for sources of information of data)

Table 4.1 identifies federal personnel numbering 940 in water supply/sanitation, 1,340 in water resources and 300 in solid wastes, for a national total of 2,580 persons.

In a further analysis federal services are concentrated by person-years as follows:

Water research (Environment, Fisheries & Oceans)	730
Water data collection (Environment, Fisheries & Oceans)	750
Water pollution control (Environment, Fisheries & Oceans)	630
Drinking water (Agriculture, Health and Welfare, Indian Affairs and Northern Development)	10
Flood control (Environment, Transport)	160
International and interprovincial agreements (Environment, External Affairs, International Joint Commission)	240
Administration of Northern Waters, (Indian Affairs)	60
TOTAL	2,580

An analysis of these person-years indicates that about 65 percent of staff can be considered professionals and managers and the remainder technicians or clerical staff.

4.2.2 Provincial Governments

Because responsibility for health and for natural resources management and use falls mainly into the provincial domain, provinces have a large interest and large staffs in these areas. Although much of the detailed responsibility is delegated to the municipal levels, provincial personnel staff in the water sector are estimated at 4,510. This is 75 percent greater than in the federal government. Of this total 2,190 are concerned with water and sanitation services, 1,860 with water resources management and 460 with solid waste management. As at the federal level, the responsibility is shared by many departments, the major ones being Health, Environment, Agriculture, Natural Resources and Municipal Affairs. Expertise is distributed throughout all professions and trades.

Several provinces, such as Ontario and Manitoba, actually operate regional water supply and sewerage services as well, which inflates their employment under the "water and sanitation" designation. Western Canadian provinces require a large proportion of their personnel to manage their water resources due to the wide variations in supply.

Waste management personnel requirements are growing, mostly in a regulatory role, although several provinces have now created crown corporations to deal with hazardous waste management.

All provincial electric power commissions contain considerable staff relating to water management. Expertise in water management also exists in conservation and irrigation districts which, despite some local autonomy, come under provincial control.

Catalogue 72-007 of Statistics Canada contains data relating to provincial employment under water sector functions. These data were supplemented by contacts within provincial governments of several provinces to arrive at the figures in Table 4.1.

4.2.3 Municipalities

Information on municipal employment was calculated from data supplied by Statistics Canada under Catalogue 68-204. In many cases, these data had to be adjusted for the three subsectors, based on estimates provided by individual managers working in various municipal governments and associations such as the Ontario Waste Management Association. The actual employment figures were calculated using factors applied to local government expenditures in the various categories.

Municipalities provide by far the largest reservoir of practical management of water supply and sanitation operations. Many municipal systems have excellent professional, technical and laboratory capabilities and proficiency. More than one quarter of the total expertise for the sector resides in the municipal employment, almost 30,000 persons, with the greater portion (85 percent) being trained technicians, operators, bookkeepers, statisticians and clerical support and the remainder professionals.

The foregoing figure of 30,000 includes approximately 5,000 persons representing staff of private contractors servicing the solid waste collection system of numerous municipalities. Municipal capability is highly relevant to developing countries needs because of the ability to transfer technology at the operating level for water supply and sanitation services.

4.2.4 Consultants

The data presented in Table 4.1 for Consultants were obtained from a number of sources. These included Statistics Canada 1982 reports, special reports prepared for DRIE in 1982 and 1985, directories of consulting engineers and direct contact with a number of engineering firms. Total employment in the private sector engineering field is approximately 40,000, employed by around 2,250 firms. Approximately 12 to 15 percent of these personnel are estimated to work in the water and sanitation sector in around 210 firms. Direct contact with firms has confirmed these ratios. Most of the water and sanitation work is done by firms engaged in municipal engineering which also includes roads and sidewalks, etc. The proportion of staff mix in firms was reported in 1982 as being 33 percent professionals, 41 percent technicians, three percent non-engineering professionals and 23 percent administration and clerical.

On the international scene, over 20 firms out of the 210 engaged in this sector have carried out two or more projects overseas. Included are small companies and several large firms, which are very active internationally. On a global basis, Canadian firms rank fourth in the sector. Approximately eight percent of the earnings in the consulting engineering field are in water and sanitation (See Box 4.2).

CANADIAN EXPERTISE IN GROUNDWATER DEVELOPMENT **Box 4.2**

Hydrogeologists, specialists in groundwater, are relatively rare in Canada, numbering only a few hundred in total. Hydrosult Inc. of Montreal is a small firm which was established in 1980 to deal with groundwater and other water resources projects. Its first international assignment (1981) was to serve as project monitor for CIDA on a rural water project in Colombia. Later the firm planned hydrogeological investigations to be carried out with CIDA support in Indonesia as part of the Lower Solo River Planning Study.

Hydrosult's first feasibility report for a rural water supply project was carried out for CIDA in Niger in 1984. Other assignments is the Sahel followed. In 1987/88 Hydrosult completed a feasibility study for a rural water supply and sanitation project in Lesotho.

In Canada, the firm provides groundwater expertise for Hydro Quebec and various municipalities in Quebec.

But some 90 percent of Hydrosult's business concerns projects outside Canada, usually dealing with hydrogeological aspects of projects in developing countries. The United Nations Development Programme first used the firm to develop training programs for water resources staff in Arab countries (1984). Subsequently, Hydrosult has prepared and evaluated many other water projects for UNDP. In 1988 the firm was chosen to review water resources available for irrigation projects in Ethiopia.

The United Nations Sahel Office has chosen Hydrosult for two challenging assignments in the Gambia: a diagnostic study of well rehabilitation and the development of a mathematical model for groundwater planning.

Starting with its early CIDA assignments, Hydrosult is now using its special expertise to help supply more water for many developing countries.

4.2.5 Construction Services

This group of services include general contractors engaged in building facilities, building and operating solid waste management services, and the well drilling industry.

General construction employment numbers were derived from construction volume given in Table 18, catalogue 64-201 of Statistics Canada. The Journal of Commerce 1985 was also used, particularly to provide a breakdown into the type of construction activity. The actual number of personnel reported in Table 4.1 was derived by applying factors to the construction dollar volume for the various subsectors. Employment in the private sector of the solid waste field was provided by the Ontario Waste Management Association.

4.2.6 Manufacturing

Figures in Table 4.1 are estimates of the number of persons employed by companies which manufacture pipes, mechanical equipment, treatment plants for water and sewage, instrumentation systems, solid waste collection and disposal equipment, and equipment for water resources projects such as gates, control valves, well drilling equipment and pumps. Information to confirm the estimate of 16,420 people working in this area was obtained from the Canadian Trade Index provided by the Canadian Manufacturers Association - 1986. The split of personnel between water/sanitation and water resources manufacturing is arbitrary, with 10 percent of the totals being allocated to water resources manufacturing.

4.2.7 Industrial Systems

The group of personnel shown in Table 4.1 under industrial systems and numbering 14,360 includes persons working in the control, operation and maintenance of industrial water and wastewater systems who are not included in other categories. These people work mainly for industrial companies that use water which must be treated and processed and subsequently discharged as wastewater. It must also be treated and processed before being discharged back into water courses, or into municipal sewerage systems. The estimates of personnel were obtained by adjusting figures for Ontario on a national basis. See Section 4.3.7 for further comments.

4.2.8 Training and Educational Services

Personnel working in the water sector of training institutions are found mainly in the various universities and colleges with full-time courses in this area, as well as a number of government training institutions. These are discussed more fully in Section 4.3.8.

Table 4-1 shows that there are approximately 1,000 professional persons who have the potential to give educational assistance in the water and sanitation sector for developing countries. This figure was generated from "Educational Statistics for the Seventies" published by Statistics Canada as Catalogue 81-569. Figures derived from that source were pro-rated to determine professionals active in the water sector within universities and community colleges. These figures were adjusted for the subsectors on the basis of information provided by individuals working in a number of institutions.

4.3 EXPERIENCE AND CAPABILITY

The distribution of human resources in the water and sanitation sector in Canada is given in Section 4.2. The purpose of this section is to amplify the capability and experience of these personnel.

It must be kept in mind that Canadian capability and experience is extremely multifaceted and varied, not only because Canada itself is diverse and varied but also because over the last thirty years the experience of thousands of Canadians has been gained abroad, including working in developing countries.

It is important to recognize that the majority of experience in Canada relates to programs of greater sophistication and costs per capita than are appropriate or affordable in the developing world. There is, therefore, a concern that Canadian expertise will not adapt and gear itself to local conditions. However, Canadians are

pragmatists and generally insist on physical and fiscal efficiency of the service and temper the solutions, especially those of convenience, so they can be financially supported.

The experience of Canadians working overseas has been extensive and has included: service as individuals under contract to development agencies, local government departments and educational institutions; service as volunteer or contract personnel to NGOs; service as employees of large and small consulting companies; and service as employees of manufacturing and/or construction firms. Canadians have worked in the sector, in varying numbers, in practically every developing country. Similarly, the type of work and location of projects has ranged from urban, modern systems to very basic, rural systems. In most cases, once people have had overseas experience, they are favorably inclined to make themselves available again - either for short or long-term assignments.

One very important strength of the Canadian personnel resource base is its language diversity. In addition to the two official languages, Canadians speak many others because of extensive immigration to Canada from all parts of the world. These multilingual characteristics make Canadians particularly versatile and well-suited for work in developing countries.

In assessing Canadian resources for work in developing countries it is important to recognize the role played by the public and private sector - both in Canada and in the recipient country. In Canada, there has always been close cooperation between the public service, the private sector and the population served. The role of the public service has been strong and central in assessing needs, setting standards, and managing the programs, including the financing. The private sector's role has been to plan, design and build the needed works. Because of the relative weaknesses of the public sector in the Third World countries and the less effective communication and dialogue all around, the roles in developing countries are not always the same. In particular, consultants are often given far greater responsibility than they are in Canada. The implication of this should be reflected in staffing for work in developing countries. Consultants may need to integrate personnel with public sector experience in their teams when bidding for jobs.

The following sections provide additional comments on the capability and experience of Canadians by category.

4.3.1 Federal Government

The federal role requires competence in marine, lake and river basin water quality and quantity modelling and resource management. It also requires the associated knowledge of contributions of biological and chemical contamination from point and diffuse sources, as well as a knowledge of a wide range of abatement techniques.

The Federal Government performs a major role in the management of toxic chemicals, spills control, radioactive waste management, standards setting and in environmental impact assessment. Much of the role of the Federal Government in the area of environmental enhancement and protection is carried out through supporting research, collecting and disseminating information, and advocating and supporting needed changes.

World class research and technology development in the area of wastewater treatment and disposal is done at the Wastewater Technology Centre (WTC) of Environment Canada in Burlington, Ontario. Also, the National Research Council of Canada has an

Associate Committee on Hydrology (ACH) and, within this committee, a Subcommittee on International Activities (ASIA) on which both CIDA and IDRC are represented. These groups, and others, can provide support and assistance for CIDA's projects in water and sanitation in overseas countries.

The human and physical resources are concentrated in Environment Canada, but many of the skilled people and the analytical capabilities are also to be found in the Departments of Agriculture (e.g., agricultural pesticides, fertilizers and erosion products in drinking water sources, as well as infrastructure financing in Western Canada through the PFRA); Energy, Mines and Resources (e.g., geo-science of groundwater resources; radioactive and metals contamination of drinking water; fuels derived from urban wastes); Fisheries and Oceans (e.g., fish toxicity related to water quality standards); and Health and Welfare (e.g., human health related to water quality standards).

Expertise Available

- Water quantity and quality surveys - data acquisition, remote sensing, photo interpretations etc.
- Hazardous chemical and toxic waste identification and management, including risk assessment.
- Laboratory development and analysis programs.
- Water resource management, including drought proofing, flood control, habitat management, flow regulations etc.
- Watershed planning, including modelling options.
- Ground water surveys and management programs.
- Preparing regulations and guidelines for environmental protection.
- Identification and undertaking of research needs.
- Training of professional and technical staff.
- Development of public awareness and participation programs.

4.3.2 Provincial Governments

The provinces exert great efforts in identifying, quantifying and analyzing the quantity and quality of surface and ground waters, and in predicting the effects of water demand and of waste discharges upon water resources. These tasks command a substantial and highly-qualified staff, a strong analytical capability and well-equipped laboratories to deal not only with biological contamination but also with traces of toxic chemical substances.

Provincial water supply and sanitation management can be separated into two broad categories. One category is associated with the regulation of individual systems, typified by the rural dwelling equipped with a water well and a septic tank located on the property, and often served by a modest community solid waste collection and disposal system. The regulatory requirements for this category are usually simple and

influenced more by basic public health considerations than by convenience. The resources associated with these systems are important because, despite the relative lack of sophistication, they have been successful in maintaining public health. The principles employed seem to be appropriate for use in many developing nations.

The second category is associated with regulation of the community systems typified by the services provided to urban dwellings. In Canada, the services provided to cities include: a properly treated water supply, adequate for all domestic and fire-fighting purposes; sewer systems that remove domestic liquid wastes and drainage water from rainfall; treatment systems in most cities to cleanse waste water before discharge into the environment; and a highly organized solid waste collection and disposal system. The associated regulatory requirements and fiscal structures are elaborate and commensurate, not only with a high degree of public health protection, but also with a great deal of personal convenience. Costs are usually considerable.

Implicit in the provincial governments' role are the needs for the services of technical experts in the fields of medicine (e.g., public health risk analysis); law (e.g., legal drafting, enforcement); finance and revenue (e.g., community debt management and audits); engineering (e.g., design studies, construction, operations, maintenance, training); hydrology geo-science (e.g., groundwater availability and protection); chemistry (e.g. laboratory chemical analysis); and microbiology (e.g., laboratory microbiological analysis). Skills and experience associated with these experts are required at each stage of a project cycle: identification of need; feasibility studies; financial analysis; legal framework; funding; design; construction; operations and maintenance; training; and evaluation.

Expertise Available

- Identifying, quantifying and analyzing the quantity and quality of surface and ground water.
- Laboratory development and analysis.
- Watershed planning and modelling.
- Storm water management.
- Small and private system design and operation.
- Water withdrawal and wastewater discharge licensing regulations, surveillance and enforcement.
- Water supply and wastewater design standards and approval.
- Plant and system operation, maintenance and training (limited to some provinces).
- Solid waste management methodologies, disposal site selection and control.
- Technical and professional services in water-related issues - lawyers, engineers, hydrogeologists, economists, sociologists, chemists, biologists, toxicologists, operations research, etc.

4.3.3 Municipal Governments

Provinces delegate a large measure of their authority over water and sanitation management to the populous municipalities in Canada. Regulation at the local level is by means of by-laws made under provincial enabling legislation. The degree of delegation varies considerably from place to place but, in major cities, there is often near-autonomy in water supply and sanitation services, drainage and in solid waste management. Water resources management, though substantially represented, largely remains with senior government. For most of the services, the municipalities adhere to standards and codes set by the provincial ministries concerned. This applies to water supplies, sewerage, drainage and the solid waste disposal sites and systems.

Municipal water supply and sanitation management can be separated into two regulatory categories, the regulation of individual water and waste management systems, and the regulation of community systems. Population density and size are the main determinants in deciding whether individual systems provide acceptable service, though there are no hard and fast rules defining the boundary between individual and community systems.

Municipalities provide by far the largest reservoir of practical management of water supply and sanitation operations. Many have excellent professional and laboratory capabilities and technical proficiency. The same comment applies to solid waste management, where much of the outside operations are contracted out, but the control and standards are the responsibility of the municipality.

Despite the growing emphasis on operation and maintenance (O&M) in developing countries, Canadian government expertise, at all levels of government, is not readily available to service that need. Therefore, a program must be developed that will interest, and make available, government employees who can transfer this Canadian knowledge and experience to developing communities to meet O&M and other water management needs.

Expertise Available

- Management, accounting, personnel relations and finance as it relates to setting rates, billing and collection, system management, record keeping, personnel management, finance and debt servicing, computer systems, etc.

- Engineering planning, design and construction for water supply, wastewater collection and disposal, rainwater drainage and solid waste collection and disposal.

- Operations, maintenance and training in plant, system management and accounting.

- Regulatory and enforcement procedures for system operations.

- Public involvement and education programs.

4.3.4 Private Consulting Services

All levels of government rely heavily on the professional services of engineers, biologists, chemists, sociologists and geo-scientists, as well as economists, accountants and lawyers contracted from private firms to provide the up-to-date skills in the design and management of capital projects. Often they are contracted by governments and often they are engaged through developers who organize the resources required to carry out the planning and implementation of major projects.

Since the 1950's, Canada has produced a number of world-class companies, especially in the water and wastewater areas, and it seems clear that the present strong public interest is causing a comparable increase of capability in solid waste management. In fact, this process is already well started and new disposal techniques are being developed here. For example, methods to optimize the recovery of useful amounts of methane from urban waste are already under active investigation by the Ontario Research Foundation for Environment Ontario and show promise for a "Canadian" technology. Furthermore, private consultants are supplanting some of the roles previously assumed by the public sector. For example, the preparation and presentation to the public of socio-economic issues in environmental impact studies, the chemical and microbiological analysis of water samples, and analysis of trace chemicals are some of the tasks that are progressively moving into the private sector.

Some companies, including many of the larger ones, have a strong and growing capability in surface and groundwater resource assessment and planning, both in terms of quality and of quantity. Several of the larger ones have undertaken major water resources projects around the world and are very highly regarded in this field. This has been demonstrated in a number of countries such as Indonesia and Thailand. Some very recent work on industrial and agricultural chemicals in groundwater and surface water (e.g. the Niagara River) shows that Canada's experience is of exceptional quality.

Consultants can be expected to furnish economic analyses and cost comparisons for alternative methods of treating and distributing water; for collecting and disposing of wastewater and stormwater; and for disposing of solid wastes by landfill or incineration. Some who are expert in assessing the flow expected from wells are also attaining recognized expertise in predicting the movement of trace chemicals from landfill sites. A comparable competence is evident in the prediction of the movement of agricultural pesticides and fertilizers and of the consequences to surface and groundwater resources.

Expertise Available

Canadian consulting firms have a wide range of capability in many areas of this sector. Their Canadian experience in this field is naturally much greater than their experience in developing countries. Nevertheless, the latter has grown steadily over the last thirty years. Expertise covers the following areas:

- Fiscal planning and rate establishment.

- Water resource planning and development.

  - o remote sensing
  - o water quantity measurement
  - o quality surveys
  - o multiple-use planning and design, including benefit/cost analyses and construction supervision.

- Ground water investigation and exploration.

- Planning, design and construction supervision of conventional urban water and wastewater systems,

- Rural, northern and developing country water supply and sanitation schemes

- Solid waste management including recycle programs, collection system design, landfilling, leachate control, energy from waste facilities and source reduction programs.

- Project management and commissioning.

- Procurement and purchasing.

- Human resource development programs and institutional development programs.

- Rehabilitation programs, including unaccounted-for water surveys, leak detection programs, sewer infiltration and inflow control, pipe relining, etc.

- Environmental assessment, impact and planning.

4.3.5 Construction Services

A large construction industry has developed around water and wastewater services, and a substantial industry has been developing since the 1970's around the transportation and disposal of solid wastes. Some appreciation of the value of work performed by the construction sector may be gleaned from the estimate that the approximate replacement value of community water and sewer services in Ontario alone stands at $40 billion for an urban population of about 7.5 million people.

On the other hand, high costs have forced construction companies into fierce competition from which only the better-managed companies have survived, and from which a source of efficient construction managers are available for water and sanitation projects in developing countries.

Over the last dozen years or so, a number of Canadian firms have developed excellent procurement and purchasing capabilities to supply international projects. Some of them operate as engineering companies, while others operate as trading houses (See Box 4.3).

The well-drilling industry can also be grouped with the private construction area. This is well represented across the country, though there is relatively more strength in Western Canada and in Prince Edward Island where groundwater sources predominate. However, this industry is largely made up of small companies that see private contracting in developing countries as a high risk venture, beset by the hazards of long delays before payment. Nevertheless, the industry senses that there is room for optimism based on innovative approaches involving local joint venture partnerships.

The general experience of Canadian construction companies in international bidding is that they are competitive in limited areas. In common with others of the private sector, the desire to work in developing countries is often governed by the state of business in Canada. In overseas markets, economics and employment preferences usually dictate that skilled and unskilled labour should be found locally or supplied by a joint-venture partner from a country such as China, India, or Korea, where labour costs are suitably low.

SERVICE CONTRACTS FOR THE WATER AND SANITATION SECTOR ***Box 4.3***

Contractors, consultants and NGOs play an important part in sector projects funded by CIDA. A recent study of 106 typical service contracts for CIDA support to more than 30 countries revealed a total contract amount of $107.9 million for water and sanitation sector services.

The contract size ranges from a few thousand dollars to over $10 million. Most of the contracts are for consultants with some large contracts (over $4 million) for both NGO's and for contractors. The larger NGO projects are done under a "country focus" program which is funded by the Bilateral Branches. WUSC are implementing a project for water supply and sanitation in Darfur Province of Sudan with a CIDA contribution of $4.5 million. Crippen International Limited from Vancouver, B.C., won over $10 million in contracts for water resources work in Sri Lanka and a recent (1987) contract for $10.4 million for a water resources project in Indonesia. From Montreal, Quebec, the Consortium SDS Hydrogeo signed a contract (1985) for over $3 million for village water supplies in Niger. Callavino Inc., a contractor from Windsor, Ontario, received a contract (1984) for almost $7.0 million for pipeline construction in Cameroon. Several consultants from Atlantic Canada, along with others from Quebec and Ontario, have standing offers for on-going consulting services in this sector.

Expertise Available

Canadian construction and supply firms can offer:

- Excellent experience and capability in construction planning and management.
- Well drilling and groundwater production.
- Procurement and purchasing of materials and equipment for projects.
- Watermain and sewer construction techniques, especially rehabilitation.
- High quality construction contracting.

4.3.6 Manufacturing

Canada is a large and successful manufacturer of pipes, valves and fittings. Much of the remaining mechanical equipment for Canadian water and wastewater services is imported and distributed through agents, or manufactured by licensees or subsidiaries of foreign companies. While there is no doubt that the capability exists to design and manufacture from scratch, the development of the Canadian market has not warranted an indigenous industry to produce the required range of pumps, conveyors, mixers, etc. There are notable exceptions. Canada excels in small customized or prefabricated treatment plants, ultra violet irradiators, some types of surface aerators and screw pumps. Also, it should be observed that in a survey conducted in 1979, 70 percent of manufacturing companies in the water and wastewater field indicated that the Canadian content of their products exceeded 50 percent (according to the Pollution Control Equipment Manufacturing Industry in Canada, 1979). Current major programs for wastewater treatment and disposal in Quebec can be expected to result in some concentration of manufacturing capabilities there for related equipment (See Box 4.4).

CANADIAN SUPPLIERS ACTIVE IN WATER AND SANITATION PROJECTS — *Box 4.4*

Many firms in Canada are involved in sector projects supported by CIDA. A recent review of procurement for 14 typical water and sanitation projects indicated 806 separate contracts with a total value of $27.9 million.

The contract size ranges from over $3 million to small purchase orders of under $100, for materials, equipment and transportation. Goods include such things as pipes, valves, fittings, pumps, motors and drives, mechanical and electrical equipment and controls. Typical recipient countries for major water sector procurement have included Bangladesh, Indonesia, Ethiopia, Ghana, Tanzania, Cameroon, Niger, Belize and Honduras. Suppliers have included companies such as Canron, TPS Industries, Flygt Canada, Monarch Industries, Wallace and Tiernan, Federal Pioneer, Motorola Canada and various vehicle suppliers. Included in these purchases have been thousands of Canadian handpumps for the rural areas of developing countries, as well as components for water treatment plants to serve the rapidly increasing populations in the cities of the developing nations.

Pipes are generally the most expensive item in any water or sewerage system. From past experience, plastic, steel, ductile iron and asbestos-cement pipes can be competitively made in Canada for export to developing countries, but transportation costs may place Canadian suppliers at a disadvantage in some regions. Concrete pressure pipe has been manufactured locally in Africa under Canadian management. This successful experience suggests that Canadian technology and management skills can be advantageously applied in foreign joint ventures (See Box 4.5).

Canadian experience in equipping dams and large water diversion projects provides good capacity and skills for supplying such equipment overseas. Items in this category would include: spillway gates, trash racks, penstocks, large valves, etc.

It is worth observing that despite the large disparity between labour rates in Canada and those in developing countries, some recent Canadian bids have not lagged far behind successful competitors. This suggests that Canadian productivity, planning and management are strong. These can be important both to technology transfer and to successful joint ventures, in which Canadian management can be coupled profitably to low local labour rates.

CANADIAN PIPE MANUFACTURED FOR EXPORT **Box 4.5**

Canron Inc. has won export orders for water pipes in many countries because of the quality of their products and, by being known through the supply of their pipes to CIDA aid projects in the developing countries.

From plants in Quebec and Ontario ductile iron pipe has been supplied to CIDA projects in Belize and Ivory Coast. For a Pan American Health Organization project in Haiti, ductile iron pipe was shipped from Quebec. For a CIDA project in Tanzania a joint venture was formed with Comestock to produce 85,000 meters of cast-in-place prestressed concrete pipe for a water trunk main.

Recently, Canron has exported ductile iron pipe and fittings from Hamilton, Ontario, for potable water projects in Barbados, Cameroon, St. Kitts and Kenya.

Canada's manufacturing capabilities in the solid waste management field suggest the same story. It seems likely that economics and the composition of urban solid waste prevailing in developing countries will constrain most disposal to landfill rather than to incineration. This means that Canada's export interests should concentrate on collection vehicles, centralized waste containers, specialty waste incinerators (e.g. for hospital and pathological wastes) and, possibly, small waste grinders.

In addition to meeting price competition for equipment from other industrialized countries, Canadian firms interested in selling to developing countries also have to provide demonstrated competence to service the equipment sold.

Expertise Available

- Local joint ventures in manufacture of pipes and equipment in which Canadians provide the management and the know-how and the local partner maximizes low-cost labour content.

- Direct export at competitive prices of certain specialty items, including ductile iron pipes.

- Manufacture of small or customized treatment or process packages developed for easy shipping and installation.

- Rehabilitation of water or sewage systems that have deteriorated, including water and sewage treatment plants.

- Supply of pipes, fittings, valves, pumps, drives, treatment equipment and components for water supply and sewerage systems.

- Drilling rigs for groundwater investigation and development.

- Handpumps for rural water projects.

- Supply and installation of water control equipment for dams, canals, and water diversion structures, etc.

4.3.7 Industrial Systems

Studies have indicated that there is an average of ten equivalent persons committed to water supply, waste water treatment and waste management for each industry directly discharging to water courses in Ontario. That represents a total involvement of 3,000 persons. Environment Ontario confirms that this number is realistic. Experience in Metropolitan Toronto indicates that, for industries discharging directly to municipal sewers under new legislation, an average of one-third equivalent person per industry would be employed, or 4,000 persons for all of Ontario.

Based on the relative withdrawal of water for industrial purposes in other provinces compared with Ontario, and reported by the Inland Waters Directorate of Environment Canada, comparable employment numbers would be 750 for the Atlantic Provinces, 3,600 for Quebec and 3,200 for Western Canada. Approximately 25 percent of this equivalent employment would be employed in industrial waste management, as distinct from water supply and waste treatment.

These personnel, of whom probably 25 percent represent professionals and managers, are highly skilled in the design and operation of industrial water supply and waste water treatment plants. Recently they have acquired considerable expertise in hazardous waste management both in the work place and in disposal off-site.

Developing countries are avidly seeking new industry to improve their economic growth and stability. Sometimes in the past, industry has expected to find less restrictive pollution controls under such conditions. As developing countries increasingly strive for sustainable development which is economically and environmentally sound, they are moving to strengthen environmental measures and assure that improved conditions of waste water management or solid waste disposal are reinstituted. This provides increasing opportunities for using Canadian expertise in this sector.

Expertise Available

Canadian industry is well positioned to provide personnel, either directly or through other Canadian companies, to:

- Draft and oversee industrial waste treatment standards.
- Give advice on centralized waste management programs for industrial complexes.
- Directly train operating staff.
- Provide assistance in developing recycle and reclamation programs.

4.3.8 Training and Educational Services

Canadian resources in this area are available to developing countries in several ways: Canadian institutions can accept students for training; Canadian experts are available to provide technical assistance to institutions in developing countries; and Canadian institutions can undertake training on contract arrangements to strengthen the institutions in developing countries.

Training and education in water and wastewater services for technicians is available in full-time courses at community colleges in Alberta (Northern Alberta Institute of Technology), Ontario (Sault College and, planned for the near future, Sir Sandford Fleming), and Quebec (Vaudreuil). A full-time course is also given at the Royal Canadian Engineers training centre at Chilliwack, British Columbia (though this may be restricted to military or federal government personnel).

The training facility at Vaudreuil not only offers a working treatment plant but it also provides French language correspondence courses that could be of particular value to developing Francophone countries. Environment Ontario's training facility at Brampton also has a full-scale working treatment plant and the coursework has been published in a series of textbooks.

University courses and graduate studies in the water and sanitation sector are available in most universities offering engineering programs. The emphasis varies considerably between surface waters, ground waters, water resources, hydrology, hydrogeology, microbiology and biochemistry. The emphasis also varies across faculties (engineering, agriculture, physics, chemistry and biology) so that some care is required in making the proper choice of a university to suit a particular need.

A number of universities offer specialized courses or programs for developing country studies in the sector. One of these is the University of Ottawa which has recently created the International Water Resources Centre. Another is the University of Alberta where special courses in rural water and sanitation are offered. Ecole Polytechnic in Montreal is strong in environmental engineering and has long provided institutional support for the University of Thies in Senegal. The University of Calgary, the University of Saskatchewan, and Simon Fraser University have arranged special programs in the water area. Mount Royal College in Calgary is in the process of establishing an international centre for water management in cooperation with private industry and consulting.

Practical, on-the-job training (attachments) in water supply and in the management of wastewater and solid wastes is often made available by municipalities and by provincial governments. Similarly, private consulting companies can also provide on-the-job training for young professionals from developing countries. The movement towards twinning of provincial, city and educational institutions seems to provide fertile ground for promoting further training and technology transfer.

Expertise Available

Canadian educational institutions, governments and private companies are capable of supporting training in the developing countries to provide:

- Business management courses directed to customer servicing, accounting and fiscal management of utilities.

- Technical planning and design, including data acquisition and processing. This includes all three components of the sector on a multidisciplinary basis, i.e. engineering, public health, environment and social aspects.

- Operations and maintenance, theory and practice.
- Research and scientific developments.
- Management of training and educational institutions.

4.3.9 Non-Governmental Organizations

Canadian non-governmental organizations are very active in the field of international development. Many of them exist for the sole purpose of engaging in this field and have no other significant Canadian operations, while others operate programs in Canada as well as overseas. Many NGOs are religious-based, while others are completely secular. Some focus on education and training, while others are involved in areas such as relief work, food production, skills development and water supplies and sanitation. A common feature among all of them is that they are highly motivated with a humanitarian interest to help the people of developing countries improve their living conditions. Anglophone NGOs account for the largest number; however, there are a large number of Francophone ones as well (See Box 4.6).

AN NGO PARTNER IN DEVELOPMENT ***Box 4.6***

World University Services of Canada (WUSC), with the assistance of CIDA, is providing Canadian technical assistance and equipment for water and sanitation projects in several developing countries.

In Peru, Swaziland and Sudan, CIDA-WUSC water projects are providing long-term solutions to water accessibility and health care problems.

These projects focus on water supply, sanitation, and hygiene education, including training to upgrade local skills in both rural communities and urban squatter settlements.

CIDA funding enables WUSC to provide safe clean water, better sanitation facilities and improved health for the more than 200,000 men, women and children who will benefit from these projects.

The 1986 directory of Canadian non-governmental organizations entitled "I.D. Pro File" published by the Canadian Council for International Cooperation, lists 316 organizations engaged in international development. This grouping includes NGOs which receive funds from CIDA's NGO Division, as well as organizations like WUSC and CUSO which are funded from CIDA's ICDS Division as well as Bilateral. Of these, 31 are listed as being involved in the water sector in developing countries at the present time. Most of the organizations obtain a significant part of the funding for their projects from CIDA. These organizations are involved in many hundreds of projects, many of which are in the water and sanitation sector. Appendix E provides a list of NGOs which have received assistance from CIDA for this sector in the past.

The major portion of the effort in the sector is attributable to four organizations which have developed considerable capability and expertise as a result of having undertaken major programs in water supply. These organizations include CARE Canada, WUSC, CUSO, and UNICEF. Many NGOs operate their overseas projects directly by having some of their own personnel in the recipient country to assist in implementation and administration. The four NGOs referred to operate in this way. Many others, usually the smaller ones, support their overseas operations by providing financing only, without direct involvement. Often this financing is provided to a sister NGO in the country concerned, which administers it.

Because NGOs work effectively at the grass roots level, they have generally been quite resourceful in establishing rural, community-based water and sanitation systems. Since they are non-governmental, there are generally fewer problems with subsidies and non-payment of tariffs by beneficiaries than with government-sponsored schemes. Furthermore, NGOs have been relatively more successful at developing community organizations capable of mobilizing self-help resources and accepting operation and maintenance responsibilities than have government-sponsored schemes. In essence, this ability to organize community support at the grass roots level is the strength of the NGOs.

Most NGOs do not have technical expertise as part of their normal full-time staff. Personnel for projects overseas are engaged as required. This points to one weakness sometimes encountered among NGOs, i.e. that they do not have strong home office technical capability to support their field-based personnel. The four organizations named previously have engaged in water and sanitation projects for many years and have built up a measure of expertise both in the field as well as at headquarters.

Over the years, the methodology for introducing and implementing community-based water and sanitation projects in rural areas of developing countries has been refined. It has now become fairly standardized in that the main components of promotion, community organization, self-help construction, hygiene education, operation and maintenance are common to most NGO water programs. In fact, the bilateral and multilateral agencies are also following this same methodology.

There has been very little cooperation between NGOs and the Canadian private sector, such as consultants. This is accounted for by the fact that most projects undertaken by NGOs are rural and small scale, so there has not been a need for extensive technical design and analysis work.

The practical experience of NGOs provides a useful adjunct to cost-effective water and sanitation sector programs. For example, they have learned how to profit from the investment in new water supply systems by conducting health-education programs and the building of latrines to reduce sources of human pathogens that could imperil clean water. Several features of NGOs stand out:

- They make a substantial financial contribution to development aid from Canada by the funds they raise directly from their members and the public;
- Some have practical local experience that is very effective;
- Some have deep insight into the importance of health education and social aspects that can make the difference between the success or failure of projects;
- They have tended to operate directly at the community level with little government and little private sector involvement; and
- They tend to concentrate their water and sanitation sector projects in rural areas and avoid the large urban areas, although recently a number of peri-urban projects have been undertaken by NGOs.

DESCRIPTION OF TWO TYPICAL NGO PARTNERS ***Box 4.7***

CARE Canada has 46 years experience and has 17 staff in Canada and 41 abroad. At present, it has interests in water supplies in Central and South America, West Africa and Indonesia. Its work, which by choice has been confined to rural areas, has involved a considerable amount of local water development. CARE Canada is well aware of the costs and effectiveness of several types of water supply systems. It has concluded that all water supply systems require a preceding health education and organizational development program, together with the building of latrines, before a clean water supply program will work effectively to improve health. A typical precursor program will last a year. Another year of social work is usually required after installation to ensure that the system is working smoothly.

CARE's projects are normally done on a shared basis with the community, whereby the community supplies labour and CARE supplies the materials. Where technical designs are required, the local government water agency is often used to provide them.

Emmanuel International, an evangelical church organization working in international development, provides villages and even single dwellings with water supply systems in a manner closely resembling that adopted by CARE Canada. The differences lie in the smaller scale of the water systems and a greater emphasis on personal involvement associated with Emmanuel International's projects. However, both stress the need for public health education and technical simplicity as vital to success.

4.3.10 Professional and Institutional Associations

This section is intended to provide an introduction to the various Canadian professional and institutional associations with an interest in the sector and to comment on their membership, objectives, activities and possible role in international development. Some of these are more international in their outlook and interests, while others are interested primarily in the Canadian scene.

In general, these organizations provide a service to their membership, which consists of individuals, firms or other organizations. Membership is normally voluntary. Permanent or paid employment by the associations is usually very small, consisting of a few administrative persons who act as a secretariat for the professional volunteers. Because the membership is voluntary and their activities part-time, they are not listed or counted separately in Table 4.1. Most volunteer members would be counted in that category where they engage in full-time employment, i.e. firms, industry or government.

In general also, these organizations do not undertake international development work such as on a project-by-project basis as do consultants, contractors or NGOs. On an occasional basis, they may undertake to sponsor international conferences which could be funded by CIDA or other aid agencies. Their more usual role, however, is to provide a forum to inform their members and the public about issues of concern; to act as an informed pressure group to lobby government, industry and the public about general issues. They also function as effective facilitators to assist outsiders as well as members to get into contact with the appropriate persons in the professional area. It is in these ways that the professional associations are able to assist CIDA officials as well as consultants and contractors in developing and implementing programs. In the following paragraphs a number of specific associations are briefly described.

Canadian Water Resources Association (CWRA)

The Canadian Water Resources Association (CWRA) has a membership of approximately 1,000 from across the country, made up of representatives from universities, governments, consultants, irrigation districts, conservation authorities, wildlife organizations, drainage districts, suppliers and manufacturers and lay people. The common bond is an interest in the proper management of Canada's water resources. Accordingly, the purposes of CWRA are to:

1. Stimulate public awareness and understanding of Canada's water resources.

2. Encourage recognition by all governments of the high priority of water as a resource, and towards that end, to encourage the formulation of appropriate water policies.

3. Provide a forum for the exchange of information and opinion relating to the management of Canada's water resources.

4. Participate with appropriate agencies in international water resource activities.

Currently, realization of these objectives occurs largely through the staging of regional and national seminars and conferences, by publication of the *Canadian Water Resources Journal* and *Water News*, and by preparing and presenting briefs reflecting CWRA's position on water-related issues to Provincial and National Governments, Commissions and Agencies. An example of this is the brief presented to the Pearse Inquiry on Federal Water Policy.

The organization has just completed a comprehensive, long-range plan aimed at increasing its significance and a general awareness of CWRA by the public and by government. While CWRA has in the past focussed on Canadian water management issues, the long-range plan calls for a greater involvement at the international level and to this end the Canadian Committee on Irrigation and Drainage (CANCID) is now officially a permanent committee of CWRA. Other such amalgamations are distinct future possibilities, notably the Canadian Committee of the International Water Resources Association (IWRA).

Canadian National Committee of the International Water Resources Association (CNC-IWRA)

The objectives of the Canadian National Committee of IWRA are to:

1. Stimulate public awareness and understanding of the management of international water resources and their relationships to Canadian water resource management activities.

2. Encourage recognition by all governments of the high priority of water as a resource, and towards that end, to encourage the formulation of appropriate water policies.

3. Provide a forum for the exchange of information and viewpoints relating to the management of international water resources and the export of Canadian expertise, technology and services.

4. Disseminate information on international water resources.

CNC-IWRA's purpose is very similar to that of CWRA, except international in scope. The 6th World Congress of IWRA, held in Ottawa, May 29 to June 3, 1988, had for its theme "Water for International Development".

Canadian Water and Wastewater Association (CWWA)

Membership of this national body comprises water utilities and regional associations of water and wastewater utilities. There is also provision for associate membership and subscribing membership by government agencies, professional associations, educational institutions, corporations, suppliers, etc.

The objective of CWWA is to represent the interests of the members in dealing with government, to facilitate the exchange of information and to encourage the exchange of information between the public and the water and wastewater industry.

Activities include:

- with and on behalf of municipalities, to determine municipal infrastructure rehabilitation requirements and to develop remedial programs;

- with the federal Departments of the Environment and Health and Welfare, to establish water quality guidelines and to review the Environmental Protection Act;

- to promote reciprocal certification, education and training programs throughout Canada;

- to identify research needs on such subjects as water and wastewater service costs and prices;

- to develop working relationships with the Association's international counterparts that will benefit municipal, organizational and individual members; and

- with the Departments of the Environment and External Affairs and with CIDA, to explore the trade opportunities available to Canada's water-related environmental industries.

During 1987, CWWA helped coordinate a series of seminars in five cities across Canada conducted by CIDA and the World Bank on new approaches in community water supply and sanitation.

Regional Water and Wastewater Associations

Six different, regionally-based water and wastewater associations operate to serve their members. They are:

- o Atlantic Canada Water and Wastewater Association
- o Association Quebecoise des Techniques de L'eau (AQTE)
- o Ontario Section of the American Water Works Association
- o Pollution Control Association of Ontario
- o Western Canada Water and Wastewater Association
- o British Columbia Water and Wastewater Association

The membership of these associations comprises individuals working in the sector in the particular regions. Membership includes engineers, technicians, students, operators of systems and suppliers of equipment. Each association also includes a local section of the American Water Works Association (AWWA) and/or the Water Pollution Control Federation (WPCF), both of which are USA-based technical associations.

The objectives of these regional Canadian associations are to improve water management by undertaking and supporting numerous educational-type activities including holding seminars and conferences, publishing materials and engaging in public awareness activities.

Of the groups listed, AQTE is by far the most highly developed and best organized. They have a significant permanent staff, produce a high quality journal and hold excellent trade shows.

Association des Entrepreneurs en Services Sanitaires du Quebec Inc.

Membership of this Quebec-based association includes 210 solid wastes collection and disposal contractors.

Its objectives are to support its membership and improve and promote the best technologies for collection and disposal of solid wastes. Its activities include the holding of seminars and reviews and the preparation of standards on disposal of wastewater, solid wastes and toxic wastes.

4.3.11 Environmental Protection Organizations

A number of organizations concerned with enhancing and preserving the environment operate in Canada. These are all public, voluntary organizations with diverse professional and lay membership. The number of permanent employees is small, numbering probably 100 or so for all the organizations listed below. Their purpose is environmental enhancement and protection by engaging in a variety of activities. Some are more research and professional oriented, while others work with the public and the media to raise awareness and action in this field. Organizations active in this area include:

- Pollution Probe Foundation
- Canadian Environmental Law Association
- Friends of the Earth
- The Sierra Club
- Canadian Environmental Law Research Foundation
- Probe International

The strongest of these at the present time is Pollution Probe with a staff equivalency of some 56 persons.

Many of the groups have concerns which are international in nature and could support CIDA's efforts from a policy and public contact perspective, as well as providing contacts with knowledgeable people if required.

4.4 CONCLUSIONS

This chapter has provided detailed information on the various Canadian capabilities in this sector from which resources may be drawn to carry out projects and programs by CIDA. A significant number of those Canadian resources are already experienced and knowledgeable in developing country work as a result of 30 years of international involvement, carrying out projects for CIDA, other international agencies and developing country governments directly. These resources include consulting firms, NGOs, government personnel, trading houses, equipment manufacturers and suppliers and construction personnel.

Much of the relevant expertise exists in federal, provincial and municipal governments, with people experienced in operation and maintenance of water and sanitation systems, solid waste disposal, the adoption and administration of design standards, conducting resource studies, surveys and research. Public sector agencies at all levels of government have their own mandates to pursue so their expertise has been somewhat difficult to access for projects in developing countries. Efforts by some federal government departments and provinces to free up such expertise for overseas assignments is encouraging, but major complications remain, particularly within municipalities where most sector expertise exists.

Times and needs are changing in developing countries. In the past, the emphasis was on building new systems. Emphasis is shifting to operations, maintenance, administration and rehabilitation. These activities are often done in Canada by government or municipal personnel rather than by consultants. Similarly, there is a shift to projects which involve design/build and operation. For all of these, there will increasingly be a need for integrated teams. For some projects, the ideal team will

consist of consultants combined with NGOs and government personnel. For other projects, the team may best comprise consultants, contractors and suppliers.

Another area of significant potential is in the training and human resource development area, using Canadian institutions in twinning arrangements with counterpart organizations in developing countries. This is a method of operation which has proven to be highly effective in numerous cases and is likely to gain popularity.

In many aspects of this sector, Canadian resources in goods and services have proven to be competitive internationally and highly regarded. When applied intelligently and effectively, the introduction of Canadian goods and services (including training) during aid programs has led to continuing and expanding markets.

As a final point, it should be emphasized that CIDA has, over the last 20 to 30 years, undertaken work in this sector worth several billion dollars at current values. All of this work was carried out using a mix of Canadian resources. For the most part, they performed very well and are highly regarded by the recipient countries. These resources are now much more experienced, and capable, than they were when the process started. They are prepared to take on greater and more demanding tasks.

Chapter 5

INVENTORY OF CIDA PROJECTS

Chapter 5
INVENTORY OF CIDA PROJECTS

5.1 INTRODUCTION

Canada has the capability to provide overseas development assistance throughout the whole spectrum of the water sector. As already noted in Chapter 4, CIDA has provided aid in land and water resource surveys, including aerial surveys, groundwater and river basin surveys, water requirements studies and hydrological and meteorological inventories. Planning studies have been carried out to prepare master plans for water supply and sanitation and solid waste disposal, as well as for river basin management. Feasibility studies have been completed and designs and tender documents have been prepared for multipurpose schemes, as well as for water supply and sanitation projects.

Large and small projects have already been undertaken. They range from dams, barrages, canals and water supply systems for multipurpose schemes, to the drilling of wells for village water supply; from the construction of complete water treatment plants with transmission and distribution pipelines, to the rehabilitation of existing systems; from the provision of massive equipment for major water distribution networks, to simple handpumps in rural areas. Assistance in sanitation projects has included studies, sewer and latrine construction, solid waste disposal and incineration facilities.

In addition, CIDA has contributed thousands of person/months of technical assistance and training in all of these water development enterprises.

The Government of Canada's official development assistance (ODA) for international aid is channelled through numerous agencies and departments of government. The largest of these is CIDA, but it is important to recognize that there are significant other channels. Table 5-1 summarizes these contributions, by source of financing, over several fiscal years.

Table 5-1
Canadian ODA Disbursements by Source of Finance and by Year (1983-88)
($ in millions)

Agency/Department	Net Amount of Disbursements				
	Actual				Estimates
	83/84	84/85	85/86	86/87	87/88
CIDA	1,459	1,691	1,637	2,000	2,110
IDRC	70	85	91	100	106
External Affairs and Other Dept's	48	49	54	61	67
Department of Finance (2)	179	208	352	284	342
Other Sources (3)	56	64	40	75	35
Total ODA (Canada)	1,812	2,097	2,174	2,520	2,660
Percentage of ODA to GNP	0.45	0.49	0.46	0.50	0.50
Canadian GNP ($ billions)	398.7	428.4	468.8	502.3	532.0

Notes:

1. Information in this Table is taken from CIDA Annual Reports 85/86 and 86/87 and Government estimates.

2. Department of Finance disbursements represent ODA to International Financial Institutions such as the World Bank and regional development banks.

3. Other sources include Petro Canada International Assistance Corporation, International Centre for Ocean Development, Contributions by Provincial Governments to NGOs, and Latin American loan repayments to the Inter-American Development Bank.

The official Government position on total ODA as stated in the new strategy is as follows:

> *"Canada's official development assistance has reached .5 percent of Gross National Product (GNP) and will be maintained at that level until 1990/91. Then, it is the Government's objective to raise the ODA/GNP ratio by gradual increments, beginning in 1991-92, to .6 percent by 1995 and to .7 percent by 2000."*
>
> *(CIDA, 1987c)*

This paper is concerned with CIDA's activities in the water and sanitation sector. However, it should be noted that funds, other than those disbursed through CIDA also support this sector, in particular, the International Development and Research Centre (IDRC). In addition, a significant proportion of the funds provided to the international financial institutions by the Department of Finance is spent by them in support of the water sector.

Within CIDA, assistance in the water and sanitation sector to developing countries is provided through seven of its branches. These branches are:

i) Multilateral Branch;
ii) Asia Bilateral Branch;
iii) Americas Bilateral Branch;
iv) Anglophone Africa Bilateral Branch;
v) Francophone Africa Bilateral Branch;
vi) Special Programs Branch; and
vii) Business Cooperation Branch.

Each branch delivers aid through different channels, such as international organizations and the private sector. A brief description of each of these branches is given to provide the reader with an overview of the methods used to deliver projects by each branch.

Multilateral Branch. This branch of CIDA provides financial support to numerous international institutions working in the field of development. The management, control and spending of the funds is the responsibility of those institutions. Included in this group are the Regional Development Banks, United Nations organizations, (such as UNDP and UNICEF), the World Bank, the Commonwealth Fund for Technical Cooperation (CFTC) and the Programme Special de Developpement.

Bilateral Branches. There are four bilateral branches: Asia Branch, Americas Branch, Anglophone Africa Branch and Francophone Africa Branch. These branches deliver Canada's government-to-government aid program on a project-by-project basis and account for the largest share of CIDA's program. Through these branches, the largest contribution is made to the water and sanitation sector. Different from the Multilateral Branch, the bilateral branches deliver assistance by way of planning and implementation for specific projects which are agreed to by the recipient government and by CIDA.

Special Programs Branch. The Special Programs Branch of CIDA is organized into a number of divisions. The divisions active in support of the water sector are: The Non-Governmental Organizations (NGO) Division; Institutional Cooperation and Development Services (ICDS) Division, and the International Non-Governmental Organizations (INGO) Division. Historically, the Special Programs Branch supported Canadian NGOs, INGOs and institutions by making financial contributions only. The organizations then used the money to undertake their own development projects in Third World countries. However, a change in this process has been made recently through country focus projects. That is, NGOs are now carrying out bilateral projects with CIDA's assistance.

It is interesting to note that Canada, according to the OECD, provides more of its ODA to NGOs than any other country except Switzerland.

Usually, the CIDA funding is only part of the total funding; the remainder is contributed by the Canadian organization itself and sometimes by a counterpart organization in the recipient country. The recipient organization may be nongovernmental or, sometimes, a government department or institution.

For CIDA, program and project funding by the Special Programs Branch is simpler than by the Bilateral Branches. The usual effect of this lesser involvement by CIDA is that funds can be approved more quickly by the Special Programs Branch than by the Bilateral Branches. Individual projects within the Bilateral Branches, however, are usually much larger than those supported by Special Programs Branch.

Business Cooperation Branch. The program division of the Business Cooperation Branch which disburses development assistance is the Industrial Cooperation Division (CIDA-INC). Until a few years ago, this division was a part of the Special Programs Branch.

CIDA-INC operates by providing contributions to Canada's private sector companies in support of their activities in developing countries. In this program, Canadian companies identify and develop projects and then apply to CIDA for assistance in funding. CIDA's contributions cover only part of the cost of activities undertaken. The remainder of the costs are borne by the Canadian company and the recipient country. Assistance provided by CIDA can cover a variety of activities, including business viability studies, technology transfer and project preparation studies. The process is much simpler than that for bilaterally-funded projects and the time required for CIDA to respond is much less, since CIDA contributes a portion of the funds, but does not administer the project.

To give the reader an indication of the amount of work each branch carries out, Table 5-2 is a breakdown of the total disbursements by each branch.

Table 5-2
Disbursements by CIDA Branches By Year (1983-88)
($ in millions)

Branch	Disbursements				
	Actual				Estimates
	83/84	84/85	85/86	86/87	87/88
Multilateral					
(total CIDA and others in ODA)	672	684	864	953	901
Bilateral					
Asia	275	337	335	377	390
Anglophone Africa	147	195	160	218	202
Francophone Africa	138	196	176	199	202
Americas	97	128	116	153	164
Special Programs		155	152	202	238
Business Cooperation					
Industrial Cooperation Div. (CIDA INC)		38	28	32	38

Notes: From 85/86 and 86/87 CIDA Annual Reports and CIDA estimates.
Figures include food aid.

Table 5-2 shows a short-term trend in bilateral disbursements for Anglophone and Francophone Africa of about $200 million per year, just over $150 million per year for the Americas and from $300 to $400 million per year for Asia. There is also a trend to increase the contributions to the NGOs from the Special Programs Branch.

CIDA Assistance in the Water and Sanitation Sector

In this report, the water and sanitation sector refers to both water resources management, and water supply and sanitation. In the report sections that follow, detailed CIDA budgets for the water and sanitation sector are shown for the various branches and are summarized in Table 5-3 for the last seven years (1980-87). The data in Table 5-3 indicate that CIDA has made commitments totalling $465 million for water and sanitation projects over the past seven years through Bilateral, Special Programs and Business Cooperation Branches, an average of $66.5 million annually.

No budget figures for water and sanitation aid are available for the Multilateral Branch, but it is estimated that five to seven percent of CIDA assistance plus other non-food aid to international financial institutions would be used for water and sanitation projects. Budgets for Bilateral Branch projects come from the list of projects in Table D-1 of the Appendices which shows approved water and sanitation projects from 1968 through 1987. Budgets rather than disbursements have been used for most tables in this report since disbursements on a sectoral basis are only available for the last four fiscal years. Budgets, however, are available for all approved water and sanitation projects back to 1968, the year when CIDA was established. At the end of this chapter, an estimate of future budgets and disbursements in the sector has been made in accordance with available data.

Table 5-3
CIDA Budgets for Water and Sanitation Projects
by Branch and by Year (1980-87)
($ millions)

Branch	80/81	81/82	82/83	83/84	84/85	85/86	86/87	7 Year Total	Percent of Total
Bilateral									
Asia	89	19	3	62	-	1	44	218	46
Anglophone Afr.	-	17	1	8	12	-	21	59	13
Francophone Afr.	2	33	6	13	25	2	5	86	18
Americas	3	6	-	23	12	3	10	57	13
	94	75	10	106	49	6	80	420	90
Special Programs	2	3	8	13	5	2	6	39	8.5
Industrial Co-op.	0.5	0.5	0.5	1	0.5	1.5	2	6.5	1.5
Total	96.5	78.5	18.5	120	54.5	9.5	88	465.5	100.0

Source: Table D-1 in Appendix D.

5.2 MULTILATERAL BRANCH SUPPORT FOR WATER AND SANITATION PROJECTS

In general, CIDA is not directly involved in the allocation of funds provided to multilateral institutions. The responsibility for the allocation and administration of funds belongs to the particular recipient institution, each of which has one Executive Director appointed by Canada. Some of these institutions, such as the World Bank, the Regional Development Banks, UNICEF and UNDP, are very active in the water and sanitation sector.

There are some exceptions to the general pattern of CIDA support to the sector through multilateral institutions. For example, CIDA made a specific contribution to the World Bank project to develop *"Training Materials for Low-Cost Water and Sanitation"*, which is now being used for training all over the world.

Data outlining the amount of Canadian funds spent directly on this sector by the various multilateral agencies are not readily available and are, therefore, normally excluded from the calculations of percentage of funds allocated by CIDA to this sector. However, as a guide, from 1974 to 1985 the World Bank lending for water supply and sanitation alone has been 5.2 percent of the total lending of the World Bank (IBRD and IDA). Also for its first twenty years of operations (1966-1986), the Asian Development Bank provided 8 percent of its total lending for water and sanitation projects.

Total Canadian disbursements (not including food aid) to the international financial institutions were $1,263 million over the three fiscal years from 1983 to 1986. A conservative estimate is that 5.0 percent of this funding has been allocated by the multinational institutions for the water and sanitation sector in developing countries. This would result in Canadian assistance averaging $21 million per year to this sector through the multilateral institutions.

5.3 BILATERAL BRANCHES SUPPORT FOR WATER AND SANITATION PROJECTS

5.3.1 Introduction

Because of CIDA's direct involvement in administering bilateral projects, the records and information available on bilateral aid is generally quite good, as may be seen from the contents of Appendix D. In Table D-1 of Appendix D is a summary of inputs and outputs for all the bilateral water and sanitation sector projects approved by CIDA from 1968 to December 1, 1987. This summary is broken down into projects funded by the four Bilateral Branches. For each branch, the countries are arranged alphabetically showing the CIDA project number and title, the period of the project, the CIDA budget, the sub-sector, and, where available, the population served by the project. For convenience the outputs for each project are summarized under three main headings: studies and technical assistance, equipment and infrastructure, and training.

The complexity of the project approval process is shown in Figure B-2 of Appendix B, which includes the decision tree for the development of major bilateral projects.

In the following sections is a financial overview, followed by an analysis of the projects funded by each of the four Bilateral Branches.

5.3.2 Financial Budgets for Bilateral Branches by Sub-Sector

The amounts budgeted for water and sanitation projects by the four Bilateral Branches from 1968 to December 1, 1987 totalled about $700 million. A breakdown of these bilateral budgets into the two main sub-sectors of water supply and sanitation, and water resources is shown along with the number of projects for each branch in Table 5-4. These data indicate that roughly half of the $700 million was committed for 121 water supply and sanitation projects, with the other half for 36 water resource management projects. Details on each project are found in Appendix D.

Table 5-4
Summary of Budgets of Approved Bilateral Projects in the Sector by Sub-Sector and by Number of Projects, 1968-1987
($ in millions)

	Water Supply & Sanitation		Water Resources Management		20 Year Total		% of Total	
	No. of Proj's	$	No. of Proj's	$	No. of Proj's	$	No. of Proj's	$
Asia	11	9.1	21	232.3	32	241.4	20	35
Anglophone Afr.	29	147.9	3	13.5	32	161.4	20	23
Francophone Afr.	25	89.3	3	88.2	28	177.5	18	25
Americas	56	109.2	9	10.8	65	120.0	42	17
	121	355.5	36	344.8	157	700.3	100	100

Source: Budget details in Table D-1 of Appendix D.

5.3.3 Sector Budgets by Year

Table 5-5 shows the water and sanitation budgets (from 1968) of the four Bilateral Branches by year, broken down into the two main sub-sectors of "Water Resources Management" and "Water Supply and Sanitation". These figures are compiled from projects listed in Table D-1 of Appendix D. Budget figures are listed in the year of approval since fiscal year disbursements for water and sanitation projects are not available for most of the years shown. Where projects are completed and actual CIDA disbursements are known, these are reported herein as budgets in the year of approval; otherwise original CIDA commitments are used. Cancelled projects are not included.

Table 5.5 : Approved Bilateral Water and Sanitation Sector Budgets by Branch and by Year
(1968 - December 1, 1987)

Branch	Year	71/72 *	72/73	73/74	74/75	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88 **	20-year TOTAL
WATER RESOURCES MANAGEMENT																			
Asia	# of Proj.	1	-	-	1	-		2	4	1	3	1	2	3	-	-	3	-	21
	million $	0.98	-	-	1.30	-	-	5.00	10.48	0.06	88.83	18.40	3.17	60.55	-	-	43.50	-	232.26
An Africa	# of Proj.	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	3
	million $	2.70	-	-	-	-	-	-	-	-	-	-	-	-	8.46	-	-	2.20	13.45
Fr Africa	# of Proj.	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-	-	3
	million $	-	-	-	54.90	-	-	0.08	-	-	-	33.00	-	-	-	-	-	-	88.21
Americas	# of Proj.	4	1	-	1	-	-	-	-	-	-	-	-	2	1	-	-	-	9
	million $	2.72	2.81	-	2.40	-	-	-	-	-	-	-	-	0.19	2.65	-	-	-	10.83
TOTAL	# of Proj.	6	1	0	3	0	0	3	4	1	3	2	2	5	2	0	3	1	36
	million $	6.41	2.81	0.00	58.69	0.23	0.03	5.08	10.48	0.06	88.83	51.40	3.17	60.74	11.11	0.02	43.50	2.20	344.75
WATER SUPPLY & SANITATION																			
Asia	# of Proj.	-	-	-	3	-	-	-	1	-	-	1	-	4	-	1	-	1	11
	million $	-	-	-	6.27	-	-	-	0.02	-	-	0.11	-	1.22	-	0.44	-	1.00	9.07
An Africa	# of Proj.	1	1	-	1	1	2	3	2	1	-	3	2	2	3	-	6	1	29
	million $	8.00	34.15	-	14.62	0.85	0.90	25.12	3.63	0.81	-	16.87	0.64	8.61	3.54	-	21.18	9.00	147.92
Fr Africa	# of Proj.	-	-	-	1	3	-	-	3	1	1	-	2	2	5	2	3	2	25
	million $	-	-	-	1.50	8.23	-	-	22.25	2.60	1.96	-	5.50	12.71	24.70	2.26	5.03	2.07	89.33
Americas	# of Proj.	16	1	7	4	2	1	1	2	1	1	1	0	6	3	3	5	2	56
	million $	19.82	0.17	2.94	15.51	3.83	0.05	1.22	5.44	0.37	3.04	6.50	0.12	22.61	9.65	3.05	10.51	4.40	109.21
TOTAL	# of Proj.	17	2	7	9	6	3	4	8	3	2	5	4	14	11	6	14	6	121
	million $	28.35	34.32	2.94	37.91	12.90	0.95	26.34	31.35	3.77	5.00	23.48	6.26	45.15	37.88	5.75	36.71	16.47	355.53
GRAND TOTAL	# of Proj.	23	4	7	12	6	3	7	12	4	5	7	6	19	13	6	17	7	157
	million $	34.76	37.13	2.94	96.60	13.14	0.98	31.42	41.82	3.83	93.83	74.88	9.43	105.89	48.99	5.77	80.21	18.67	700.28

* 71/72 includes four years (1968-1972).
** from April 1, 1987 to December 1, 1988.
Data listed includes budgets from all projects listed in Table D-1 of Appendix D.
Budgets also include evaluations and mission studies amounting to less than one percent of total.

From the information in Table 5-5, the following four figures have been compiled showing CIDA Bilateral Branch budgets (1972-1987):

Figure 5-1: Water and Sanitation Sector Budgets by Year of Approval
Figure 5-2: Trends for Bilateral Water and Sanitation Budgets
Figure 5-3: Trends in Bilateral Budgets for Water Resources Projects
Figure 5-4: Trends in Bilateral Budgets for Water Supply and Sanitation

Figure 5.1 shows the budgets of water and sanitation sector projects approved by branches by year from 1972/73 to 1986/87. As can be seen, these budgets can vary from over $90 million to almost zero in any one year. This reflects the relatively small number of projects approved yearly and the wide variation in budgets for individual projects. To determine a trend in these budgets, five-year moving averages were prepared and are shown in Figure 5-2. These averages vary from a low of below $20 million per year to a high of over $65 million per year. The average trend line for total water and sanitation budgets over this 15-year period is rising from about $25 million per year to $60 million per year. However, the last two five-year periods (1981-86 and 1982-87) show average total budgets of $50 million per year, somewhat below the trend.

In Figures 5-3 and 5-4, the five-year moving averages are plotted separately for bilateral water resource management budgets and bilateral water supply and sanitation budgets. The water resource management budget trend more than doubled over the 15-year period from a low of about $11 million to an average of $27 million per year for the years 1982-87. The average budget trend, as shown in Table 5-4, for water supply and sanitation, is also increasing over the same period from about $15 million per year to approximately $23 million per year. Recent trends (from 1980) show that water resources management budgets have been decreasing, while water supply and sanitation budgets have been increasing.

Fig. 5.1: Bilateral Water and Sanitation Sector Budgets by Year of Approval

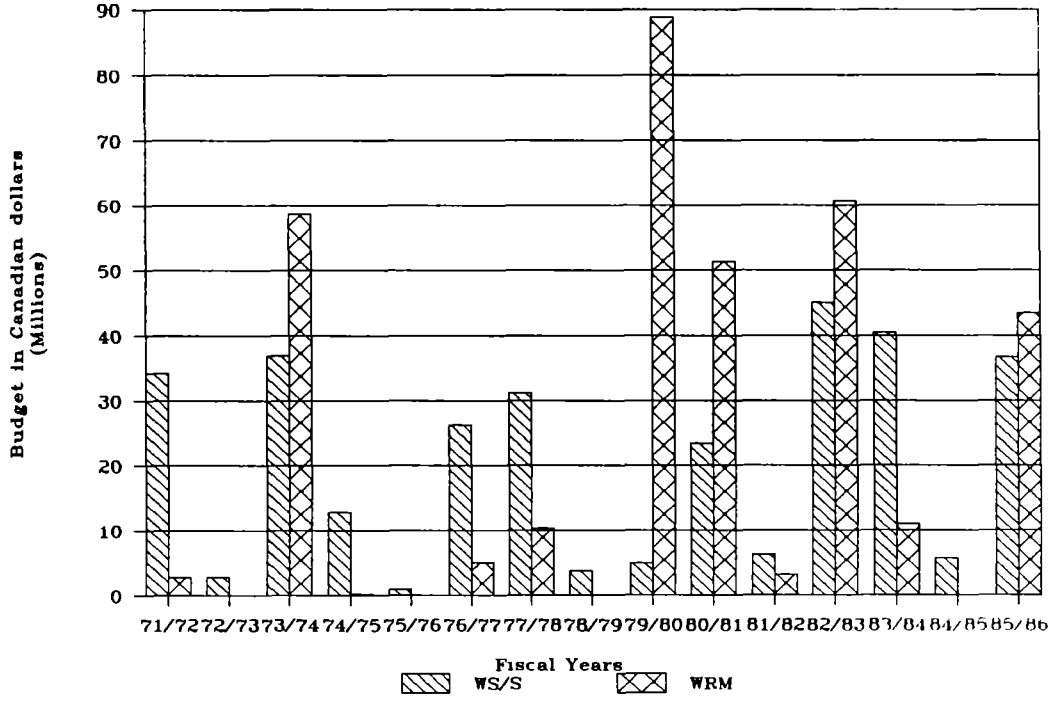
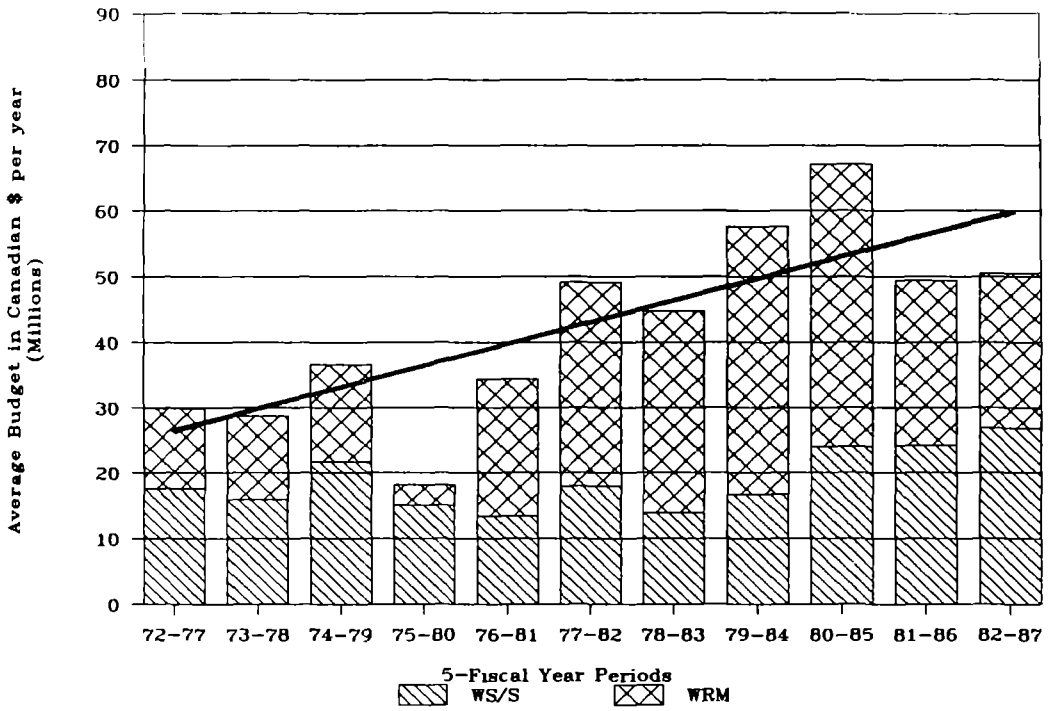
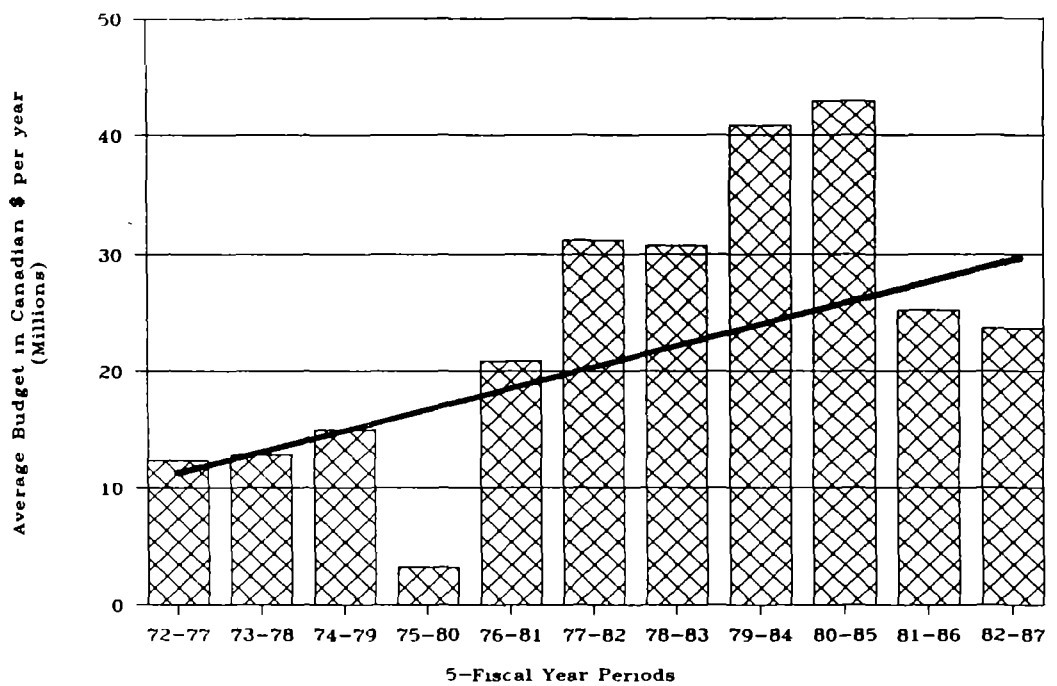


Fig. 5.2 : Trends for Bilateral Water and Sanitation Sector Budgets



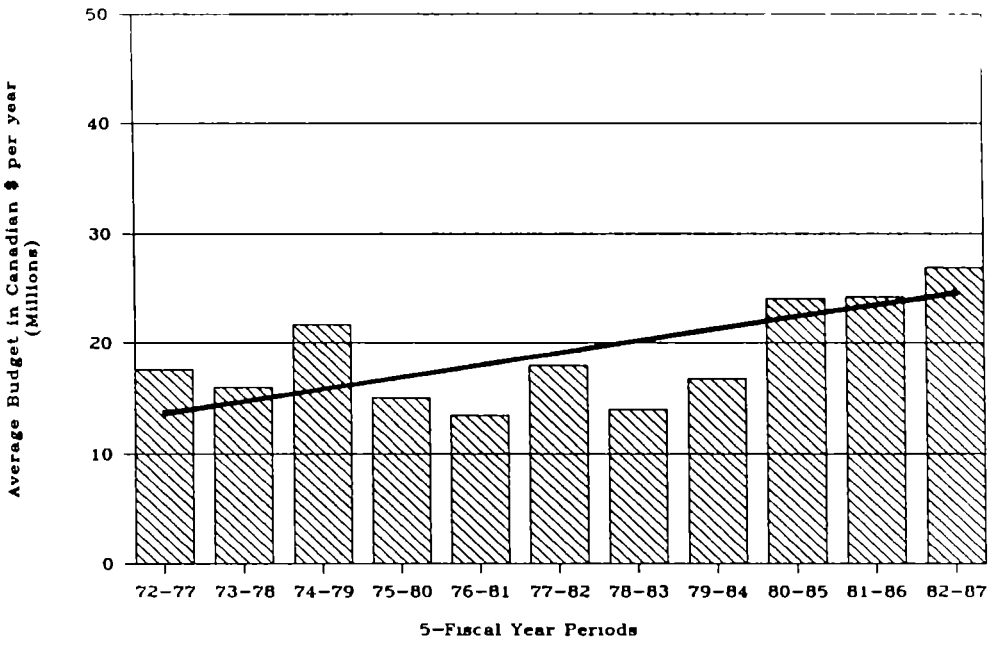
Note: Trend line is 5-year moving average (per year)

Fig. 5-3 : Trends in Bilateral Budgets for Water Resources Management Projects



Note: Trend line is 5-year moving average (per year)

Fig. 5-4 : Trends in Bilateral Budgets for Water Supply and Sanitation Projects



Note: Trend line is 5-year moving average (per year)

It should be noted that all dollar figures shown are in current dollars. If allowances were made for inflation, the rates of increase indicated for the funding of water sector projects by the bilateral branches would be more modest.

5.3.4 Analysis of Water and Sanitation Sector Projects by Bilateral Branches

As already noted in Section 5.3.1, Table D-1 in the Appendices shows a summary of all CIDA bilateral water and sanitation projects approved and funded by each of the four Bilateral Branches from 1968 to December 1, 1987. The projects are broken down into two main sub-sectors, namely water supply and sanitation (WS/S) and water resources management (WRM). The approved budgets for each project are shown for funding of Canadian experts, equipment, construction, training and project evaluation.

Also shown in Table D-1 in summary form are the outputs under the headings of studies, technical assistance, equipment procurement and training. Since most projects have more than one main component, an analysis was done of the projects within each main sub-sector to determine the components of water sector projects that have been approved for funding by the Bilateral Branches. Although subjective, the following five tables give an indication of the type of aid components that have been approved in the four bilateral regions. The components chosen for analysis are implementation, institutional development (including training), procurement, studies and evaluation. Table 5-6 shows a summary of project components for all bilateral water and sanitation projects approved from 1968 to 1987. This Table shows that just over 50 percent of the budgets were for equipment procurement, 30 percent for implementation, 12 percent for studies and about four percent for institutional development and training. Fifteen evaluations were done of which fourteen were for water supply and sanitation projects

at an average cost of about $100,000 each. As noted previously, about one half the total funding shown is for water resources projects and one half for water and sanitation.

Equipment procurement, shown in Table 5-6, is 60 percent of water and sanitation budgets whereas water resources shows 48 percent for procurement. Although water resources projects are fewer in number and higher in cost per project than those for water supply and sanitation, 35 percent is spent on implementation, compared to 24 percent for water supply and sanitation. Amounts budgeted for training and studies are similar percentages for both main water sub-sectors, i.e. about four percent for institutional development and 12 percent for studies respectively.

In the following sections and in Tables 5-7 to 5-10, a closer look is taken at the outputs of the water and sanitation sector by the four Bilateral Branches.

Table 5-6
Components in Bilateral Water and Sanitation Projects
(1968 - Dec. 1987)
($ millions)

	Water Supply & Sanitation			Water Resource Management			20 Year Total		
Project Component	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $
Implementation	48	84.5	24	10	121.0	35	58	205.5	30
Institutional Dev. & Training	45	15.2	5	15	12.0	4	60	27.2	4
Procurement	82	214.8	60	18	165.3	48	100	380.1	54
Studies and CIDA Missions	43	39.5	11	31	46.5	13	74	86.0	12
Evaluation	14	1.5	<1	1	-	-	15	1.5	<1
Total	232	355.5	100	75	344.8	100	307	700.3	100

Source: Table D-1 in Appendix D plus evaluation and mission reports.

Sub-projects may consist of one or more of the five project components as listed above for any one CIDA Bilateral project.

Asia Branch

The Asia Branch budgets of $241 million for water sector projects are 35 percent of the total $700 million shown in Table 5-6. From Table 5-7 it can be seen that a large percentage (96%) of the Asia water sector budget was for water resources projects and only four percent was used for water supply and sanitation. The bulk of the money went to Sri Lanka, Indonesia, Bangladesh and Afghanistan, with very limited amounts (under $1.0 million each) to India and Pakistan (see Table 5-11). These latter two countries along with other parts of south-east Asia have some of the worst health conditions and the highest numbers of people to be served with water supply and sanitation facilities. Water resources training in at least 14 projects included many fellowships, scholarships, seminars and on-the-job training for a total funding of about five percent of the total budgets shown.

The largest project is the Maduru Oya Reservoir in Sri Lanka which included a very large rock-filled dam, irrigation works and settlements for over 20,000 families. Indonesia has had a number of large water resources projects, some of which are on-going, with many long-term experts from Canada in the fields of hydrology, well drilling, canal construction, supervision and training. Two of these Indonesian projects are known as the Lower Solo River Development and the Lombok High Level Diversion. For summary details of the projects included in Table 5-7 see Table D-1 in the Appendices.

Anglophone Africa Branch

Most of the water sector budgets for the Anglophone Africa Branch have been for funding in water supply and sanitation (almost $148 million) or 92 percent of the total, with only $13.5 million for water resources (Table 5-8). This is the exact opposite of the Asia Branch where budgets for water resources predominated. Of the $148 million, about 81 percent was for equipment procurement and 43 percent for project implementation. Institutional development and training in both main sub-sectors is about six percent. Most of the funding for water resources was for studies (86 percent), with nine percent for studies in the water supply and sanitation budgets. The main concentration of funding is in four countries: Ghana, Tanzania, Ethiopia and Swaziland.

One of the major long-term projects has been for water supply in Ghana's Upper Region, where thousands of wells with pumps have been constructed in rural areas. Experience revealed that operation and maintenance training were key activities within the projects for long-term, safe water supply. More details on this and other projects are in Chapter 7.

Another important project was a water treatment system for Dar es Salaam in Tanzania which included a treatment plant, reservoir, water supply pipelines and on-the-job training.

As for Asia, a listing of projects by country, with summary information, is shown in Table D-1 of the Appendices under Anglophone Africa Branch.

Table 5-7
Analysis of Asia Branch Water and Sanitation Projects
(1968 - Dec. 1987) ($ in millions)

	Water Supply & Sanitation			Water Resource Management			Total		
Project Component	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $	Sub-Proj's	Budget $	% $
Implementation	2	5.2	57	9	120.0	51	11	125.2	52
Institutional Dev. & Training	4	0.5	6	14	11.0	5	18	11.5	5
Procurement	4	2.3	25	9	81.4	35	13	83.7	34
Studies and CIDA Missions	3	1.0	11	13	19.9	9	16	20.9	9
Evaluation	1	0.1	1	-	-	-	1	0.1	0
Total	14	9.1	100	45	232.3	100	59	241.4	100

Table 5-8
Analysis of Anglophone Africa Branch Water and Sanitation Projects
(1968 - Dec. 1987) ($ in millions)

	Water Supply & Sanitation			Water Resource Management			Total		
Project Component	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $
Implementation	19	43.4	30	-	-	-	19	43.4	28
Institutional Dev. & Training	18	9.4	6	1	1.0	7	19	10.4	6
Procurement	21	80.9	55	3	1.0	7	24	81.9	51
Studies and CIDA Missions	6	13.2	9	4	11.5	86	10	24.7	15
Evaluation	5	1.0	0	-	-	-	5	1.0	0
Total	69	147.9	100	8	13.5	100	77	161.4	100

Source: Table D-1 in Appendix D plus evaluation and mission reports.

Table 5-9
Analysis of Francophone Africa Branch Water and Sanitation Projects
(1968 - Dec. 1987) ($ in millions)

Project Component	Water Supply & Sanitation			Water Resource Management			Total		
	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $
Implementation	12	17.0	19	-	-	-	12	17.0	10
Institutional Dev. & Training	3	1.6	2	-	-	-	3	1.6	1
Procurement	19	64.0	72	2	81.9	93	21	145.8	82
Studies and CIDA Missions	9	6.6	7	3	6.3	7	12	13.0	7
Evaluation	2	0.1	0	1	0.0	0	3	0.1	-
Total	45	89.3	100	6	88.2	100	51	177.5	100

Table 5-10
Analysis of Americas Branch Water and Sanitation Projects
(1968 - Dec. 1987) ($ in millions)

Project Component	Water Supply & Sanitation			Water Resource Management			Total		
	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $	No. of Sub-Proj's	Budget $	% $
Implementation	15	18.9	17	1	1.0	11	16	19.9	17
Institutional Dev. & Training	20	3.7	3	-	-	-	20	3.7	3
Procurement	38	67.6	63	4	1.0	10	42	68.6	57
Studies and CIDA Missions	25	18.7	16	11	8.8	79	36	27.5	23
Evaluation	6	0.3	1	-	-	-	6	0.3	<1
Total	104	109.2	100	16	10.8	100	120	120.0	100

Source: Table D-1 in Appendix D plus evaluation and mission reports.

Francophone Africa Branch

Francophone Africa has almost an even split between approved budgets for water resources and for water supply and sanitation, as shown in Table 5-9. Procurement is very high for both main sub-sectors, averaging about 82 percent or $146 million of total sector budgets. Although budgets are similar, the number of projects is six for water resources versus 45 for water supply and sanitation. Institutional development and training is very low at one percent of funding, according to the interpretation of the summary information. Studies average seven percent of funding for both sub-sectors.

Almost 90 percent of the budgets were for six countries: Tunisia, Morocco, Cameroon, Niger, Cote d'Ivoire, Mali and the OMVS regional project, with 31 percent of the funds for one project in Tunisia. The Tunisia project is the large Sidi Saad dam for flood control and irrigation where CIDA provided machinery, equipment and on-the-job training. Another project is a solid waste treatment facility to produce compost from the wastes of the City of Fez in Morocco. In Mali, materials and equipment have been provided for new wells and for the rehabilitation of existing wells. For a list of the projects that form the basis of the analysis in Table 5-9, see Table D-1 in the Appendices under Francophone Africa Branch.

Americas Branch

The Americas Branch has budgeted $120 million for the water and sanitation sector since 1968, as shown in Table 5-10. This is 17 percent of the total of $700 million for all Branches. Over 90 percent of Americas Branch funding is for many small water supply and sanitation projects in the Caribbean Islands, in Central America and for a few projects in several countries of South America. Under water supply and sanitation, procurement is shown at over 60 percent. Most of the funding for water resources is for studies (almost 80 percent), while studies for water supply and sanitation used 16 percent of this sub-sector's budget. Three percent of the total was spent on institutional development and training for a total of about $4 million over 20 years. A total of 22 countries received aid, with over one-third going to two countries, Belize and Barbados.

Evaluation, as with all the Branches, is a small budget item for water and sanitation projects. For the Americas, six evaluations were done at an average cost of $50,000 each. A $30 million project for water supply and sewerage systems for Belize City is the largest of the projects listed in Table D-1 of the Appendices. Most other projects are mainly for water supply, with only a few having a sanitation or sewerage component. For most of the medium to large bilateral projects, procurement of Canadian materials and equipment is often a major part of the budget.

Bilateral Water and Sanitation Projects by Country

Table 5-11 shows water sector budgets for recipient countries for each Bilateral Branch for the fiscal years from 1968/69 to 1986/87. This shows that 53 countries received aid in the water sector over the 20-year period noted. The aid is not evenly distributed, but tends to be concentrated in certain countries due to the large size of one or more projects in that country. The countries are listed for each Bilateral Branch in accordance with the aid budget for each country, starting from the largest aid recipient to the smallest, to show the magnitude of aid for water and sanitation projects in each country.

It is interesting to note that seven countries out of 54 received over 60 percent of the aid funding over this 20-year period. These seven countries and the aid received for water and sanitation projects are as follows:

Sri Lanka	$140 million
Indonesia	$ 74 million
Ghana	$ 56 million
Tunisia	$ 55 million
Tanzania	$ 47 million
* OMVS	$ 33 million
Belize	$ 30 million

* See Table D-1 in Appendix D for details.

These seven countries averaged $62 million in aid funding each, while the remaining 47 countries averaged about $5.5 million each, or less than 10 percent of the top seven countries.

Sizes of Bilateral Water and Sanitation Projects

CIDA Bilateral Branches supported two projects with CIDA funding of over $50 million each. These were large dams in Tunisia and Sri Lanka. Most projects, however, are small- to medium-sized. A great majority of the projects had their budget lower than $5 million. Of all the bilateral water and sanitation projects during 1968-1987, only fifteen projects had a budget over $10 million - six of them in Asia, two in the Americas, three in Anglophone Africa and four in Francophone Africa. Nevertheless, these 15 projects represent nearly half of the total funding in this sector. (Refer to Table D-1).

Population Served by Bilateral Water and Sanitation Projects

It is difficult to determine the exact number of people benefitting from CIDA's bilateral water and sanitation projects. However, rough estimates of populations served in the sector are presented by region in Table 5-12. This table includes data which is shown by project in Table D-1 of Appendix D. It is recognized that the figures are only estimates as it is not possible to accurately estimate the precise number of people served in a country by feasibility studies, training, institutional development, large water resource projects, etc. It should be noted that these population figures are for water and sanitation projects in bilateral programs only. Many other people are served by multilateral projects, by NGOs, etc. Therefore the number of people who have benefitted from water and sanitation projects funded by CIDA is well in excess of the indicated total population of 25.7 million, which roughly equals the population of Canada.

Table 5-11

CIDA Bilateral Water and Sanitation Budgets by Branch and by Country (1968-1987)

Asia		Americas		Angl. Africa		Franco. Africa	
Country	Disbur. ($'000)	Country	Disbur. ($'000)	Country	Disbur. ($'000)	Country	Disbur. ($'000)
Sri Lanka	140,239	Belize	30,154	Ghana	56,474	Tunisia	54,925
Indonesia	74,097	Barbados	12,274	Tanzania	47,022	Morocco	17,500
Bangladesh	16,527	Nicaragua	9,083	Ethiopia	24,052	Cameroon	15,109
Afghanistan	8,003	Dominica	6,955	Swaziland	13,424	Niger	13,549
India	984	Honduras	6,762	Kenya	7,336	Cote d'Ivoire	12,794
Pakistan	957	St. Lucia	6,045	Nigeria	4,764	Mali	11,957
South Vietnam	523	Guatemala	5,460	Sadcc	2,200	Togo	9,739
		Haiti	5,300	Egypt	1,700	Burkina Faso	4,207
		St. Kitts/Nevis	5,127	Malawi	1,597	Rwanda	3,480
		Grenada	4,965	Mauritius	850	Zaire	1,467
		Jamaica	4,381	Uganda	663	Gambia	81
		Ecuador	4,068	Sudan	655		
		St. Vincent	3,716	Lesotho	166		
		Guyana	3,188			OMVS (Regional)	33,000
		Monserrat	2,528				
		Peru	1,629				
		Anguilla	1,421				
		El Salvador	1,218				
		Antilles Reg.	928				
		Leeward/Winward	740				
		Antigua/Barbuda	184				
No. of countries	7		22		13		12
Region total budget	241,329 ($ '000)		116,123 ($ '000)		161,377 ($ '000)		177,806 ($ '000)
% budget by region	34.7%		16.6%		23.2%		25.5%
Average country budget	$34,476 ($ '000)		$5,278 ($ '000)		$12,414 ($ '000)		$14,817 ($ '000)

Source : Table D-1 of Appendix D.

Evaluations and mission studies of less than one percent of total are not included.

Table 5-12
Estimated Population Served by Bilateral Water and Sanitation Projects, 1968-1987
(millions)

Region	20 Year Total
Asia	6.2
Anglophone Africa	14.3
Francophone Africa	3.0
Americas	2.2
Total	25.7

Source: Table D-1 of Appendix D.

5.4 SPECIAL PROGRAMS BRANCH

Three divisions in the Special Programs Branch are involved in the water sector. These are the Non-Governmental Organizations (NGOs), Industrial Cooperation Development and Services (ICDS) and the International Non-Governmental Organizations (INGOs). Table 5-13 indicates that some $36 million has been provided for water sector projects of this Branch over the past seven years, an average of $5.1 million per year.

As can be seen from Table 5-13, some 97 percent of Branch funding for the water sector is through the NGOs. Historically, most of this aid in the past has been for water supply, but in recent programs more attention is being paid to sanitation, women in development, institution building, environment and training. NGOs are not normally involved in water resources projects since these projects are highly technical in nature and usually require major funding from one or more agencies.

Most of the average of 75 NGO projects per year are small in size, with CIDA support averaging $72,000 per project. These funds are used for single wells for one village to medium size water supply and sanitation systems for towns and cities. Many of the projects are water supply by gravity from spring sources or by shallow wells with handpumps. Recently more and more sanitation work is included, such as pit latrines in the villages or sewer connections in larger communities.

Over the last seven years, only five NGOs have had total contributions of over one million dollars from the Special Programs Branch for water and sanitation projects. These are:

	($ millions)
CARE (Canada)	13.5
UNICEF (Canada)	4.6
CCODP*	1.3
Rotary International	1.3
Canadian ORT**	1.0

* Canadian Catholic Organization for Development and Peace
** Canadian Organization for Rehabilitation Through Training

Of the total amount of contributions by the Special Programs Branch to NGOs, 11 percent is for projects in the water and sanitation sector. Approximately 40 NGOs have received funds from CIDA for water and sanitation projects over the last seven years. Contributions by CIDA to NGOs usually average about 40 percent of the total value of the projects. Therefore these funds act as a catalyst to encourage other donors to provide aid to the developing countries. Figure 5.5 illustrates the Special Programs budgets per year for the last seven years. More details of project contributions to NGOs in the water sector are shown in Appendix E.

Fig. 5.5: Special Programs Budgets for Water and Sanitation Sector Projects

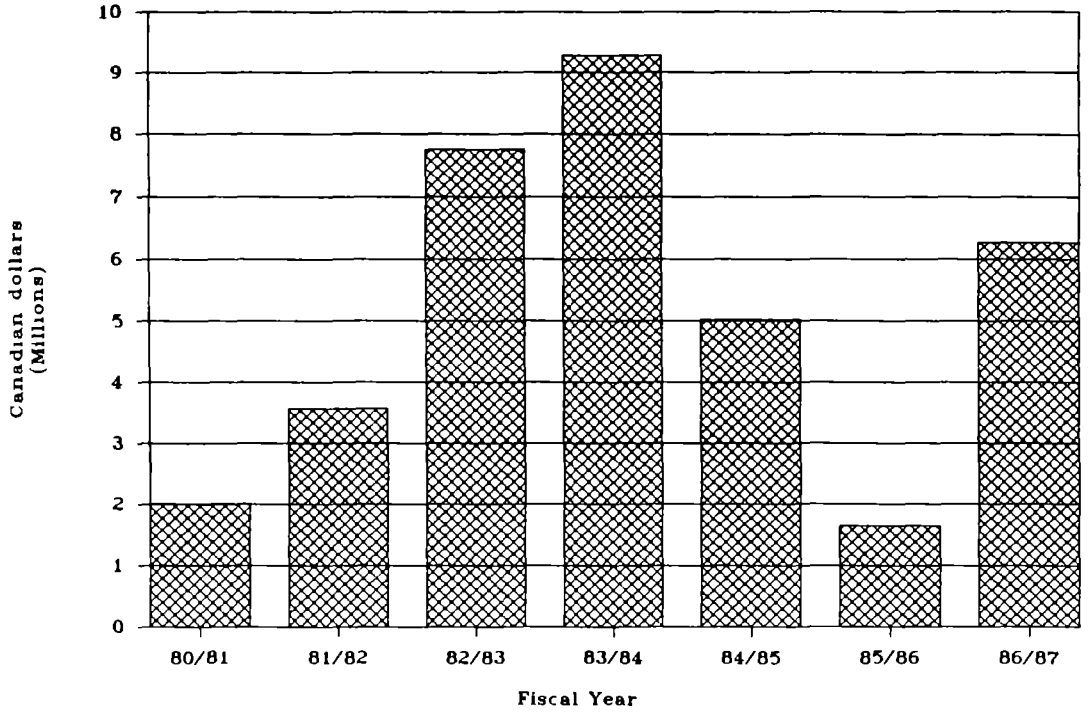


Table 5-13 shows that ICDS are not involved in the water and sanitation sector on a regular basis. Recent funding by year is shown in Appendix E. Over the last few years, ICDS recipient organizations have been CUSO, WUSC and the University of British Columbia. Similar to NGO contributions, the ICDS contributions are usually about one half the total value of the project, but in some cases, the contribution can be ten percent or less.

The INGO Division has been involved in this sector only since 1983/84. Although this funding is small compared to the NGO Division, over ten percent of the INGO budget is used for funding water and sanitation projects. These funds are for institutes, foundations and training in countries such as Niger, Sri Lanka and Indonesia. Further details on CIDA contributions through the INGO Division are shown in Appendix E.

In summary, over the past seven years the Special Programs Branch has funded 541 projects at a total cost of $35.5 million, or an average of 77 projects per year at an average annual cost totalling $5.1 million. Approximately 40 NGOs have received 97 percent of this funding in an amount of $34.4 million over the seven year period, or an average of $4.9 million per year.

Table 5-13
CIDA Special Programs Branch Water and Sanitation Budget
by Year and by Region
($ 000's)

Region	Div.	80/81	81/82	82/83	83/84	84/85	85/86	86/87	6 Year Total
Asia	NGO	257	1,648	1,780	1,896	761	358	685	7,383
	ICDS	-	-	15	-	-	-	-	15
	INGO	-	-	-	90	12	8	52	162
	Total	**257**	**1,648**	**1,795**	**1,986**	**773**	**366**	**737**	**7,560**
Americas									
	NGO	315	866	2,288	3,520	3,050	373	2,014	12,426
	ICDS	-	-	464	35	12	-	41	552
	INGO	-	-	-	-	-	-	52	52
	Total	**315**	**866**	**2,752**	**3,555**	**3,062**	**373**	**2,107**	**13,030**
Ang. Africa									
	NGO	1,304	872	2,412	2,605	849	75	1,043	9,850
	ICDS	3	-	8	-	69	-	-	80
	INGO	-	-	-	89	1	10	52	152
	Total	**1,307**	**872**	**2,420**	**2,694**	**919**	**75**	**1,095**	**10,082**
Fr. Africa									
	NGO	134	179	804	927	268	121	2,273	4,706
	ICDS	-	-	-	23	2	-	-	25
	INGO	-	-	-	87	1	10	52	152
	Total	**134**	**179**	**804**	**1,037**	**271**	**131**	**2,325**	**4,883**
Sector Total		2,013	3,565	7,771	9,272	5,025	1,645	6,264	35,555
No. of Projects									
	NGO	56	52	105	114	86	43	65	521
	ICDS	1	-	4	2	4	-	1	12
	INGO	-	-	-	3	2	2	1	8
	Total	**56**	**52**	**109**	**119**	**92**	**45**	**67**	**541**

NGO data compiled from NGO Division records. Figures are rounded.

CIDA NGO funding shown above represents, on average, 37 percent of the total cost of the completed NGO projects. Other funds come from the NGOs themselves, other agencies, recipient governments or recipient communities.

NGO funding for the seven years shown is $34.4 million or 97 percent of the total shown for the Special Programs Branch.

5.5 BUSINESS COOPERATION BRANCH: INDUSTRIAL COOPERATION DIVISION (CIDA INC.)

Approved projects funded by CIDA INC are to encourage Canadian firms in their endeavors in developing countries, leading to joint ventures, transfer of technology or business collaboration with local firms. This program is responsive to and depends on initiatives from the private sector.

Although the average funding per project is just under $100,000, most of the projects are smaller, but a few, particularly in the water resources field, are larger. Table 5-14 shows budgets as well as the number of projects by region for the last seven years, for the two main sub-sectors of water supply and sanitation, and water resources. CIDA INC supported 63 projects with a budget of $6.3 million for an average of $0.9 million per year. Of this total, 57 projects had a CIDA contribution of $4.8 million for water supply and sanitation projects. Most of these projects were studies to promote Canadian goods and services for both aid and trade. Based on a $250,000 study in Tunisia supported by CIDA INC, a Canadian consultant received contracts for over five million dollars in the water resources field. In another case, water supply studies in Ethiopia led to large aid contracts in rural water supply and sanitation for the southern region of the country. From Table 5-14 and Figure 5-6 a trend can be seen for increased support to Canadian companies for studies and equipment promotion in developing countries. More details on CIDA INC projects can be found in Appendix F.

Fig. 5.6 : CIDA INC Budgets for Water and Sanitation Sector Projects

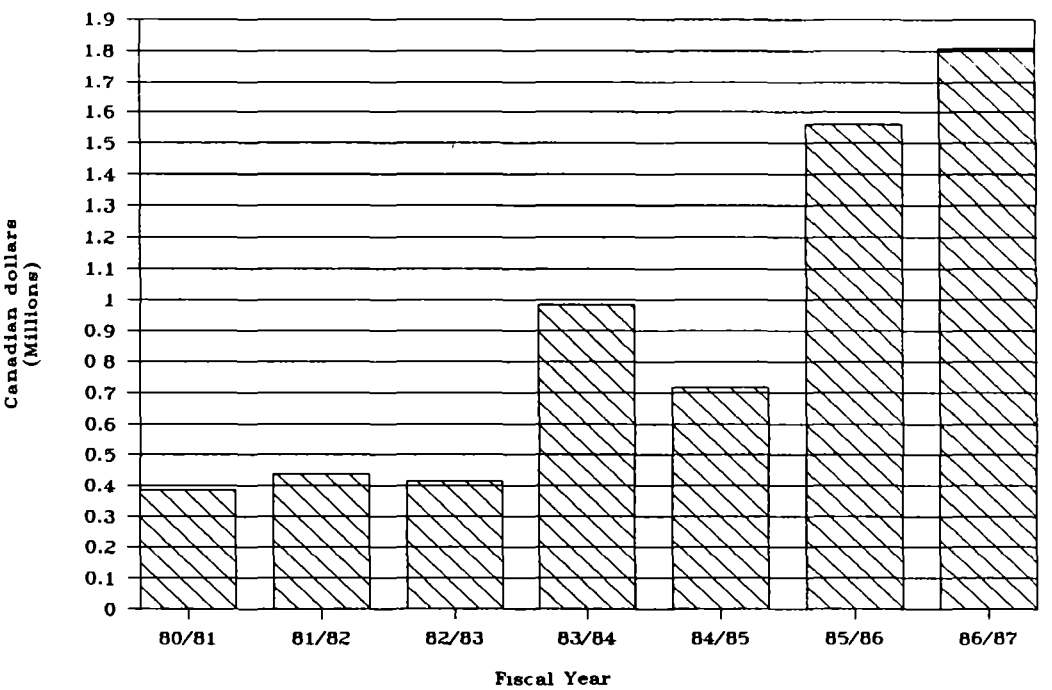


Table 5-14
CIDA INC Projects and Budgets for the Water and Sanitation Sector (1980-1987)
($ 000's)

Water Supply & Sanitation

REGION/YEAR	80/81	81/82	82/83	83/84	84/85	85/86	86/87	7 Year TOTALS
Asia	1/8	1/239	1/13	1/100	2/374	2/293	5/682	13/1709
Anglophone Africa	1/10	2/160	1/177	3/247	-/-	-/-	1/296	8/890
Francophone Africa	2/110	2/20	1/10	4/329	1/15	2/101	2/302	14/887
Americas	1/10	1/19	3/120	7/309	5/330	2/245	3/253	22/1286
TOTALS (WS/S)	5/138	6/438	6/320	15/985	8/719	6/639	11/1533	57/4772

Water Resources

REGION/YEAR	80/81	81/82	82/83	83/84	84/85	85/86	86/87	7 Year TOTALS
Asia	nil	nil	1/96	nil	nil	3/920	nil	4/1016
Anglophone Africa	nil	nil	nil	nil	nil	nil	nil	nil
Francophone Africa	1/248	nil	nil	nil	nil	nil	1/275	2/523
Americas	nil	nil	nil	nil	nil	nil	nil	nil
TOTALS (WR)	1/248	-	1/96	-	-	3/920	1/275	6/1539

Source: Information from CIDA INC.

1. Budgets equal disbursements (approx) since most projects are of 1-2 year duration and final payments closely match original budgets.
2. 1/248 = No. of Projects/Budget ($000's).

5.6 OTHER WATER-RELATED PROJECTS

In addition to water resources projects and water and sanitation projects, CIDA also provides funding for other water-related projects which are not included in previous chapters or sections of this paper. Two areas where CIDA funding of water-related projects is considerable are energy and agriculture. Most of the support is provided through Bilateral Branches. In the past 20 years (1968-1987) some $1,000 million has been budgeted for water-related projects in these two other sectors.

Many hydro-electric power projects have been supported in the energy sector. CIDA has agreed to fund some $630 million for such projects: roughly $450 million towards planning and implementation of civil works (particularly dams) and about $180 million for powerhouse designs and equipment (particularly turbines and generators). Approximately $63 million, or 10 percent of the total, was for various studies and technical assistance. Most of the support for water-related energy projects has been in Asia. Two major planning projects are particularly interesting. One is for the Three Gorges multipurpose project (flood control, power and navigation) in China and the other includes national water resources planning for power and irrigation in Nepal.

The agriculture sector in CIDA includes irrigated agriculture which, of course, depends on water. In addition to the water resources management projects already reviewed under the water and sanitation sector, CIDA's Bilateral programs include funding of almost $400 million for irrigation and drainage projects. Most of these projects and associated costs are for Asia.

Canada also provides indirect support for water and sanitation programs through other channels not previously discussed:

a) Food and commodity aid can result in the sale of these items in developing countries and the associated generation of local funds. These local funds are sometimes used, in turn, to help finance water and sanitation projects.

b) Mission-administered funds, controlled by the Ambassador or High Commissioner, often support small-scale projects in the water and sanitation sector.

No data is available on the magnitude of funding provided by these channels. Their net impact would probably be minor, however, on the overall level of CIDA support in the water and sanitation sector.

5.7 SUMMARY OF TOTAL CIDA SUPPORT FOR THE WATER AND SANITATION SECTOR

5.7.1 Approved Budgets for Sector

Budgets for Bilateral Branch projects in this sector have averaged $60 million per year over the last seven years - 1980/81 to 1986/87 (see Table 5.3). In a similar period Special Programs and CIDA INC have averaged over $5 million per year and about $1 million per year respectively, giving a total average budget from these Branches of some $66 million per year for water and sanitation projects. Although sector data for the Multilateral Branch is not available, it has been estimated (see Section 5.2) that in recent years a minimum of $21 million per year would be funded by the international financial institutions for this sector from funds received from CIDA. Therefore the

total budget support by CIDA for the water and sanitation sector would average approximately $87 million per year during recent years.

5.7.2 Disbursements for the Sector

Actual CIDA disbursements for projects in the water and sanitation sector are known for the last four years - 1983/84 to 1986/87 - for the four Bilateral Branches. These are $33.7 million, $26.5 million, $29.1 million and $30.4 million respectively, for an average of $30 million per year. Recorded disbursements for the water and sanitation sector over the past years, therefore, represent about 3.3 percent of total disbursements from Bilateral programs (excluding food aid).

Present forecasts for CIDA bilateral disbursements in the sector for the next three years - 1987/88 to 1989/90 - are as follows: $29.0 million, $38.6 million and $45.2 million. These Bilateral Branch disbursement figures are lower than budget figures indicated earlier, reflecting a lag between planned and actual disbursements. Another possible reason for disbursements being lower than budget figures could be differences between how planned projects were classified and how actual disbursements have been recorded within CIDA.

From the CIDA bilateral disbursement forecast in the sector for 1990/91, $50 million has been determined as a reasonable estimate. Using these figures, Table 5-15 was developed to give an indication of probable total CIDA disbursements for water and sanitation projects over the last four years and for the next four years - an eight year period from 1983 to 1991.

Table 5-15 indicates that annual disbursements by Bilateral Branches for water and sanitation are expected to rise from a present average of $30 million per year to $50 million or more by the early 1990's. Funding for the sector from Special Programs and from CIDA INC is expected to increase by about 50 percent by 1990/91, to about $8 million and $3 million per annum respectively. Total CIDA disbursements for the water and sanitation sector, therefore, are estimated to rise from a present level of about $60 million per year to over $90 million per year in the early 1990's. The present level of disbursements of some $60 million annually for the water and sanitation sector represents some 2.7 percent of Canada's total ODA over the past four years.

Estimated disbursements for sector projects over the eight years 1983/84 to 1990/91 are shown graphically on Figure 5.7.

Table 5-15
Estimated Total CIDA Disbursements for the
Water and Sanitation Sector (1983 - 1991)
($ in millions)

Branch	Past				Future				Total
	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91	
Multilateral	21	21	21	21	24	26	28	32	194
Bilateral	34	27	29	30	29	39	45	50	283
Special Programs	6	6	6	6	7	7	8	8	54
Industrial Cooperation	1	1	1	2	2	2	3	3	15
Total	62	55	57	59	62	74	84	93	546
Est. Averages/Year	——— 58.25 ———				——— 78.25 ———				68.25

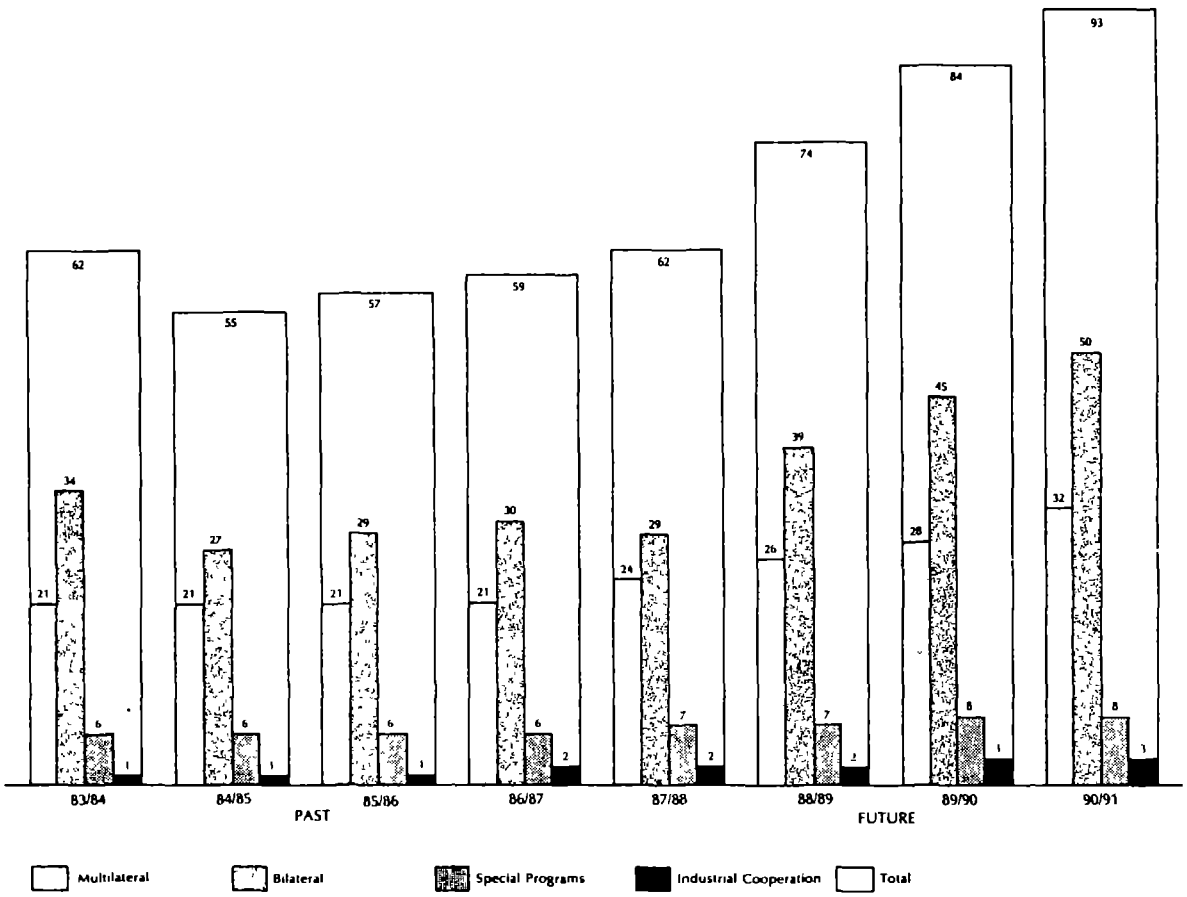
Source: Previous sections and CIDA printouts of actual and forecast bilateral disbursements for the water and sanitation sector (Feb. 1988).

For the three years (84/85 to 87) actual total bilateral disbursements averaged $0.9 billion per year for all sectors without food aid.

For the three years (87/88 to 90) forecast total bilateral disbursements show an average of $1.1 billion per year without food aid.

Note: These data exclude substantial disbursements on water projects in the agriculture and energy sectors. Some of these projects included significant components in the water resources management area.

Figure 5.7
Estimated Total CIDA Disbursements for the Water and Sanitation Sector (1983-1991)
($ millions)



Chapter 6

ACTIVITIES OF OTHER DONORS IN THE SECTOR

Chapter 6

ACTIVITIES OF OTHER DONORS IN THE SECTOR

6.1 INTERNATIONAL INITIATIVES IN THE SECTOR

The United Nations has taken a leadership role in sector coordination with the holding of four major UN Conferences which touched on aspects of water sector programs:

- Human Environment: Stockholm, 1972;
- Human Settlements: Vancouver, 1976;
- Water: Mar del Plata, 1977;
- Desertification: Nairobi, 1977;

Each conference has influenced policies and practices on the water sector's development. An important turning point came with the UN World Water Conference at Mar del Plata, 1977. More than 1500 participants attended, representing 116 governments and many international organizations. Canada sent a large delegation, including representatives from the federal and provincial governments. The Conference Secretariat produced two overview documents: *"Resources and Needs: Assessment of the World Water Situation"* and *"Present and Future Activities of the United Nations System in Water Resources Development"*. The Conference approved a final Action Plan with two parts: a series of recommendations covering all the essential components of water development, and twelve recommendations on a range of subjects.

The main purpose of the World Water Conference was to promote a level of preparedness, regionally and internationally, which would help the world avoid a water crisis of global dimensions by the end of the present century. An attempt to assess the achievement of that Conference was made ten years later during the Interregional Symposium on Improved Efficiency in the Management of Water Resources, at the UN Headquarters in New York in January 1987. It seems that the specific achievements of the 1977 Conference, with respect to water resources management, are impossible to quantify, although some progress has been made on the implementation of some parts of the Mar del Plata Action Plan (Biswas, 1987).

6.1.1 Water Supply and Sanitation

The principal outcome of the World Water Conference has been the current International Drinking Water Supply and Sanitation Decade (IDWSSD, 1981-90) for which the UN established an inter-agency Steering Committee for Co-operative Action. The most active members of this Decade Steering Committee are UNICEF, UNDP, WHO, and the World Bank. The Committee is the focal point for information exchange on members' activities. Sub-committees are active in the areas of human resource development, information exchange, project formulation, public information and women's roles in the IDWSSD.

At the country level, UNDP resident representatives act as focal points for IDWSSD activities. As a result, there has been a substantial increase in inter-agency coordination and inter-sectoral co-operation. The IDWSSD has also resulted in increased co-operation among bilateral donors. Six inter-agency meetings have been held in the past three years, with important benefits to the sector. They are as follows:

- European Donor Consultation, Federal Republic of Germany, Oct., 1984;
- Development Assistance Committee (DAC/OECD) Consultations, France, May 1985;
- Asia Regional External Support Consultation, Philippines, Oct., 1985;
- Americas Regional External Support Consultation, USA, April, 1986.
- Africa Regional External Support Consultation, Cote D'Ivoire, Nov. 1986.
- International Drinking Water Supply and Sanitation Consultation, Switzerland, Oct., 1987.

These meetings have had a substantial impact in advancing water supply and sanitation sector development, especially in achieving consensus between external support agencies (ESAs) and most developing countries on the major policy issues.

For example, the African Regional meeting drew up what has become known as the Abidjan Statement which clearly spells out policy direction for water supply and sanitation. This policy is highlighted in Box 3.2.

The four most active UN agencies in water supply and sanitation are UNICEF, World Bank, WHO and UNDP. UNICEF is currently allocating over US $50 (Cdn $65) million a year to projects aimed at child survival and development. In particular, UNICEF has recently accelerated its efforts to integrate water supply and sanitation with other health measures, such as health education, growth monitoring, oral rehydration therapy, breast feeding and immunization. It now has activities in 35 countries of sub-Saharan Africa, 9 countries of the Middle East and North Africa, more than 20 countries of the Americas and 16 countries of Asia and the Pacific. It has a total of 151 staff devoted to the water supply and sanitation sector.

Apart from its major lending activity in this sector, the World Bank initiated its Low Cost Water Supply and Sanitation (Decade) Program in 1978. Since that time, it has provided technical assistance to about twenty countries and currently has a staff of about 50 international and local professionals worldwide. Up to mid-1987, its work was divided into six projects, namely:

- Rural Water Supply Handpumps Project
- Low Cost Sanitation Project
- Resource Recovery Project
- International Training Network
- Project Preparation Units, Asia
- Sector Development Teams, Africa

The UNDP/World Bank have taken a leading role in developing and testing new approaches, including technologies which poor people can afford and sustain, coupled with effective delivery systems. Although the programs initially focused on technology development, they are now reoriented to the development and demonstration of effective delivery systems, information dissemination and human resources development.

The Program receives its core financial support from the UNDP, which up to mid-year 1987, had provided just over US $30 (Cdn $39) million. Other support comes from bilateral agencies such as CIDA, GTZ, NORAD, SDC and others. Thus far, CIDA has contributed US $2.1 (Cdn $2.7) million, primarily for health impact studies, investigations into institutional strengthening requirements and handpump development.

Of particular interest is the International Training Network (ITN). In 1982, CIDA funded the preparation of training materials for low-cost water supply and sanitation through the Multilateral Branch. These are now being disseminated through the ITN, which addresses the training needs of professionals and technicians in planning and implementing appropriate technology projects using multi-disciplinary approaches. Its dissemination project consists of strengthening Network Training Centres (currently operating in India, Zimbabwe, Kenya, and Indonesia), enabling them to upgrade their own curricula and support training in low-cost water supply and sanitation in other training institutions. The ITN is becoming instrumental in supporting efforts of developing countries to develop more and better qualified trainers, more appropriate training methods and more adequate training facilities.

In summary, the UNDP/World Bank Decade Program has:

- Made handpumps a viable choice for rural water supply projects by solving the technological problems that had plagued their use. This was followed by the development of a guide to their selection for various conditions, and by beginning the demonstration of community management of handpump systems, combined with local manufacturing of handpumps and spare parts.

- Made on-site sanitation acceptable by improving latrine designs and solving problems of odour and insects, and by successfully demonstrating models for delivery of sanitation in Botswana, India, Lesotho, and Zimbabwe.

- Developed an extensive set of information and training materials on low-cost water supply and sanitation. These are now being distributed, and a network of training centers in developing countries put in place. These and other materials are used to increase awareness and build local capabilities to plan and deliver low-cost services.

- Played a major coordinating role among the external support agencies and supported changes in donor policies toward investments in the sector.

- Successfully promoted government policy shifts toward adoption of low-cost water supply and sanitation systems and toward community management and financing of services (UNDP/World Bank 1987).

WHO has been active in documenting and creating a data base for Decade progress. It has recently established the Country External Support Information system (CESI) which gathers, collates and disseminates information on externally supported projects within the water supply and sanitation sector. CESI is intended to be actively updated, with information exchanged between key ministries in the developing countries, ESAs, UN agencies and their affiliates.

Its other work in this sector is in the field of environmental health and human resources development. WHO's annual expenditure in this sector averages US $20 million. It has 70 sanitary engineers in the field and 10 in Geneva.

The UNDP itself provides funding (US $20 to 25 million/year) for the development of novel program approaches and Decade coordination.

6.1.2 Water Resources Management

Whereas international ESAs have been very active, separately and cooperatively, in dealing with water supply and sanitation programs, there has been less activity, and the collaboration has been of a more general nature, on the matter of water resources management. In part, this reflects the diversity of uses for water, as water resources are developed for use in many different sectors - agriculture, energy, transport, industry, etc. Inter-sectoral collaboration is difficult within any given country and even more difficult between international agencies concerned with water resources.

No single agency within the United Nations system exists to deal primarily with water resources. However, many agencies have programs and projects which deal with various aspects of water management, including:

- **The World Meteorological Organization (WMO)** actively assists countries on questions of meteorology and hydrology, on the collection and analysis of information on rainfall and water resources.

- **The Food and Agriculture Organization (FAO)** is concerned with water resources from the perspectives of irrigation, fisheries and forestry.

- **The United Nations Educational, Scientific and Cultural Organization (UNESCO)** which deals with some training aspects of water resources management.

- **The United Nations Environment Program (UNEP)** has programs related to the preservation of water quality, particularly on a regional basis, focussing for example on the Caribbean and Mediterranean Seas.

- Habitat, **The United Nations Centre for Human Settlements (UNCHS)** undertakes activities in the field of infrastructure: research, information dissemination, training and demonstration projects.

- **The United Nations Department of Technical Cooperation and Development (UNDTCD)** has a staff of 20 hydrogeologists and works primarily in the field of water resources, especially in Africa. It contributes US $10 million annually.

- **The World Health Organization (WHO)** and **The United Nations Children's Fund (UNICEF)**, as previously mentioned, are both quite active in water supply and sanitation programs, but are little concerned with other aspects of water resources management.

Development banks and the bilateral development agencies actively support specific water projects in various sectors - energy, agriculture, transport, etc. - but few maintain a broad perspective on all aspects of water resources management. The World Bank, for example, has no part of its organization which focuses broadly on the water sector. When a multipurpose water project is developed, that bank deals with it mainly through the primary sector concerned. For example, a project providing benefits for energy, river transport, irrigation and city water supply, would be analyzed and managed by an ad hoc group led by the sector most concerned.

In the absence of strong leadership by any single international agency in the water field, most international cooperation on general (rather than specific) topics proceeds on an ad hoc basis. This pragmatic approach reflects the institutional complexities in most countries, Canada included, concerning the management of water resources.

One international agency which is actively involved in matters of water resources management is the United Nations Development Program (UNDP), again on a case-by-case basis rather that as a general policy. In many developing countries the UNDP is actively supporting a variety of projects and programs which deal with various specific water resources problems. One good example is a recent initiative of UNDP's Regional Bureau for Africa, concerning a hydrological assessment of water resources in sub-Saharan Africa. The project purpose is to evaluate the status of all existing hydrological data networks and collection systems. The proposed study will also make recommendations for filling important information gaps, for upgrading the quality of data collection and for the general enhancement of the capability to measure, retrieve, process and publish hydrological data and information in sub-Saharan countries. The ultimate aim is to assist countries in the creation and/or improvement of a sound hydrometric base, for the purpose of planning and evaluating water resource development programs and projects.

Funding for this study is expected to be provided mainly by the UNDP and the World Bank. Project execution will apparently be shared by the World Bank and UNDTCD, with WMO assistance concerning hydrometeorology.

6.2 FINANCIAL RESOURCE MOBILIZATION

6.2.1 International Agencies

The 1980 cost estimate to reach Decade goals (expressed in 1978 prices), was US$ 600 billion (World Bank, 1980). However, with the acceptance of low-cost technologies, it is now estimated these goals can be achieved with an expenditure of US$ 180 billion (based on 1987 prices).

UNICEF estimates that if domestic inputs were raised to 80 percent (which is optimistic) of total funding, through low-cost technologies and strong community contributions, then some US $18 billion/year would be required for a 10-year period beginning in 1990. It is also estimated that 62 percent of requirements will be in Asia and only 12 percent in sub-Sahara Africa (UNICEF, 1987).

UN funding has been an important catalyst in increased flows of resources from bilateral donors and development banks. These are listed in Table 6.1. The total UN funds allocated to water-related activities (including hydropower and irrigation) between 1973 and 1985 were US$ 1,337 million or an average of US$ 103 (Cdn.$ 147) million annually. The total allocation to the water supply and sanitation sector between 1973 and 1985 was US $707 (Cdn $919) million. Water-related activities include hydropower, irrigation, environmental conservation and multi-purpose projects. The latter two were allocated US $22 (Cdn $29) million and US $65 (Cdn $85) million respectively.

Allocations to the water supply and sanitation sector rose from US $7.7 (Cdn $10) million in 1973 to US $104 (Cdn $135) million in 1983, but declined to US $84 (Cdn $109) million in 1985. UNICEF's funding has been the major influence over these trends, particularly the rapid rise in the early years of the IDWSSD and also the subsequent decline. It is noted that UNDP's contributions have continued to rise throughout the Decade. It is also interesting to note that of the total water sector, water supply and sanitation were given a high priority starting at 24 percent of the total in 1973, rising to 61 percent in 1979, and levelling out at an average of some 55 percent since then.

Table 6.2 lists the funding levels for water supply and sanitation of the major external support agencies, and compares them to CIDA's assistance in this sector. Although the data from other ESA's were gathered from a variety of sources (and accuracy may vary), they do reveal some interesting facts and trends. The World Bank is by far the largest ESA for this sector. Its lending program for water supply and sanitation has risen from a low during this decade of US $441 million in 1982 to US $969 million in 1987. Other major donors are Germany and Japan. The EEC is also a major donor, contributing in the order of US$60 million/yr. USAID has undergone major reductions in support to this sector, responding to cutbacks in its overall aid program during the eighties. During the mid-eighties, donors either maintained funding levels or substantially reduced them. This trend is now being reversed by the World Bank and Japan who have increased their support over the last two years. Financial support to the sector by CIDA puts Canada in the same league as supporters such as NORAD and the Saudi Fund. Information on CIDA programs of sector support is provided in greater detail in Chapter 5.

The total (global) amount of external funds contributed to water supply and sanitation in Third World countries rose rapidly during the seventies but levelled off during 1980-81 at about US $2.1 (Cdn $2.7) billion, coinciding with the stagnation of foreign aid and the world recession. Loans from the World and Regional Banks constituted some 50 percent, bilateral donors 37 percent, UN agencies 7 percent and NGOs 6 percent of the total (UN, 1985c). Funding by the international banks has remained relatively steady during the first half of the eighties, but there has been a perceptible shift towards higher interest rates. Loans have tended to be taken increasingly by the larger and more affluent countries of Asia and Latin America. The vast majority have been for water supply, primarily in urban areas (90 percent) where the resource base enhances cost recovery.

The trend towards funding urban water supply by the larger international banks has been partially offset by the bilateral donor agencies, which have been increasingly orienting their support towards the rural areas of the poorer developing countries and towards Africa, in particular. Approximately 90 percent of bilateral assistance still goes to water supply, rather than sanitation and hygiene education, although there are indications that this is changing (the trend being led by Germany).

Another trend taking place is the strengthening of external assistance to institutional development and non-capital components of projects such as human resources development, hygiene education, community participation and especially operation and maintenance. This is evidenced in the more recent bilateral donor policy statements and the general agreement on policy directions, an example of which is the earlier quoted Abidjan Statement (Box 3.2).

Table 6.1 : United Nations Disbursements for Water-Related Projects
1973-1985* in millions of U.S. Dollars

Agency	Year													Total	% of WS&S	% of Total Sector
	73	74	75	76	77	78	79	80	81	82	83	84	85			
WATER SUPPLY & SANITATION (WS&S)																
UNICEF	2.79	8.20	10.86	12.77	18.57	18.36	54.11	50.58	45.32	61.70	67.43	63.33	42.14	456.16	64.5%	34.1%
UNDP	4.90	5.63	9.63	7.21	7.05	7.28	9.22	13.84	14.67	18.69	21.93	22.17	27.22	169.44	24.0%	12.7%
CDF	-	-	0.02	1.41	2.89	2.28	1.65	2.68	8.30	3.83	9.37	7.62	5.81	45.86	6.5%	3.4%
WFP	-	-	-	1.81	1.81	1.99	1.36	1.71	1.36	2.71	5.73	7.67	9.30	35.45	5.0%	2.7%
TOTAL WS&S	7.69	13.83	20.51	23.20	30.32	29.91	66.34	68.81	69.65	86.93	104.46	100.79	84.47	706.91	100.0%	52.9%
OTHER WATER-RELATED ACTIVITIES	24.03	23.60	29.47	31.79	28.45	32.23	42.63	48.68	56.50	68.66	70.17	74.37	99.65	630.23		47.1%
GRAND TOTAL	31.72	37.43	49.98	54.99	58.77	62.14	108.97	117.49	126.15	155.59	174.63	175.16	184.12	1,337.14		100.0%

WS&S - Water Supply and Sanitation
UNICEF - United Nations Children's Fund
UNDP - United Nations Development Programme
CDF - Capital Development Fund
WFP - World Food Programme

* Source : UN Secretariat, Dept. of Intl. Economic and Social Affairs (1986)
"Improved Efficiency in Management of Financial Resources: MDPFU/SYMP/2, November.

Table 6.2
Trends in Funding for Water Supply and Sanitation
by Principal External Support Agencies
US$ Millions

Agency	1984	1985	1986
CIDA[1]	55	10	88
KfW and GTZ (Germany)[2]	190	202	154
USAID (USA)2	405	98	25
DECF & JICA (Japan) grants[2]	56	81	76
DECF & JICA (Japan) loans[2]	151	171	153
NORAD (Norway)[2]	23	120	1
SIDA (Sweden)[3]	-	-	26
Saudi Fund[2]	34	41	11
African Development Bank, loans[4]	52	114	107[2]
Other Regional Banks, (ADB, CDB, IDB), loans[5]	192	194	191
World Bank, loans[6]	641	781	605
UNICEF[7]	63	42	52

Notes:

1. Budgets for new projects in bilateral programs.
   Details in Table D.1, in Appendix D.
2. Data obtained from CECI/WHO.
3. Data obtained from SIDA.
4. Estimated in 1986 based on data reported by individual AfDB project officers.
5. Estimated on the basis of 5% of total lending programs.
6. Data from the World Bank annual reports.
7. Data from Table 6.1.

During the first half of the IDWSSD, Belgium, Denmark, Italy, Norway, Switzerland and USA reported increased allocations in support of water supply and sanitation. These were led by Germany which increased its already substantial support by 67 percent between 1981 and 1984. The percentage of bilateral overseas development assistance allocated to water supply and sanitation ranges from 2.7 to 15 and averages about 6 percent (UN, 1985c).

Canada's disbursements to this sector, including water resources management, during the past four years represents less than four percent of Canada's overall development assistance, shown in Chapter 5.

The WHO/BMZ European Donor Consultation of 1984 in Konigswinter, Federal Republic of Germany, provided a useful forum for exchange of information between external support agencies and is the basis of the following notes on the principal activities of the bilateral and multilateral agencies active in water supply and sanitation (Lieser *et al.*, 1985).

In implementing its sector strategy paper policies the **Federal Republic of Germany** emphasises the integration of water, sanitation and health components of projects, protection of natural resources, use of appropriate technologies, operation and maintenance, cost recovery and community participation.

Some SF 25 ($22 Cdn) million were contributed to water and sanitation projects by **Switzerland** during 1983, almost all being for rural water supplies. The Swiss Development Corporation sector policies correspond almost exactly to those of Germany.

The **Danish International Development Agency (DANIDA)** channels some 15 percent of its ODA funds for mainly rural water supply projects in 20 countries. Emphasis is again on community participation, appropriate technology and assumption of responsibility for operation and maintenance of installed systems by the beneficiary communities themselves.

The **Overseas Development Administration** of the UK also emphasises the importance of adequate operation and maintenance through cost recovery mechanisms. The UK has successfully instituted twinning arrangements between its water authorities and those of the developing countries in support of institutional development. The UK has recently published a new water sector appraisal manual which underscores the importance of hygiene education and the adaptation and use of local technologies.

The **Norwegian Agency for International Development (NORAD)** concentrates its aid in the poorest countries (5 in Africa, 4 in Asia) and contributed some US$ 40 ($53 Cdn) million to the water supply and sanitation sector in 1984. NORAD also focusses its assistance on the priority problems of the sector: institutional development, cost recovery and the need for greater involvement of the community, especially by women.

From 1965 to 1984 the **Swedish International Development Agency (SIDA)** contributed a total of some SEK 1,250 ($258 Cdn) million to rural water supply programs in developing countries. Again emphasis was on community involvement, appropriate technology, sanitation, hygiene, institutional development, water resources management, human resources development, standardization and sector policy development. SIDA concentrates on rural water supplies in five countries: Botswana, Ethiopia, India, Kenya and Tanzania.

The **U.S. Agency for International Development's (USAID)** activities are decentralized, coming under its housing and disaster assistance programs, long term drought prevention systems, and support to NGO's. USAID supports the Water and Sanitation for Health (WASH) program which has been actively pursuing appropriate technology development. USAID's activities emphasise institutional development, "software" elements in projects, rural water and sanitation and recurrent cost recovery by the beneficiaries.

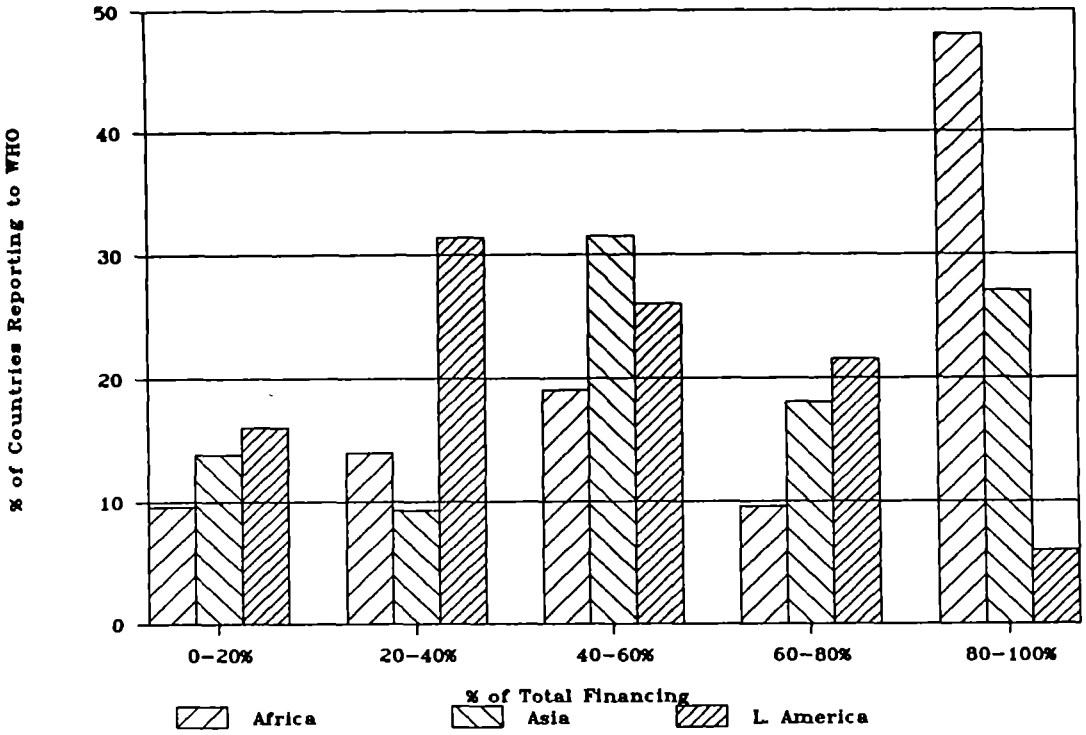
The **European Economic Community** increased its committment to the sector over the first half of this decade by 18%. Between 1981 and 1985 its total contributions amounted to ECU 200 ($300 Cdn) million, averaging $75 Cdn million per year. Its financing of NGO-implemented projects amounted to ECU 30 ($45 Cdn) million per year in 1985.

6.2.2 Developing Country Budget Allocations

Budget data for water resources management as defined herein is not available in any published form and therefore cannot by analyzed. However, data on water supply and sanitation expenditure by developing countries is due primarily to the increased focus and strong trend towards international support for water supply and sanitation following the World Water Conference in 1977. The proportions of national budgets being allocated to the water supply and sanitation sector have remained relatively stable since the beginning of the Decade. Most countries report allocations within the range of 1 to 6 percent of national budgets, although some (including Malawi, Uganda and Zambia) report percentages higher than 10 percent. Significant increases have been made, since the beginning of the Decade, in India, the Philippines, Nepal, Sri Lanka and Sudan.

In general, external bilateral financing has been directed to the poorer countries, indicating that this sector is viewed as one responding to the basic needs of the lower income groups. The lower the per capita income and the higher the dependency on foreign assistance, the higher the external support given for this sector. In Latin America and Asia, some 40 percent of sectoral investment in new works projects is financed by external sources (primarily loans). In Africa, this percentage often exceeds 80 percent and in some cases sector development relies almost exclusively on external funding (UN Secretariat, 1986). In these cases, economic recession, debt repayment and declining public sector investment has forced this sector into almost total dependency on external sources. Fig. 6.1 illustrates the distribution of external support as percentages of total financing within the water supply and sanitation sector, according to region. The extreme situation of ten African countries (out of the 21 reporting to WHO) is readily apparent in that they depend almost entirely on external financing for sector development. There are, however, many others located north of the Sahara whose dependency is less than 40 percent. It is noted that half of the external assistance comes in the form of loans, much of them at near commercial rates. In many cases (especially in Latin America and Asia) the term dependency is not relevant. In summary, nearly half of the total 62 countries reporting indicated that external funding constitutes over 60 percent of total funding for water supply and sanitation.

Figure 6.1
External Support as Percentage of Total Water Supply and Sanitation Financing



Source: UN Secretariat (1986)

Table 6.3 lists the median percentage values of sector investment from external sources. The highest is in Africa which in 1985 was 75 percent. If present trends continue, external funding will probably account for some 40 percent of developing country water supply and sanitation investment in 1990 (IDWSSD, 1987).

Table 6.3
Proportion of Sector Investment from External Sources

Region	Percentage From External Sources Median Values for External Investment 1980 %	1983 %	1985 %
Africa	48.5	83.0	75.0
Americas	24.9	40.0	33.5
South East Asia	49.0	47.0	61.0
Eastern Mediterranean	-	45.0	17.5
Western Pacific	73.0	62.5	51.5

Source: IDWSSD (1987) Table 6.8.

There is reason to believe that a similar condition applies to other components of the water resources sector as well (UN Secretariat, 1986). For the poorest of countries this condition will likely deteriorate, rather than improve, in coming years.

6.3 EXTERNAL SUPPORT AGENCY POLICIES FOR WATER SUPPLY AND SANITATION

For reasons previously mentioned and because of the multiplicity of uses of water resources, few operational policies of external support agencies can be discerned concerning the general fabric of water resources management. On the other hand, most ESAs have now written and published "policy" statements pertaining to water supply and sanitation. These have been influenced by first hand experience in sector programs and by collaboration between ESAs, especially the series of inter-agency consultative meetings mentioned above. In reviewing other donors' policies, it may be useful to focus first on two leading external agencies (Germany and UNICEF) and then on the most recent donor consultation (Interlaken, Switzerland in October, 1987) where a general consensus was reached on sector policy.

The Federal Republic of Germany is one of the most active ESAs in the water sector. (Table 6.2) Its Ministry for Economic Cooperation has set down criteria for project selection and design. Some of the highlights are as follows (BMZ, 1984):

- The principal objective of water supply projects is to ensure the supply of sufficient amounts of hygienically safe drinking water for basic human needs (drinking, cooking, washing) for all strata of the population.

- In general, only those projects where the target group of the poorer population strata represents the major part of the beneficiaries should be promoted.

- Project preparation should lead to an integrated plan of all the measures necessary for the supply of water, as well as the disposal of sewage, faeces and solid waste.

- Project design should provide for staged improvements, so that the population can benefit immediately from low-cost initial measures and is given an incentive to actively support the respective next step of the improvement sequence.

- Operation and maintenance should be taken over by local workers trained for the job.

- As water resources are limited almost everywhere, the preservation of these resources must be given top priority when planning, constructing and operating water supply projects.

- Drinking water projects must include all necessary project components, i.e. the water catchment works, treatment facilities (if necessary) and conveyance to the consumers, as well as preparation of systematic maintenance and the necessary hygiene education.

- The principle of aiming at maximum simplicity in the design of water supply projects is of particular importance in rural areas. This is not only for cost-savings but also to avoid difficulties in ensuring adequate operation and maintenance of the facilities. This implies an awareness of local conditions in the construction of simple dug or drilled wells-equipped with easy-to-maintain handpumps, rain water cisterns, or spring water catchments with gravity lines into supply areas.

- For every water supply project, the planning should include provisions for suitable disposal facilities for wastewater, (possibly also rain water) and for faeces, as well as for the necessary finances.

- In the interest of environmental protection, as well as housing and drinking water hygiene, solid waste disposal requirements should be taken into account as an integral part of the planning for any sanitary engineering project and should cover all strata of the population and settlements in the project. Similarly, storm water disposal projects must take into account adequate disposal of solid waste, even if no drinking water and sanitation measures are planned or carried out simultaneously.

- Latrine programs, as developed by the World Bank/UNDP, are particularly suitable for promotion, as they are typical low-cost solutions adapted to local conditions and can provide opportunities for users' participation in construction, operation and maintenance.

- Hygiene education campaigns, institution-building support activities and training of technical staff must be included in line with local requirements as integral parts of all water supply and sanitation projects.

- The participation of the people in the planning, construction, operation and maintenance of water supply and sanitation projects is designed to ensure, in the long run, their acceptance of the new facilities and to contribute towards decisively improving the efficiency and prolonging the life of these facilities.

- As a matter of principle, cost-recovery charges should be aimed at for water supply, as well as for sewerage/sanitation. At least, actual effective income must cover all running expenses (operating and maintenance costs, small replacement expenditures) of the project and/or of the executing agency.

UNICEF's program focuses on the survival, health and well-being of children and, by implication, their mothers and the rest of the community. As children are hardest hit by poor hygienic conditions, UNICEF's program in water and sanitation rose to be its largest and most visible activity during the early eighties. Its policies have evolved over the past decade from a strong procurement orientation to project implementation in its fullest sense, both for and with governments. More recently, there has been a strong policy direction linking water and sanitation projects with other child related sectors, including health, education, food and nutrition and social welfare. The policies noted above in the German aid program also pertain, in general, to UNICEF.

Representatives of some thirty ESAs (including CIDA and IDRC) met in October, 1987 at the International Drinking Water Supply and Sanitation Consultation, in Interlaken, Switzerland. This meeting represented a turning point in this sector. It established a general consensus on policy and set directions for the remaining years of the IDWSSD and to the year 2000. The report of the Interlaken consultation (WHO/SDC, 1987) summarized the constraints affecting water and sanitation developments under six main headings. Recommendations were made to External Support Agencies such as CIDA under each topic, as follows:

Institutional Changes

1. Increase resources for public awareness campaigns and hygiene education.

2. Encourage decentralization and/or privatization of water supply and sanitation institutions, or certain functions of these institutions, and promote collaboration with rural development ministries on integrated programs.

3. Involve benefitting communities in project identification, planning, design, implementation, operation and maintenance.

4. Establish harmonized strategies to be adopted by all agencies active in particular countries or regions.

5. Provide support for institutions' management and staff training (as well as for education in community participation and hygiene awareness) through technical cooperation. TCDC should be encouraged.

6. Expand R&D programs and encourage local manufacture. Press for standardized engineering design criteria relating to appropriate water supply and sanitation technologies.

Cost Recovery

1. Emphasize in all dialogues with recipient country governments, the crucial importance of cost recovery in sustainable and replicable programs.

2. Encourage the establishment of strongly progressive, cross-subsidizing tariffs.

3. Support public awareness campaigns which stress the benefits of water supply and sanitation services and so promote willingness to pay.

4. Promote and support urban project designs based on full cost recovery from affordable technologies. Back sector agencies in strategies to achieve self-sufficiency and financial autonomy.

5. Use early community participation in rural areas to establish commitments to contribute cash, labour and materials for construction, operation and maintenance of appropriately designed facilities.

6. Extend support where necessary into the operation and maintenance phase of projects, but always with the long-term aim of establishing community responsibility for recurrent costs.

Balanced Development

1. Ensure that hygiene education campaigns emphasizing the complementarity of water supply and sanitation are included in sector programs receiving donor support.

2. Bring to the attention of program planners and designers the sources of information on low-cost and socially acceptable sanitation technologies.

3. Raise the proportion of technical cooperation and funding support given to integrated projects, and to the expansion of national water supply agencies' capacities, to enable them to cope with liquid and solid waste disposal activities.

4. Re-emphasize the key Decade concept of precedence for the *underserved* urban and *rural* populations, and encourage recipient countries to balance investments accordingly.

Operation, Maintenance and Rehabilitation

1. Ensure that project or program proposals take account of operation and maintenance needs, and that financial and human resources are available.

2. Compare proposed investments in new projects with alternatives for rehabilitation of existing systems which are disused or underperforming.

3. Assist sector agencies in developing countries to establish policies and institutional structures which provide for adequate operation and maintenance of existing and proposed new facilities.

4. Extend program support, where necessary, beyond completion of construction, to help equip agencies and communities for their O&M tasks.

Community Involvement

1. In providing program support, ensure that the balance of "software" and "hardware" is correct, and that training of community workers is part of the package.

2. Use hygiene education programs to motivate community members to participate in all project phases, with special emphasis on the role of women. Bring the benefits of water supply and sanitation investments into health education messages promoted through other sector agencies.

3. Provide technical cooperation to establish - where possible - the support system necessary for community management of completed installations to function effectively.

4. Ensure that project proposals have considered and properly reflected the views of the community on technology choice, service level, affordability, and operation and maintenance commitments.

Coordination and Cooperation

1. Promote cooperative efforts among sector agencies in developing countries, through UNDP and other aid coordination meetings.

2. Encourage integration of water supply and sanitation projects and programs with plans in other sectors.

3. Coordinate with other external support agencies policies of standardization for particular countries or regions. Avoid unnecessary proliferation of equipment types resulting from tied aid, and support the introduction of technologies appropriate for the specific situation of the country concerned.

4. Provide timely and accurate information for WHO's monitoring of project plans and progress, and use the proposed CESI system as a basis for sector planning.

5. Continue participation in global and regional discussions among groups of external support agencies, to use agreed sector strategies, publicize the findings to as wide an audience as possible, and convince the working level in each organization to acknowledge the new concepts and approaches.

The above recommendations to ESAs summarize current thinking and policy direction with respect to the water and sanitation sector.

6.4 INTERAGENCY COLLABORATION FOR WATER SUPPLY AND SANITATION

6.4.1 Consultative Mechanisms

Having the background of the previous five donor consultations (1984-6, Section 6.1.1), the objective of the 1987 Interlaken Consultation was to carry forward coordinated strategies and resource mobilization activities to the end of the IDWSSD and beyond. It was also proposed that a Collaborative Council be established to coordinate accelerated and expanded sector activities through to the year 2000. The Council would include representatives from UN Agencies, multilateral and bilateral funding agencies and NGOs involved in the IDWSSD. Measures would be sought to involve developing country representatives in the Council's activities. The Council itself would meet infrequently, but collaborative efforts would proceed through a Working Group.

The intention of the Collaborative Council proposal is to formalize arrangements already underway on an ad hoc basis to coordinate sector policies and programs by ESAs. A new organization is not envisaged, nor are extra resources required to support the concept.

Using the existing UNDP/World Bank (described in Section 6.1.1) program as a focus, the Council's activities would expand beyond water supply, sanitation and hygiene education, to encompass other environmental issues, such as wastewater reuse, solid wastes management, drainage and hazardous wastes management. The aim would be to help developing countries formulate sector strategies which capitalize on past experiences and the results of research and development work, by incorporating them into full-scale projects.

The proposed Collaborative Council was seen as being at the heart of a future framework whose objectives would be to:

(a) Maintain Decade impetus beyond 1990 and accelerate the provision of water supply and sanitation services to all, with special emphasis on the unserved rural and peri-urban poor.

(b) Expand the scope of activities to ensure these services are provided on an environmentally sound and sustainable basis.

(c) Improve the effectiveness of individual activities through increased coordination and collaboration.

In order to achieve these objectives, it was proposed that the Council would:

(a) Serve as a transfer point of information and act as a catalyst for coordinated action;

(b) Monitor, evaluate, distill and disseminate sector experience and promote relevant human resource development efforts;

(c) Promote/assist country sector strategy development and resource mobilization;

(d) Review/comment on work programs, projects and proposals of ESAs to alert proponents to opportunities for collaboration and to experience gained elsewhere. Disseminate results of those activities to all interested sector agencies; and

(e) Promote broadening of the scope of water supply and sanitation to include sector activities protecting/improving the environment, such as water conservation and reuse, drainage, and solid and toxic waste management.

In its work, the Council would be supported by a Working Group consisting of representatives from the bilaterals, NGOs, the Regional Banks, the World Bank, the Arab Funds, UNICEF, UNDP and WHO. The Working Group would work through task groups and advisory panels. The UNDP/WB program, complemented by WHO and ESAs as appropriate, would function as the Technical Support Group (TSG). The TSG would develop proposals, identify funding and carry out work programs in support of the Consultive Council (Kalbermatten, 1987).

The Council's proposed work program would consist of a series of projects suitable for funding by individual ESAs such as CIDA.

The UNDP/World Bank Decade Program presents many opportunities for inter-agency collaboration in this sector, some of which have already been taken by CIDA. Examples are to be found in CIDA/World Bank efforts in handpump testing and training in low-cost water supply and sanitation. In particular, it was CIDA's initial support for the preparation of training modules (multilateral funding) which has now evolved into the UNDP/World Bank International Training Network, a program which has subsequently been supported by several other bilateral and multilateral donors.

6.4.2 Joint Financing

The international banks are currently adopting policies aimed at general sector rather than project support. Unfortunately, sector loans require strong institutions, whereas this sector's principal constraint is the lack of institutional capacity to take on large projects. There will be an increasing need for institutional development in the future. Institutional development programs are well suited to bilateral funding, especially through human resources development. This gives rise to co-and-parallel financing opportunities, which call for stronger links and collaboration between the banks and bilateral donor agencies.

Several countries with the greatest debts are undergoing structural readjustment to reduce national deficits while bolstering their economies. Although money is injected into the economy by the international banks, in the form of low interest loans, structural adjustment also often means that currencies are devalued, the government civil service streamlined and food subsidies reduced. The poor are often hardest hit. Improving living conditions in low-income communities under these conditions is one way of reducing the impact of this structural readjustment on the poor. It is also a means of generating employment, fostering self-help programs and strengthening government institutions through institutional development. The water and sanitation sector can provide opportunities to reduce the burden of structural readjustment on the poor by joint financing arrangements with the international banks.

Chapter 7

KEY LESSONS LEARNED FROM EXPERIENCE IN THE SECTOR

Chapter 7

KEY LESSONS LEARNED FROM EXPERIENCE IN THE SECTOR

This chapter is a synthesis of the experiences of CIDA and other external support agencies working in water sector projects in developing countries. To date, only 11 end-of-project and 17 mid-project evaluations have been made by CIDA. These vary in quality and content; consequently inter-project comparisons are not possible. There are several "in-house" end-of-project reviews, but these are brief and deal with administrative matters rather than impacts or effectiveness. They were of little use in this analysis. The first lesson to be learned is that CIDA should systematically evaluate all water projects to gain useful insights for future projects.

This chapter is based on discussions with CIDA staff and what could be gleaned from the evaluations. Some lessons learned from projects are incorporated in this text in "boxes".

In view of the many lessons learned in water supply and sanitation by both ESAs and recipient countries over the past decade priority is given to that subsector. Lessons in water resources management are mentioned in the following sections, but specifically focused on in Section 7.3.

7.1 MEETING BASIC WATER AND SANITATION NEEDS OF PROJECT BENEFICIARIES

Development projects should be assessed in terms of their impacts upon the people to be served.

In most countries (Canada included), the first areas to receive water and sewerage infrastructure were the residential and central downtown areas of the larger cities. These areas are the most accessible, influential and able to pay for services. In 1985, 75 percent of urban populations in developing countries were served with water supplies. But urban statistics do not reveal the plight of those in the squatter settlements which comprise a high percentage of the unserved urban population. Figure 7-1 shows the percentages of the population already served in developing countries for both rural and urban areas.

Table 7.1
Percentages of Population in Developing Countries Served by Water and Sanitation

	1975		1985	
	Rural	Urban	Rural	Urban
Water Supply	19	74	42	75
Sanitation	11	51	15	59

Source: IDWSSD (1987), Table A.3.2. Data exclude China.

Governments have been slow to provide services in squatter settlements, due in large measure to questions of land tenure and cost recovery. Also, implementing agencies which act as public utilities are learning that their conventional methods of implementation are often inappropriate in squatter settlements.

A similar situation is found in the rural areas. Here the situation is compounded by the inaccessibility of most communities and the absolute necessity of relying on the communities themselves for systems' maintenance.

Coverage is worse for sanitation, especially in the urban squatter settlements where conditions are extremely bad - a consequence of sanitation not having political priority. The rhetoric in support of sanitation is seldom matched by action.

CIDA has focused on low-income groups as its target for development assistance. This is entirely appropriate, since unsanitary conditions affect the low-income communities most. The most vulnerable are the poor. The highest morbidity and mortality rates are found in the lowest income groups.

7.1.1 Rural Communities

Deficiencies in water resources management, the need for water and sanitation infrastructure in the rural areas, and the large numbers of people remaining to be served, indicate that the rural areas and the low-income groups inhabiting them will remain a primary target for this sector in the decades to come.

In their attempts to service the rural areas, water and sanitation agencies are becoming increasingly aware that institutions and methods first developed for the wealthier areas of the cities are inappropriate to the rural poor. The rural inhabitant is unable to afford conventional urban technologies and the centralized agency is unable to maintain them. These are hard lessons. In retrospect, they may appear straightforward, but they have taken over a decade to learn.

Questions relating to the design of appropriate technology have largely been answered, but the problem of ensuring long-term operation and maintenance by the low-income community remains. Active community participation has major implications for the majority of water sector agencies. Such agencies are not accustomed to decentralized decision-making at the community level. Neither do they have the personnel necessary

to carry it out. Understandably, non-engineering agencies, such as departments of community development and non-government agencies, have been most successful in developing community-based projects (Malawi, Lesotho). Unfortunately, NGO-based projects are limited in size and seldom achieve national program status. The challenge is to incorporate proven successful implementation methods into national rural water supply and sanitation programs. This implies fundamental changes in orientation, attitudes, staffing and organization of most sector agencies. The task is not impossible. There are good examples to follow, but there will have to be increased emphasis on institutional (particularly human resources) development.

More people can be served if low-cost technologies are used and standards are set to meet basic needs. These needs can be met by the provision of 25 to 50 litres of clean unpolluted water within 500 metres of the home in rural areas. Basic service levels imply that point sources (in preference to house connections) suffice. Basic sanitation needs are met by privately-owned (and where necessary public) latrines near the home. These can either be dry (vented), or pour-flushed, but need not be connected to underground sewerage. It is now well-established that improvements in hygiene are essential if full health benefits are to be realized from improved water supply and sanitation services. Hygiene education is an important component of the water and sanitation "package".

People should have the highest level of water supply and sanitation services that they want, can afford and have the capacity to sustain. Experience has shown, however, that subsidies should apply only to basic levels of service. The beneficiaries themselves should be encouraged to adopt higher levels, but to pay for the additional costs. This is the only way by which resources can be effectively expended to ensure their equitable distribution.

7.1.2 The Urban Poor

Living conditions found in the slums of very large cities, such as Mexico, Calcutta, and Abidjan are among the most unsanitary in the world. The situation has reached alarming proportions in most Asian countries and in some in Latin America. The pressures of rapid urbanization are already being felt in Africa and will continue for many years to come. In Sub-Saharan Africa, for example, the urban population is growing at more than 6 percent per annum. The demand for infrastructural services cannot be met by the meager resources of these countries.

In the squatter settlements, water is commonly provided by standpipes and sanitation by latrines, but open defecation is prevalent. Water must come from centralized urban supplies, thereby making the individual dependent on municipal resources. Sanitation can be decentralized by using on-site services where population densities and soil conditions permit. Municipalities seldom plan for the needs of the burgeoning squatter settlements, which themselves are unplanned. When these areas are included in the overall urban water distribution and sewage collection networks, major new works are required. These commonly include new reservoirs, supply pipelines, sewage collectors and treatment plants. Municipal departments are geared to meet these demands and Canadian resources are suited to assist them (ref. Chapter 4).

However, as in rural areas, municipal departments are finding that the use of only engineering and contracting methods are seldom suitable for the provision of services in squatter settlements. Combined technical and community development approaches are required to enable lower income groups to contribute to their own services, with technical and financial support from the municipality. An example of the success of this combined approach is in Lima, Peru (see Box 7.1).

Water Supply and Sewerage Systems in Peru ***Box 7.1***

Since the early eighties CIDA, with the World University Services of Canada, has been supporting water and sewage infrastructure systems in under-privileged areas of Lima. This program has recently been expanded to the Micro-Region of Pucha, Department of Ancash, and includes activities in the waste, agricultural and forestry sectors.

The long-term objective of the project is to assist Peru in meeting the basic needs of the most under-privileged people and to facilitate socio-economic development in order to improve their quality of life. The short-term objective was to install potable water systems, and to improve sanitary conditions.

Water supply and sewerage systems have been completed in 41 Pueblo Jovenes in Lima, providing 6,425 lot connections and servicing a population of 41,700. In Ancash Department, 18 water systems have been completed, providing 1,215 lot connections which service 6,075 persons. Training has been given in soil conservation, forestry and gardening.

Three small nurseries have been started, and work has started on five irrigation systems.

Since no major problems were encountered and objectives were met, the extension of this program to two more Pueblo Jovenes in Lima, Peru will probably take place.

The success of this project has been the result of continuous CIDA support, experienced field staff provided by WUSC, and excellent cooperation at all local government levels and by the people receiving the services. Two qualified Peruvian engineers, working full-time with the WUSC staff, have played an important role in keeping this project technically on track.

Lessons on reaching the poor with self-sustaining services can be learned from India's latrine conversion program, which has spread to nearly all of its States. A local organization, Sulabh Suchalaya, has established itself as an intermediary between the household and the municipality. It promotes the conversion of the latrine/conservancy system to pour-flush toilets. By handling the paperwork required for application of loans from the municipality, it facilitates the usually frustrating process of getting financial support. In this decade, it has installed over 100,000 toilets.

7.1.3 Women and Children

In both urban and rural low-income communities, women, and the children they care for, are the hardest hit by unsanitary conditions and lack of basic water and sanitation facilities or infrastructure. By making potable water accessible to the home in most of the projects it supports, CIDA has improved the lives of millions of women, (e.g. Ghana, Malawi, Ethiopia, Thailand, Guatemala, Kenya, to name but a few). The day-to-day drudgery and labour is drastically reduced, so time can be spent with children, on income generation, on education, or even on leisure pursuits. Sanitation facilities also provide the poorest with privacy and enable them to protect the health of the family. Women from the lower income communities should continue to be an explicit target for CIDA's assistance in this sector.

7.1.4 Refugee Situations

Canada has made substantial contributions to the emergency relief of refugees from natural disasters and warfare. Although these have addressed the immediate needs, there are longer term needs. Next to food and shelter, water supplies and sanitation are essential to the maintenance of health within these dense settlements. Unfortunately, government and external support agencies tend to look upon refugee settlements as purely temporary, whereas in reality, the majority of these settlements soon become permanent. Governments are seldom willing to allocate funds to upgrading or "legitimizing" refugee settlements. As a result, external assistance is required to provide basic minimum services.

CIDA emergency relief programs should be multi-year commitments, ensuring that longer term infrastructure requirements are met.

7.1.5 Structural Adjustment

Many of the poorest countries are currently undergoing structural adjustment programs, encouraged by the international lending agencies. Such programs are necessary to re-establish a climate of growth and to assure effective management of foreign aid. However, the initial impacts hit the poorest hardest. Recommendations have been made by the Standing Committee on External Affairs and International Trade (SCEAIT) that bilateral programs should invest in social and human resources development, concomitant to macro-economic adjustment, so that the burden of policy reform falls least heavily on the poor. Self-help water and sanitation projects can alleviate the burden by providing services for the improvement of health and productivity and by strengthening organizational and technical capacities of low-income communities for self-help development.

7.2 MANAGING, CONSERVING AND PROTECTING WATER RESOURCES

The water resources management projects undertaken by CIDA have been summarized in Chapter 5. Over the past decade, CIDA has undertaken some 36 projects in water resources management (Table 5-4). These projects have been concentrated in Asia and the Americas. Most have only offered technical assistance such as hydrology studies, institution building and training. However, the five largest of these projects accounted for some 57 percent of CIDA financing in this sub-sector because they resulted in the implementation of major water resources systems.

One clear lesson learned from CIDA's experience, and that of other international agencies, is that large and expensive infrastructure for water projects should not be financed until definite plans exist to finance, construct and operate the entire system. Otherwise, the benefits expected to justify the investments cannot materialize. In the case of the Manantali Dam on the Bafing River tributary to the Senegal River in Mali, for example, major investments have been made for the dam before the complementary investments on electric power and irrigation have been approved. Therefore, the benefits from the completed dam will be minimal in the near term. Significant benefits can only be achieved after major additional investments are made. A similar situation exists in the Maduru Oya project in Sri Lanka, where the benefits of major investments are being delayed by ethnic strife and financial constraints (see Box 7.2).

Another general lesson learned is that projects which help to train staff and develop local institutions have substantial, long-term benefits, that are very significant but difficult, or impossible, to quantify.

Water resource planning must take careful account of land use changes and related socio-economic development, since these activities directly affect water resources. One of the most vivid examples of these inter-relationships occurs in the Sahel. The recent rapid increase in the number of water wells, partly in response to drought conditions, may in fact have aggravated the problems resulting from the drought. Additional water supplies have resulted in more sedentary living patterns for people in the region, and in large livestock concentrations and overgrazing. This stripping of the vegetation has, in turn, led to the desertification of formerly marginal lands (IIED & WRI, 1986). However, good planning was the foundation for the successful Barrage de Sidi-Saad in Tunisia (see Box 7.3).

Another lesson which has been painfully learned in many parts of the world, is that groundwater, a renewable resource if properly managed, can be over-exploited and mined, if its development is not well-planned and controlled. Such groundwater mining can result in subsidence of the ground above, resulting in structural problems as experienced in Mexico City and Bangkok. Over-exploitation of groundwater in coastal areas can cause the aquifer to become saline when penetrated by seawater. This is an extremely serious problem in southern Pakistan and many other countries.

Even when subsidence and saline water intrusions are not immediate problems, the mining of the aquifer lowers the water table, forcing the abandonment of many existing wells. These usually serve the least affluent people in the community, who may be unable to afford the cost of deepening their wells.

Such groundwater mining is not always entirely a negative phenomenon, since it can sometimes reduce water wastage by uncontrolled spring flows (as in the "qanats" of the Middle East). However, the costs and benefits of various strategies for groundwater management need to be carefully considered, before large scale well development proceeds.

The Maduru Oya Project - Sri Lanka *Box 7.2*

Since 1977, when the government of Sri Lanka decided to proceed with the Accelerated Mahaweli Development Scheme, more than $3 billion has been spent on this ambitious program. It has been designed to re-settle more than 125,000 farming families on newly-irrigated lands in the dry zone parts of the Mahaweli basin, as well as to ensure food self-efficiency for this nation of 15 million people.

Canada's total contribution towards the Mahaweli Development has been more than $100 million for studies, designs, and construction of the Madura Oya dam, reservoir and canal headworks. This project, the first component of the Scheme to be completed, and one of Canada's largest development assistance contributions, will control water releases for irrigation of about 50,000 hectares. Investigation of this project commenced in the early 1900's. Canadian engineers have been involved in all development phases for over 24 years and the work was finally completed in 1985.

One of the earliest construction problems encountered was the discovery of an ancient land and irrigation system under the surface when site clearing commenced. Archeological investigations determined that some of these works were about 1600 years old and were of an extremely advanced technical quality. So that these examples of very early irrigation works could be preserved, the Madura Oya dam was moved upstream from its originally planned location.

Sri Lanka had not previously engaged in such large-scale civil engineering works and it is not surprising that many problems were encountered. These were mostly delays caused by a myriad of supply, financing, contracting and scheduling difficulties. In spite of all such setbacks, the Canadian construction consortium completed the main project on schedule and went on to construct additional headworks facilities under a succeeding contract.

Under the category of lessons learned, it is fair to note that, with the maximum co-ordination and goodwill of all parties involved, large-scale development programs can be accelerated and even finished on time. It is nevertheless pertinent to conclude that while the major upstream works have been completed, the downstream facilities, which will enable the benefits of these works to materialize, have been substantially delayed. Canal construction on the Left Bank is now well advanced and settlement is in progress. On the Right Bank, delays have been caused initially by financing difficulties and more recently by both ethnic strife and the need to mobilize a new financial package to support the downstream construction program. At the time of writing, it is hoped that all such difficulties are being resolved, and that the first settlers will be able to start moving onto the improved lands in 1991.

Committing the funds and constructing the major works has clearly proved to be much easier than placing the settlers and realizing the benefits on schedule.

Barrage de Sidi-Saad, Tunisia *Box 7.3*

In 1969 floods killed more than 500 of the 300,000 people who were living in the valley at Oued Zeround. As a result of this, the Sidi-Saad Dam was proposed. The three-fold purpose of the dam was to control all flooding, protect the people and property in the valley and to promote development in the area. The new dam was started in 1978 and met all three objectives, as noted above, on time and within budget. There were no major problems with this water resources control project.

The important lessons learned were that good detailed planning, combined with regular monitoring, provided successful implementation and control of the finished product. Appropriate training and good technology transfer to well-selected candidates was also undertaken, to ensure long-term benefits to the recipient country.

Purely structural solutions to water resources problems are often uneconomic. In earlier times, the traditional response to controlling damage from floods was to build reservoirs to reduce flood flows and/or to build dykes to protect areas from flooding. These expensive solutions have sometimes proved to be less economic than a combined program of structural and non-structural measures, including flood flow predictions and flood plain zoning to minimize potential losses.

Projects to increase the supply of water for irrigation, industry or people, are usually engineering or structural solutions. They have often been found to be more expensive than non-structural measures used to make more efficient use of available water supplies. Major capital expenditures for new sources for urban water systems, which lose 30 percent or more of the available water through leakage, can often be deferred, or even avoided, by concentrating on leakage reduction programs. Similarly, irrigation systems can often be made more efficient, by changing water application techniques or by reducing water losses at lower costs, rather than by augmenting the water supply.

Demand management techniques, which rely on a combination of measures (reflecting actual costs in water pricing and including public education), have been found to be effective at meeting basic water requirements. The lesson here is that water system planners need to specify the basic objectives of each project carefully, and then seek the least costly method of meeting these objectives, by considering a wide range of structural and non-structural options.

7.3 STRENGTHENING SECTOR INSTITUTIONS

7.3.1 Institutional and Human Resources Development

Recent UN consultative meetings between developing countries and external assistance agencies have identified the principal requirements for rapid sector development as:

- institutional strengthening;
- cost recovery;
- integration of sanitation and hygiene with water supply;
- strengthening operation, maintenance and rehabilitation; and
- community participation.

All five relate in one way or another to institutional development. Unless sectoral institutions are strong and offer relevant programs, they will never be able to conduct effective development programs, no matter how much capital assistance is placed at their disposal. Institutions are made of the people who staff them. Human resources development must become a major, if not the central component of Canada's assistance in this sector.

Over the past forty years, institutions working in the water resources management and water supply and sanitation sub-sectors were modelled after those in industrialized countries. Technologies were transferred directly, sometimes with little adaptation to local conditions. In the cities, there was little need to interact with the consumer. Installations were made, services provided and revenues ostensibly collected. Now that the majority of urban dwellers have services, these same institutions are turning to those in even greater need - the low income inhabitants of the peri-urban areas and the rural poor. But these are far less accessible, greater in number and more difficult to serve. Many agencies are becoming painfully aware that the institutions which were created in response to urban centre needs are not appropriate to the rural and urban poor. These centralized agencies have little capacity to provide the continuing outreach necessary to operate and maintain the facilities they install.

Success in providing self-sustaining services in low income communities can only be achieved by effective outreach and by using resources from within the community itself. This cannot be accomplished by centralized institutions taking a contractor/construction approach to project implementation.

Decentralization which transfers responsibility and authority to the field has figured predominantly as a common element in successful projects (see Box 7.4). This means that although policy and programming take place at the centre, project decisions should be made in the field in close collaboration with the community, if not by the community itself. Such decentralization can mean a major shift in policy and operations for many of the institutions working in this sector. Many such agencies are run and staffed by engineers and technical specialists without the necessary community development skills which decentralization requires. So the question is not only one of the quantity of personnel but also of the quality and relevance of skills.

Box 7.4

Korea, The Saemaul Undong Movement, An Experiment in Decentralization

In the early seventies, the Ministry of Home Affairs distributed free construction materials to selected villages for construction of public infrastructures. No other instructions as to what kind of infrastructure were given. The villages chose and implemented their own projects. All other costs were borne by the villages themselves. Some chose roads, irrigation systems and commagnate halls, but many chose to build piped water systems. There were problems of quality control, but progress and the degree of participation was astonishing. Encouraged by success, the movement was extended through most of the country. By the early eighties, over 35,000 villages had built a piped water scheme. By having to pay for most of the costs, the communities kept them down to an average of US$ 80 per household - another example of the benefits of decentralization, by devolving authority to the community.

With decentralization and community participation in projects come HRD requirements for two other groups involved in project implementation: field personnel and the community itself.

Successful community-based programs in Africa and Latin America have highlighted the crucial importance of training field staff. Working at the forefront of project implementation, the project supervisor/promoter must be both technician and community development worker. This requires specialized training, which is normally carried out in the field through formal course work and in-service apprenticeship. Thus a new cadre has been created who liaises between the community and government department. A trained staff which understands both the technical and social aspects of projects is essential to the success of participatory projects.

The benefits of water supply and sanitation projects may be convenience, increased productivity and health in the medium term, but in community-based programs these are often superceded by more fundamental achievements in self-help development. There are spin-off benefits derived from the organizational capacities and human resource development brought to the community by the project. Management, development and technical skills are not only important to the success of the individual project, they also instill the confidence and competence in the community which are essential for the community's self-sustaining development in the long term.

Community Participation in Canada **Box 7.5**

By the end of the Second World War, most towns and villages in Western Canada depended on community wells and latrines. In Alberta, the number of community systems grew from 20 to 400 during the 1940's and 50's. The private sector took the initiative and visited communities, approached women's groups and local politicians to market recent advances in water supply systems. Consultants would provide low-cost cursory feasibility studies, investigate means of financing and make presentations at public meetings. Low-cost designs were worked out with the community. When projects were completed, the local people had a significant stake in maintaining them. In later years, the provincial government began financing and then making grants for projects. There was then little incentive to save money. Costs increased and local involvement was minimized.

(D. Stanley, 1988, Personal Communication).

For decades, the private sector has been very active in providing and maintaining services in the Third World. In some countries, it has been far more effective than government. Yet, projects are routinely designed without the support of the private sector, thereby ignoring its considerable resources which are available for sector development. In Pakistan, for example, a recent CIDA/World Bank joint sector review observed that the private sector had provided over half of the rural water services (primarily through handpumps) and all of rural sanitation facilities. Long term plans are being made for the strengthening of the private sector, so that its considerable resources can be used in the national government's rural water supply program.

The weak institutional capacities of agencies implementing water sector projects in the developing world is a major constraint to Canadian-assisted projects. Institutional development, or strengthening, commonly appears in the lists of CIDA's project objectives. However the resources put to strengthening project institutions, and the approaches made, frequently fall short of requirements. Attempts were made at strengthening institutions in almost all the CIDA-supported implementation-type projects for which post-project evaluations and end-of-project reports are available. However, the number of CIDA bilateral projects which specifically addressed institutional development is only 1 to 4 percent of the total, as indicated in Chapter 5.

Major inputs were made in Ethiopia (Rural Water Supply Stage I) where a water resources planning, utilization and operations capability was developed in the project area (Awassa Region). This required a major long-term involvement of Canadian personnel in establishing administrative and operational procedures and practices in the newly-formed regional office.

In Swaziland (Rural Water Supply Phase II) Canadian personnel were required to assist the newly-formed water board to establish its management, engineering and construction capabilities. Institutional development was strongly supported by human resources development, both in Canada and Swaziland, through the training of technologists and engineers. One important element in institutional strengthening has been in-service support and training of sector agency staff by Canadian personnel.

Where there have been weak linkages between local and Canadian personnel, or where training was not formally defined as a Canadian input, institutional strengthening has not proven successful. The single most important lesson learned has been that institutional strengthening must be based on human resources development.

Where inputs and linkages have been weak and not central to the institution, institutional strengthening has been limited to the duration of the project and dependent on external inputs. An example of this was the Kenyan project (Rural Water Supply) where Canadian expertise was provided for the upgrading of the Ministry of Water Development's (MOWD) operation and maintenance capability, both through management and structural changes. However, the project was not central to MOWD operations and quickly became dependent on Canadian staff. Fourteen town facilities were successfully operated and maintained while the Canadians were present. However, some two years later the rehabilitated systems were again falling into disrepair, due to lack of maintenance and funds.

Although institutional development is identified as an important bottleneck in this sector, few CIDA-supported projects have managed to tackle the problem effectively. The temptation to ignore or patch up institutional deficiencies is often too great. Projects are begun which will initially provide services to large populations, but risk failure in the long term, due to fundamental institutional weaknesses. Where institutional weakness is identified, projects should be designed to overcome them and also to provide the services for which they were intended. Institutional strengthening must be central to the institution's need and commitment to it must be long term.

Project institutions should be carefully analyzed and their absorptive capacities realistically assessed before capital investments are made. In most cases, institutional strengthening will be required, at least in the first project. Every aspect of institutional development requires some form of training. Human resources development, therefore, must become a principal component of CIDA's assistance in this sector in the future.

7.3.2 Planning

Planning is a byword in development. As in other sectors, lack of planning has exacted its toll on the water sector. In many countries, inadequate institutional and organizational planning at the national level has resulted in duplication of services and jurisdictional squabbles. Lack of planning has been the principal cause in the failure of many sector institutions to cope with the demands for infrastructure.

The more successful projects for low-income populations have had to respond to the exigencies of the communities in which they operate, that is, at a pace appropriate to the community. Very slow rates of start-up may result from this approach. In the end, however, much higher rates of expansion are achieved, as the multiplier effect and extensive resources of the community are brought into play. Project planning will have to reflect these factors and be flexible in setting objectives and deadlines (see Box 7.6).

In this respect, lessons have been learned in Canadian-supported projects such as the Malawi Rural Water Supply which have had to go through three stages of growth: demonstration, consolidation and expansion. Demonstration of the most successful approach is made through pilot projects. It is then consolidated through standardization of criteria and documentation of field techniques. Only after institutional strengthening, focused on training, is the program expanded to full scale. The value of such approaches to program development has been amply demonstrated in the field and should be incorporated into the planning and preparation of future projects.

Cote d'Ivoire: Canadian Participation in the National Village Water Supply Program ***Box 7.6***

The principal objective was to strengthen Cote d'Ivoire's institutional structure in the water sector. The program, which lasted from 1976 to 1983, provided both technical assistance and equipment to build up the capabilities in engineering, well construction, health and sanitation education and water quality control.

The project produced the following results:

- *rate of failure in well drilling was cut down from 60 percent in 1975 to 2 percent at the end of the program;*
- *22 managers, technicians and engineers were trained to take over the development of sector's activities;*
- *number of water points increased from 686 a year (1976) to 1013 a year (1979);*
- *pump failure was reduced from 40 percent to 7 percent;*
- *well pollution was reduced from 95 percent to 6 percent.*

Some of the conclusions from this project are as follows:

1. *The necessity to shorten the project planning period in order to respond, in real time, to the needs expressed by the population.*
2. *The importance of a good formal design for a training program before it starts.*
3. *The need to take into account, for all projects, the absorptive capacity not only of the country's institutions, but also of the people served.*
4. *The local people must have the necessary ways and means to take complete control of their rural water supply program with their own expertise.*

Domestic water supply is only one of many uses of water. However, because of public health concerns and high consumer demand, it is of top priority in the sector. Too often, water is supplied without full knowledge of the extent and location of the water resources, as well as conflicts with other uses. Many water supply and sanitation schemes flounder through lack of proper assessment of the quantity and quality of the water resource. Heavy irrigation uses have starved the water supply facility, or polluted the groundwater with fertilizer and pesticides. Supplies have frequently been

developed without regard to the ultimate demands. Immigration sometimes increases demands beyond the available supply and results in the creation of inadequate service or even a drought condition (an example being Somalia). This causes major transmigrations of people in search of new supplies and living areas.

Planning must address environmental issues more efficiently than in the past. During the seventies, many developing countries, either implicitly or explicitly, adopted a policy of industrialization first, and environmental protection later. Consequently, they now face massive clean-up programs, requiring major investments in industrial wastes control, wastewater collection and treatment, and the effective implementation of environmental management policies. China's major industrial centres, such as Liaoning and Beijing-Tianjin, must now invest billions of dollars in water resources protection measures, if current levels of growth are to be maintained. It is clear that environmental issues must be considered and accommodated to a far greater degree in planning and programming, if development is to be sustained.

7.3.3 Operation and Maintenance

A crucial issue in institutional development is the long-term capacity of the implementing agency and beneficiary community to operate and maintain the facilities effectively.

The need for adequate long-term operation and maintenance (O&M) is well recognised in CIDA-supported projects, but the question of how to achieve it has plagued project planners and managers. It is now concluded that establishing an effective O&M system goes well beyond training agency personnel for O&M. It involves setting up a completely self-sustaining system. Not uncommonly, implementing agencies devote almost all their resources to new construction. This is reinforced by bilateral support agencies' wishes to fund new construction, and a reluctance to support continuing O&M. The inevitable outcome is projects which provide only training for O&M, but are otherwise wholly construction projects. Training for O&M was given in CIDA-supported projects in Belize (City Water and Sewerage Construction), Tanzania (Dar es Salaam Water Supply), and Ethiopia (Rural Water Supply). In all three cases, training alone was found to be inadequate. In Kenya (Rural Water Supply), the entire project was aimed at rehabilitation and operations and maintenance. Training was a major element. However, as previously mentioned, the project was not central to the Ministry of Water Development's operations. The government was not sufficiently convinced of the importance of devoting substantial resources to O&M. Consequently, the rehabilitated systems began falling into disrepair, soon after the Canadian personnel departed.

There is now sufficient evidence (Ghana Upper Region Program, the Togo Rural Water Supply Project, and in Burkina Faso), to conclude that the principal responsibility for O&M of at least rural systems must be taken by the beneficiaries. This implies that the community must be involved in all stages of project implementation in a meaningful way, so that a sense of ownership and responsibility is instilled. In turn, this means that substantially different approaches to at least rural water and sanitation projects must be taken – approaches that regard the beneficiaries as partners in project development and not mere recipients of technologies. These approaches are now being developed and proven in the CIDA-supported Ghanian and Togolese projects.

Micro-Realization Programs, Burkina Faso ***Box 7.7***

Micro-realization programs/projects are multi-sector, with a strong emphasis on community participation. They are socio-economic-technical in nature and can include projects in water, health, education, crafts, agriculture, irrigation and fisheries. Traditional techniques are utilized, augmented by new technology that can be understood and applied by a rural community. To promote economic growth and social change, CIDA has supported this type of program in Burkina Faso and Niger (1983), in Mali and Zaire (1985), and more recently in Cameroon and Haiti.

In Burkina Faso 16 micro-projects, costing $4.0 million, were defined and funded by CIDA. These projects consisted of the following: water (9), health (3), training (7), energy (3), animal husbandry, commerce (3), co-operative development (2), and forestry (1).

In the water sector, projects were mainly new well excavation, well rehabilitation, and handpump installations, all organized by a Village Water Committee. The projects included the training of these committees and also of six operations and maintenance (O&M) crews for the upkeep of the wells. These micro-projects have met the real needs of the villagers themselves and also of the local government authorities. It is interesting to note that the O&M crews have been kept very busy.

One lesson learned from the Burkina Faso Water project is that operation and maintenance must form part of the planning process for rural water supply and sanitation systems. Provision also must be made for not only community participation, but also for formal and on-the-job training to ensure long-term solutions for the health, water and sanitation problems facing rural communities.

7.3.4 Cost Recovery

It is often said that the poor cannot afford water supply and sanitation. It is true that most cannot afford the capital cost of conventional service levels such as water supply into the household, and sewerage. Lowering the cost and service level, while still achieving the principal health and labour-saving objectives, can make services affordable. The question is frequently one of willingness to afford and not ability to pay. In fact, many poor people pay water haulers to supply polluted water for their minimum needs and commit a substantial part of their meager budgets for such poor service.

Where a household identifies fully with the need for improved services, and is convinced of their long-term reliability, the potential for cost recovery is far greater than where government (the provider) cannot ensure reliable service. There are certain factors which can ameliorate cost recovery. They include:

1. Providing the beneficiary with real opportunities to become involved in the decisions as to the levels of service, their costs, the way they are implemented in the community, and the form of participation he or she makes in the project;

2. Establishing a financial system which responds to the needs and norms of the community. These will vary country to country, and even within regions in particular countries. There are, however, always accepted methods to be identified, whereby people pay for services received; and

3. Developing a relationship between the community and the implementing agency based on trust and confidence.

Cost recovery is intimately linked to the financial strength of the implementing agency. There are two institutional models common to this sector which contrast sharply:

1. In the ***subsidy model*** the responsible agency is almost entirely dependent on government financing. In attempting to meet targets with a weak tariff base, the subsidised agency falls into debt. The deeper the debt, the more dependent on government subsidy it becomes. Loss of autonomy is the price paid for bail-out. The agency becomes increasingly subject to political priorities and interventions. It becomes caught in a downward spiral of not being able to collect adequate revenue, attract high-calibre staff or provide efficient service. Ultimately the agency loses the confidence of the consumer and the government itself;

2. The ***autonomous utility model*** is able to establish fair tariffs and cost recovery schemes and is either wholly independent of government or is para-statal. Tariffs are set by a utilities board, whose hearings are open to the public. Salary scales are set to attract high-calibre personnel. The utility is capable of forward planning by a stable financial resource base. Subsidy requirements are small or non-existent. The utility is able to provide the level and reliability of service for which the consumer is willing to pay. This model, incidently, is common to most Canadian communities and helps to explain the relatively high quality of sector services.

Governments commonly view subsidies as an efficient means of redistributing wealth. There are many reasons why, in this sector, this is not good policy. Firstly, subsidies tend to bias the choice of technology towards selection of higher, more capital intensive, conventional technologies. Secondly, subsidies remove the basic incentive for operational efficiency. Thirdly, subsidies inevitably lead to agency and consumer dependency on government.

There is a wide range of cost-recovery options. At one end of the spectrum is the village council operating the water supply system and charging consumers for all operating, maintenance and expansion costs. At the other end is the country's central water agency and the large, semi-autonomous utility operating in the larger cities and recovering all capital and recurrent expenditures. Cost recovery is the foundation of viable institutions in this sector. In all cases, from village through to city centre, the level of service must ultimately depend, to a great extent, on the ability and willingness of the community to pay. Only by the consumer paying for all or a major part of the services can the actual demand for them be established and responded to. Contributing to, or paying for services, is one means of enabling the consumer to have a say as to what level and how services are provided. By enabling the user to contribute, one enhances a "bottom-up" planning process which more accurately reflects the needs and responds to the resource base of the community. It also makes the implementing agency accountable to the consumer, thereby increasing operational efficiency.

There are numerous projects in both rural and urban areas, where operation and maintenance costs are met fully by the beneficiary communities. This has the two-fold advantage of (1) relieving the implementing agency of the continuing costs of operation and maintenance and (2) providing strong incentives for the body responsible for operation and maintenance (whether agency or the community itself) to provide a satisfactory service to the paying beneficiaries. In short, it makes it accountable to the user.

Review of post-project evaluations and reports has indicated that cost recovery and financial sustainability have received very low priority in CIDA projects. They are very weak, or non-existent, in all projects reviewed.

On the other hand, recent experience in a CIDA-supported project in Dominica has demonstrated financial sustainability to be dependent upon a combination of strong institutional policies in the area of tariffs, collection of receivables and improvements in productivity. Together with adequate financial management and control, these policies allow the organization to manage its own revenues and expenses. The Dominica Water Authority is now proceeding on a financially viable footing and is reporting profits.

7.4 CHARACTERISTICS OF SUCCESSFUL PROJECTS

7.4.1 Service Levels and Appropriate Technology

Appropriate technology is technology which is appropriate to the needs and resources of the people to be served. High levels of technology can be appropriate in some circumstances, and intermediate or lower levels in other cases.

There are outstanding needs for conventional approaches and designs for reservoirs, transmission mains and treatment plants. This is particularly true in urban areas, where large and dense populations are to be served. Experience has demonstrated, however, that most low-income populations cannot afford the capital cost of water supply by house connections or of piped sewerage schemes. The guiding principle is that **people should have the highest level of water supply and sanitation services that they want, can afford, and have the capacity to sustain.**

During the mid-seventies, IDRC and the World Bank initiated research programs into low-cost technologies for water supply and sanitation. Reviews of technologies which were already in use in developing countries were made and relevant technologies identified, adapted and field tested. The IDRC and World Bank programs have progressed to the point that the low-cost technologies are being used in full-scale projects in many countries. The principle of using low-cost technologies in this sector is accepted by nearly all countries. Progress has not been easy. One of the most difficult hurdles has been convincing engineers and policy makers (in both developing countries and the ESAs) that the lower-cost technologies are technically efficient and are maintainable in the long-term. CIDA has been instrumental in supporting efforts to prepare and disseminate training materials on the low-cost technologies. Three excellent films on this topic have been produced by Canada's National Film Board, supported by CIDA.

CIDA has consistently increased the use of appropriate low-cost technology in its projects over the past decade. The consequences of using conventional technologies in low income areas have become apparent. The Belize Water and Sewerage Construction Project is a case in point. Cost recovery is impossible when the capital cost of installation of conventional sewerage per household is higher than some of the houses themselves.

The progressive application of appropriate technology has not been easy. Reducing costs through decentralized infrastructure, or lowering service levels, invariably implies changes in the way the technologies are introduced. CIDA has carried out extensive trials on handpumps in Ghana (see Box 7.8). These tests drew heavily on program resources, but eventually resulted in the installation of appropriate handpump configurations. The need for hygiene education and better operations and maintenance systems resulted in two associated projects (Water Utilization Project and the Maintenance/Stabilization Project). Their evolution continues today. The current phase of the Ghanaian Upper Region Project is drawing on the experiences gained in these projects and is adapting implementation strategies to be even more community and local government based. These projects have provided a valuable opportunity to learn lessons from experiences gained in the field.

Appropriate low-cost technologies have demonstrated cost-effectiveness and technical viability. However, their successful long-term operation requires parallel inputs of village sensitization, education, participation and assumption of responsibility for part, or all, of the operation and maintenance requirements.

The viability of handpumps is now proven, particularly when the user group is responsible for the operation and maintenance of the pump. Where perennial surface waters are available at higher elevations, gravity-piped schemes requiring no pumps or mechanized systems are proving successful (CIDA: Malawi, Dominica, Nepal). Where such sources are not available, but rainfall is adequate, rainwater roof catchment is used (Thailand and Indonesia).

Sanitation technologies include the ventilated improved pit (VIP) latrine (in Africa) and the pour-flush toilet (in Asia). Communal sanitation systems have been built and are functional where institutional support for their maintenance is effective (Northern India and Accra, Ghana). They are, however, prone to failure and their widespread use is questionable. Where water supplies have been upgraded to house connection service, the wastewater produced often surpasses the capacity of the soil within the compound or household lot to absorb it. Excess wastewater then lies on the surface or runs away through open drains intended for storm water, with the consequent pollution of the settlement and downstream water resources. Examples of this condition abound in cities throughout the developing world (Pakistan, Philippines, Kenya, Brazil). Industrialized countries have been able to afford conventional sewers, but this is seldom an affordable option for low-income communities in the developing world. Success has been achieved in a few cases through intermediate technologies for wastewater collection such as shallow sewers and small bore sewers. However, these still need further development and demonstration.

Rural Water Supply and Health in Ghana's North **Box 7.8**
Lessons From the Upper Region Water Supply Program

CIDA has been supporting rural water development in Ghana's Upper Region for over fifteen years. This program consists of a number of projects which have resulted in the installation of over 2,500 boreholes fitted with handpumps. The program provided numerous lessons which demonstrated that improving the health of rural residents through improved water supplies is a complicated process. Phase I, started in 1973, included the drilling of 1,200 wells fitted with handpumps. It also included the extension of three rural town distribution systems, design of 40 others and hydrologic-hydrogeologic investigations. Population stabilization was also in Phase I's objectives. The first change came in 1975 when it was recognized that if the handpumps were to be kept operational, it would be necessary to provide a heavy input of unanticipated training for maintenance personnel.

In 1976 Phase II began with the objective of siting and constructing an additional 1,300 boreholes. It was clear that simply providing boreholes did not result in improved health, so a new project entitled the Water Utilization Project was commenced. Its purpose was to maximize health benefits to the people through training in hygiene, health and water use. This training was undertaken using the traditional type of government extension workers from the Water and Sewage Corporation. In 1984, a major evaluation found that operationally the program was doing quite well with over 80 percent of the pumps in operation and providing supplies of good quality water.

On the health impact side, however, the evaluation found the health and water-use training ineffective. Improved water use for health was proving to be more difficult than drilling the wells and keeping the pumps working. A new strategy was devised. It consisted of: addressing health problems identified by villagers, employing village-based health workers to use interactive training techniques rather than didactic lectures, and pilot testing of materials and methodologies. Pilot projects were undertaken in 1986 and by 1987 the project was able to reach 20,000 people. Many innovative techniques are being successfully used, including song and dance, theatre and puppetry.

The project has also had its financial crises. As in many countries, the government subsidized water supply to such a large extent that, by 1985, it could no longer manage and abruptly removed all subsidies. At the time, villagers were paying almost nothing. New tariff schemes had to be quickly devised and applied. Surprisingly, collections are now running over 90 percent and are able to cover the full cost of operation and maintenance and even some of the capital costs.

With the project's evolving objectives and strategies, its Canadian staffing has changed markedly. Initially the staff of 15 drillers, hydrologists and engineers responded to the first phase's well drilling program. The current strategies focusing on user involvement, cost recovery and hygiene education are reflected in current staffing of four educators, an evaluator, an accountant and an engineer.

7.4.2 Involving the Community

More efficient use must be made of resources that already exist and past investments must be protected through improved maintenance schemes. Vastly increased numbers of people must be reached. This implies targeting the lower income populations through low-cost technologies and placing greater reliance on participation by and contributions from the community.

At the family level, for example, the women of the household are intimately involved and most often responsible for supplying water and maintaining hygiene. Yet, they are commonly left out of water supply project planning. To raise their awareness level, women should be involved even at the early planning stage. Women of low-income communities commonly lack knowledge of how their needs can be met, or lack awareness of the costs and benefits of alternative approaches. In the example of the Baldia sanitation project in Pakistan, it is the mothers in the households who exert pressure to get sanitation, and it is the female home school teachers who inform them of how to go about getting toilets for their homes. Even low income families in the squatter settlements of Karachi are willing to buy sanitation units if they feel they need and can obtain them.

Community participation is central to this discussion. Unfortunately, it is too often seen as a panacea – often misinterpreted and misapplied. It requires the meaningful participation of the community at all stages. How the community is introduced to the process of participation is extremely important. How it is brought into the participatory process determines how involved it becomes in making decisions within the project. It also determines a community's willingness to assume responsibility for continued operation, maintenance and cost recovery. In a handpump project, for example (Ghana Upper Region Project), it took a considerable time to establish trust and mutual respect between the community and the implementing agency, to build community self-confidence, to sensitize the community to basic hygiene, to have the community assume an active rather than passive role in the project, to train community members in the technical and management aspects of the project, and to instill a feeling of responsibility for the eventual success and ownership of the project. This was not wasted time. It was essential to the long-term success of the project. Similar success in involving the community is reported from Guatemala (see Box 7.9).

Very few CIDA bilateral projects, working in low-income communities, have involved community participation in a meaningful way. This has been a result of priorities and methods of implementation established by the recipient governments and supported by CIDA. With the notable exception of the smaller NGO projects, most CIDA-supported projects have been design, procurement and construction oriented. As such, there has been little opportunity for involving the community in a participatory approach to project implementation.

Attempts were made in the Swaziland rural water supply project to ensure village participation, at least in establishing the demand for water supply and in providing labour for construction of the facilities. However, it is in the Ghana Upper Region Water program (see Box 7.8) that the greatest advances are being made, and benefits accrued through community involvement.

Guatemala - Rural Water Supply Systems **Box 7.9**

An earthquake struck regions of Guatemala in February 1976. Months later, CIDA approved a project to assist in the construction and improvement of water supplies in the affected rural areas and to help the local agency to develop a national plan for rural water systems. By 1985, when the project was completed, CIDA had provided $5.4 million and the project objectives had been surpassed. A total of 81 water systems were improved, serving more than 105,000 rural residents. The executing agency UNEPAR (Unidad Ejecutora de Programa de Acueductos Rura-les) played a key role and was strengthened through the project.

An important lesson learned with UNEPAR was that the involvement of rural communities in the implementation and administration of the project contributed greatly to its success. Furthermore, the extensive use of local personnel and other local materials helped to minimize costs. CIDA's contribution amounted to $51 per person served. Large sums are not always required to supply the basic water needs of target populations in rural areas.

The CIDA-supported project for rural water supply in Togo also provides a good example of how community involvement can improve project implementation. There, village sensitization and education takes place through a standardised program carried out by project officers. This takes three months to accomplish. At the end of this period, the need for water supply is established, a village committee (comprising at least 50 percent women) is formed and the community made aware of the health and economic aspects of water supply. This effort at sensitization and education has been found essential for the effective implementation of the program and subsequent maintenance of its handpumps. Although it may be true that CIDA's interest in community participation in water supply projects has only recently been put into effect in its projects, it is also true that nearly all other donors in this sector are at the same stage of development. The experience being gained is positive and demonstrates the importance of community participation in water and sanitation projects in low-income communities.

7.4.3 Involving Women in Sector Projects

There is now a greater awareness at the policy-making level of the importance of women as active agents in this sector. Moreover, there is increasing evidence that the involvement of women can contribute significantly to reaching the project objectives of improved water quantity and quality, improved hygiene behaviour, and long-term operations and maintenance. The following are five key lessons which have been learned about women's involvement at each stage of the project cycle in several projects worldwide:

1. *Planning:* Many reports from the field demonstrate that there are a number of obstacles which often inhibit women's participation in project planning. These obstacles include, for example: (i) limited time; (ii) exclusion from public life; (iii) low self-image; (iv) fear to speak out in public meetings; (v) inability to speak the national language; and (vii) resistance from their husbands.

Several strategies to encourage women's participation in planning have evolved in recent years. One such strategy is the use of participatory methodologies (such as games, stories, drama, photos) to achieve women's effective input of ideas and opinions. In light of the needs and lack of experience in this area, UNDP/PROWWESS has developed a participatory training strategy which trains community promoters in these participatory techniques.

2. ***Construction:*** Community contributions to construction consist mainly of unskilled labour for site clearing, digging, and transport. Women have been involved as voluntary labourers, construction workers paid in food or cash, or as motivators for voluntary labour. The ability of women to participate in construction will depend mainly on past experiences in manual labour tasks and the particular socio-cultural environment.

   In regions where women are accustomed to doing most of the agricultural work, they have also provided most of the self-help in water projects. There are examples from Lesotho, Kenya, Ethiopia, Cameroon, Zambia, and Papau New Guinea. In the Upper Region of Ghana and in Mauritania, strong Muslim influences have not deterred women from participating in the construction of water projects.

   Certain socio-political conditions have allowed for greater contributions by some women in construction. For example, in Lesotho, where many of the men work as migrant labourers in South Africa, women do most of the construction work in water projects, as well as play the dominant roles on water committees.

3. ***Operations and Maintenance:*** There is now a greater recognition of women for preventative maintenance tasks. Preventative maintenance and simple repairs can be carried out by either men or women. Training of women caretakers as part of ongoing government programs has commenced in several countries, notably in Africa: Malawi, Mali, Sierra Leone, Tanzania, Kenya, and Ethiopia.

   The first quantitative evaluation of men and women as individual caretakers was carried out for UNICEF in Bangladesh in two separate handpump programs. This study confirmed the equal technical capability of both men and women in simple operations and maintenance tasks, and indicated, as well, that better hygiene is maintained by women.

4. ***Management:*** The longest and most extensive experiences of womens' participation in local management committees for water and sanitation are probably in Central and Latin America.

   Quantitative data from Mexico and Panama on the involvement of women in management indicate that they make special efforts to solve local problems, including fee collection and fund raising for repairs. Also, women members of a board or committee often hold the position of treasurer.

5. ***Hygiene Education:*** Technical water and sanitation projects sometimes make the assumption that women will improve domestic and personal hygiene when new water and sanitation facilities are installed. Experience has shown, however, that age-old practices and beliefs will not be changed through verbal persuasion, nor through simple one-way communication such as posters, manuals, or lectures.

UNDP/PROWWESS through its continuing work in water supply and sanitation projects insists that the people themselves must be involved in the critical analysis of their own situation and in proposing solutions for change; this approach can bring about changes in the knowledge, attitudes, and practices of the population, especially the women.

One method for hygiene education includes discussions with small groups of women, to help them increase and apply their practical understanding of the relationships between water, sanitation and family health and to find practical solutions for the safe collection and storage of more and better water.

Togo - Women's Roles in Village Water Supply ***Box 7.10***

In 1985 CIDA approved funding for a project to supply potable water to 65,000 villagers in the Prefectures of Zio and Yoto in the Maritime Region of Togo. The first phase of the project cost $ 6.5 million and was designed to provide 200 wells in over 150 villages. From the beginning the project was designed to focus on village animation as a starting point: 55 percent of the total project budget was allocated to this activity. The project was implemented jointly by CUSO, a Canadian non-governmental development organization, and the Ministry of Social Affairs in Togo. The choice of a non-technical ministry was deliberate in the planning of the project as a means to reinforce the fact that the involvement of the villagers was to be the driving force of the project.

Since women are the main porters, users and managers of water at the village level, an important consideration in planning and implementing the project was the involvement of women at all levels of the project structure. At the Ministry level an effort was made to ensure that the Togolese coordinator was a woman and a significant number of the social promotion officers (the government agents responsible for interface with the villagers) were women.

At the village level the village committees were to be 50 percent women and there were to be two pump caretakers per pump, one of whom was to be a woman. An added advantage was that one of the two Canadian water engineers hired for the project was a woman; the effect of her presence was effective in persuading project participants at all levels that women could handle the technology. In addition, health campaigns conducted through the village committees were targeted specifically at women.

An evaluation of the project indicated that 30 percent of direct project participants at this point were women. Thus while a major advance has been made in this respect, emphasis still needs to be made to ensure the full participation of women as phase two of the project begins. A lesson to be learned is that the issue of involving women needs to be a constant priority in water supply projects if any progress is to be made in this area.

7.4.4 Water Supply, Sanitation and Hygiene Improvements

Within the water sector, water resources management and water supply are intimately linked. They have always taken priority over other subsectors, such as sanitation, wastewater management, hygiene education, and stormwater drainage, even though they have important health benefits. This is because low-income communities view water supply in terms of convenience and saving labour. As such, water supplies have often become politicized and implemented without these complementary inputs. As previously mentioned, the full health benefits of a safe water supply are not achieved without complementary inputs such as sanitation and hygiene education.

Water supply to urban areas will produce wastewater which, if not removed from residential areas, results in environmental pollution and can cause the spread of filariasis. When water supply systems are being improved, every allowance should be made for wastewater removal, either through on-site soakaways or by sewer systems. Plans should be made for upgrading sanitation systems, taking into account interactions with drainage systems and refuse disposal.

The water supply agency often holds no responsibility for sanitation, hygiene education or drainage. Despite some donor agencies' efforts to the contrary, only token investments are made at integration, or these elements are ignored entirely, or conveniently deferred to an indefinite future project. Different approaches are needed to implement the integrated project's various components. For example, in the peri-urban areas, water supplies can be satisfactorily implemented by the water authority installing standpipes. On-site sanitation, on the other hand, may require a much greater level of communication with, and commitment by, the household. Whereas the water authority's contractor can install the distribution system with little input from the community, individual households must ultimately be responsible for installing their own on-site sanitation facility. Hygiene education, on the other hand, is best implemented through the schools, and requires a much longer term (although a less intensive) input of resources.

CIDA-supported projects in the past have often followed the pattern of responding to immediate priorities and seldom attempted integration. Exceptions include the Belize Water and Sewerage Construction - Phase I project. There, sewerage was a principal component. Along with water supply, hygiene education (a secondary component), was implemented through radio and school programs. This project is now supported by a Canadian advisor on health education. Other examples of the inclusion of hygiene education in CIDA projects are the current phase of the Ghana Upper Region Water Program and the Ethiopia Rural Water Supply Project. Thus, CIDA's most recent projects are responding to the necessity of integration.

Evidence has shown that full integration of all sub-components is seldom practicable. However, every effort should be made to integrate key elements of the package: water supply, sanitation and hygiene education. This usually means involving more than one implementing agency in the project. The approach which is least complex in terms of inter-agency interaction is one which separates responsibilities along existing lines of jurisdiction. For example, where water supply and sanitation are the respective responsibilities of the Water Authority and Ministry of Health and these responsibilities have little or no overlap, it is possible to support two parallel but coordinated projects. However, the lines of responsibility, communications and authority must be carefully worked out and agreed upon by all parties before the projects begin. Proper monitoring and control mechanisms must also be put in place to ensure that

coordination is effective throughout the project. Primary and secondary school curricula invariably include health as a subject. Schools can (and are often very willing to) assume principal responsibility for hygiene education. Courses need to be adapted to the project. The schools themselves usually need sanitary facilities and the teachers need training in hygiene education. Paraguay is an example where rural sanitation has been integrated with hygiene education. There, the school system is the principal agency behind the national latrine program in all districts of the country.

There is no single formula or model for integrated projects. The examples given above differ considerably. Integration may be feasible only on a limited basis; but even partial integration is a worthwhile goal. The project planner must be innovative in project design and understand the various agencies' objectives, jurisdictions and jealousies. Despite all the pitfalls and bottlenecks, it is usually possible to design projects with at least partial integration of sub-sectors.

7.4.5 Solid Wastes Management and Drainage

Solid wastes management and drainage are particularly important in the urban squatter settlement. Any program aimed at improving the quality of the living environment in low-income communities must be thoroughly planned. Although on-site sanitation may solve the excreta disposal problem, excess water wastage will result in large pools within the community if it is not controlled or properly drained and disposed of. Drains are commonly used to dump refuse and accordingly fail to work unless good refuse management practices are instilled within the community.

Single-component projects in this field should only be considered when a prior master plan for solid waste management and drainage has been satisfactorily prepared and integrated into other environmental quality improvement programs. A good example of broad-based planning comes from Abidjan, Cote D'Ivoire (see Box 7.11).

7.4.6 Coordination Among Sector Agencies

Coordination among sector-related agencies within a country is a key element of project preparation and planning. External donor agencies are in a unique position to influence the planning process and ensure that adequate coordination takes place. However, there is a point where excessive coordination can hinder rather than help a project. Any coordination must be rational and ultimately "do-able". However, in this sector there are many occasions where coordination is essential, particularly where integration of subsectors is a given objective. In instances where inter-agency coordination is not feasible, the project may have to be scaled down or disbanded altogether, while the larger issues of sector institutional framework and jurisdictions are settled.

A review of end-of-project reports and evaluations showed that CIDA-supported projects seldom included coordination among sector agencies. In some cases, this had negative effects on projects, such as in the Belize City Water and Sewerage Construction project. The lack of coordination between the Ministry of Health, Housing and Co-operatives and the Water and Sewerage Authority (WASA) frequently resulted in the former's development of new housing areas without reference to WASA's plans and infrastructural capacity to meet the new demands. In another case, lack of coordination between the Ministry of Water Development and the Dar es Salaam Water Corporation resulted in overlapping responsibilities in treatment plant operation.

The lessons learned in ensuring practicable coordination of relevant agencies from the beginning are clear and have been amply demonstrated (Ethiopia Rural Water Supply and Ghana Upper Region Water Program). Where coordination is relevant, the time and resources spent to ensure that it takes place have been demonstrated as worthwhile and cost effective.

Master Plan for Resource Recovery and Waste Disposal ***Box 7.11***
City of Abidjan in Cote d'Ivoire

To support the UNDP/World Bank Global program for the study and promotion of waste recycling and recovery, CIDA funded a project in Abidjan to determine the appropriate technology for the recovery and disposal of wastes in that city.

To cope with existing health, social and economic conditions of solid waste management in the City of Abidjan, a project team (consisting of the World Bank and a Steering Committee) was formed to consider all aspects of the garbage disposal problems facing the population.

During its course, the study was reoriented to produce not only a detailed master plan with an action plan for proper resource recovery and waste disposal, but also a computerized waste management model. This model covered all aspects of domestic waste collection and disposal. It can be adapted as well, for other cities in Cote d'Ivoire. In fact, it was stated that this "study" was the most useful ever conducted in the country.

The master plan, plus the waste management model, fulfilled the "real time" needs of both the waste control managers at City Hall and those of the UNDP/World Bank global project. This project encouraged local governments, industries, small cities and others to not only consider the problems caused by improper disposal of wastes, but also to be concerned with the socio-economic-environmental aspects of a proper waste management program.

The most important lesson learned was that, even when a project is properly planned and designed, the project team must keep an open mind and be flexible enough to incorporate new ideas and concepts into the project during the implementation stage. This will ensure a better end product that can better serve and meet the needs of the people in the recipient country.

7.5 PUBLIC INFORMATION

Several international agencies have learned the advantages of using the water sector to capture public attention and build public support for international development.

UNICEF provides one of the best examples, as it has been involved in water supply and sanitation programs for more than 30 years. UNICEF has contributed more than $US 500 million to these programs, which have benefitted approximately 150 million people. Water supply and sanitation programs have obviously been one of that agency's largest and most visible activities. Most Canadians are well aware of UNICEF'S programs in this sector because of effective publicity. UNICEF has also been quite successful in promoting these programs to CIDA and other bilateral donors, through supplementary funding on "noted" projects. This is another example of success, albeit

indirectly, in mobilizing public support for sector projects. UNICEF notes *"Fortunately, there is an inherent drama about water supply projects" (Beyer and Balcomb, 1987).*

Canadians are increasingly aware of the importance of water projects in developing countries. The strong and growing support for these projects initiated by NGOs provides vivid evidence, since their project priorities reflect grass roots support from the Canadian public. Canadians from all parts of the country are doing much more than donating money for water projects abroad. They are also devoting their own time and energy, on a voluntary basis. Today, hundreds of Canadians work on important water projects in developing countries. Although accurate statistics are unavailable, due largely to the spontaneous and individualistic nature of NGOs, public education is continuing and increasing as more and more Canadians gain first hand experience in international development.

Public awareness and education about the water sector will be accelerated by a recent addition to the NGO family. WaterCan, created to focus Canadian attention on developing country needs for clean water, is cooperating with water supply utilities in every province to inform their consumers about the plight of Third World people. Funds raised for WaterCan, with the cooperation of the water utilities, are matched by CIDA and committed to projects undertaken by other NGOs. It is already clear that WaterCan is succeeding in making Canadians better informed about the water sector in developing countries.

Chapter 8

SECTOR DEVELOPMENT OBJECTIVES AND STRATEGIC CONSIDERATIONS

Chapter 8

SECTOR DEVELOPMENT OBJECTIVES AND STRATEGIC CONSIDERATIONS

CIDA's overall goals in the water and sanitation sector are to:

a) improve people's health and living standards through the provision of basic services for water supplies, sanitation, drainage, solid wastes management and multi-purpose water projects;

b) assist people and institutions in developing countries to manage, conserve and protect water resources for sustained economic development.

There are six specific development objectives for the sector, to:

1. Increase Support for Health-Oriented Water Supply and Sanitation Services
2. Improve the Management, Conservation and Protection of Water Resources
3. Strengthen Sector Institutions
4. Improve the Planning and Implementation of Water and Sanitation Projects
5. Enhance the Use of Canadian Resources
6. Develop and Implement a Communications Strategy for the Water and Sanitation Sector

A total of twenty-four strategies and associated considerations are discussed for the purpose of improving CIDA's delivery of effective programs in this sector. Although development objectives and strategies are relevant to all geographic regions, modifications should be considered by program managers, to conform to regional variations in conditions affecting sector projects.

8.1 TO INCREASE SUPPORT FOR HEALTH-ORIENTED WATER SUPPLY AND SANITATION SERVICES

CIDA regards human resource development as the lens through which all of Canada's development efforts are focussed. In accordance with CIDA's overall strategy, the first priority for human resource development must be to help supply the basics for health, including clean water and sanitation services.

Developing countries' needs for improved sector services are obvious and immense. An estimated 1.5 billion people lack safe drinking water and some 2.0 billion lack access to hygienic sanitation facilities.

More than 12 million people die each year from diseases related to unclean water and unsanitary environmental conditions. Acute diarrhea and other water-related diseases kill an estimated five million children each year - the largest single cause of death for this age group. Hundreds of millions of people are debilitated by water-related diseases. Women's lives are distorted by their need to fetch water from great distances and to tend sick family members. Improved water and sanitation services can

make profound improvements in people's lives and in their social and economic situation.

Services can be improved with CIDA support for the rehabilitation of existing systems, the construction of new facilities and the strengthening of sector institutions which can, in turn, deliver services to more people.

Strategies and Considerations

1. *Providing reliable supplies of clean water, proper sanitation facilities and hygiene promotion for the maintenance of health and for economic development.*

    a) Improvements in public health can hardly be realized unless water and sanitation services are improved together, and in conjunction with hygiene promotion and education. An awareness of potential health benefits should be developed before improving infrastructure for water and sanitation services.

    b) People's basic water needs can be satisfied by the reliable provision of 25 to 50 litres of clean, disease-free water to each person each day. People may have to carry this water to their home from a communal supply point. These supply points should be located as conveniently as possible for the consumer, preferably within 500 metres.

    c) Community water supply can be provided from a point source or by water piped from a central source. Groundwater or surface water can provide the supply but the water must be clean, safe and protected from pollution.

    d) People's basic sanitation needs are best satisfied by household-owned sanitary latrines or toilets, together with arrangements for the hygienic disposal of sullage (washwater) and solid wastes (garbage). In congested urban areas communal toilets may be the best option for basic sanitation services.

    e) Everyone should have access to water and sanitation services meeting basic needs. However, all beneficiaries should be encouraged to help cover the costs of operations and maintenance so that these services can be reliably sustained in the long term.

    f) People should be encouraged to obtain water and sanitation facilities which provide service levels in excess of basic needs. However, the following principles should pertain:

        i) Wastewater disposal facilities must be developed to match the water supply service level. Providing larger quantities of water invariably produces more wastewater so both services should be planned and implemented together or health benefits will be jeopardized.

        ii) Project beneficiaries should bear the costs associated with improving service levels beyond meeting basic needs, including a portion of the incremental capital costs as well as all operating and maintenance expenditures.

2. *Supporting water and sanitation projects to meet the basic needs of the poor in both rural and urban areas.*

   a) Lower income people will continue to be the primary beneficiaries of CIDA programs in the water and sanitation sector. Efforts should be made to identify those target groups at the outset of project planning activities. It is understood, however, that central components of communal systems, such as the water source for a piped water system, will bring benefits to the entire community.

   b) CIDA has long emphasized rural development programs and will continue to support water and sanitation projects serving people in rural areas. Such projects may often be included as components in more-comprehensive programs with broader objectives, such as increasing food production or developing community-based institutions for rural development.

   c) Low-income residents in urban areas can be among the neediest in many developing countries. They may be particularly dependent on communal water and sanitation systems if privately managed facilities are not feasible. Populations in urban areas often increase at much greater rates than in rural areas, frequently creating a backlog to be provided with services by municipal institutions. These urban needs exist in communities of all sizes, ranging from farm villages and market towns to provincial and national capitals. Sector needs are often overlooked in the smaller urban centers. CIDA support programs in this sector will be planned in the context of national or regional needs and priorities for water and sanitation services.

   d) Refugees often need more than emergency relief such as food, medicine and shelter. Longer term requirements for water and sanitation services will be considered by CIDA when planning for refugee settlements, with due emphasis on public health.

   e) Developing countries undergoing structural adjustment should be assisted by CIDA to protect their most vulnerable low-income groups from the negative effects of economic reforms. Provision of water and sanitation services through self-help projects should be a central element of such programs, improving the local environment of the poorest communities and strengthening their organizational and technical capacities for better living conditions.

3. *Focussing on women and children, those most afflicted by lack of water, sanitation and basic hygiene.*

   a) Projects supported by CIDA will focus specifically on meeting the needs of women and children in low-income communities for water supply and sanitation services. A primary aim will be to reduce the women's workload by reducing their drudgery as water carriers while at the same time enabling them to better protect their own and the family's health.

b) Project preparation will incorporate a needs assessment beginning with the community and those most affected: the women and children. Needs assessment should be carried out with women's participation as only female workers have access to the women of the community in many traditional societies.

c) Projects should be planned to enhance women's productivity and income generating potential. Features to be considered include the provision of water for agricultural plots and home gardens, as well as for domestic purposes.

d) Project design should involve women in the community by consulting women and women's groups on such components as cost recovery, financing, design, facility locations, hygiene education, operation and maintenance, and project evaluation.

e) Technologies will be selected to be amenable to local traditions, attitudes and practices concerning women and their responsibilities relating to water supply and sanitation. Technologies should be appropriate to women and children's usage (e.g. some handpumps are too heavy for women and children).

4. *Providing water and sanitation services for income generating activities which are environmentally and economically sound.*

a) Families can often use water to supplement food production from gardens or by raising livestock. CIDA will be willing to support water projects to supply such needs, provided proper sanitation measures are included and the value added by the water exceeds the cost of providing the services.

b) Urban communities can use water and sanitation services for various commercial and individual activities, which in turn create employment and generate income locally. CIDA encourages such income generating initiatives and will be willing to support associated water and sanitation projects, provided the activities are environmentally sound and the value added by the water exceeds the cost of providing the services.

8.2 TO IMPROVE THE MANAGEMENT, CONSERVATION AND PROTECTION OF WATER RESOURCES

Water is a renewable resource which is crucial for all forms of life and economic activity. This precious resource must be wisely managed, conserved and protected for the long-term benefit of all people.

Strategies and Considerations

5. *Applying the concepts and strategies of the World Commission on Environment and Development, with special emphasis on sustainable development.*

a) The report of the WCED is firm in its conclusion that humankind and the global habitat is poised in a critical situation in which future development possibilities are closely linked with actions taken to protect and enhance the environment. Indeed "our common future" depends on how we look after and

use the world's environment including its land, forests and water resources. In this light water and sanitation programs and projects should be planned with long-term conservation of the resource and sustainability as central features. This means that, in addition to satisfying specific project needs for water, all other impacts of these programs should be assessed in accordance with CIDA's environmental policies.

b) The WCED report also concludes that in most cases the people of developing countries degrade their environment because their poverty allows them no options. Survival is their first priority. Environmental conservation and improvements must be linked with improvements in living standards. CIDA will support a strategy of balanced development in which living conditions of the poorest people are improved, for only then will they be able to make choices in favour of protecting and enhancing environmental resources.

6. *Improving water resources data, supporting comprehensive water resources planning and encouraging international cooperation in water programs.*

a) Water resources cannot be properly managed unless the basic resource is well understood and documented. Present and probable future demands on the resource must also be assessed. Accordingly, CIDA will assist developing countries to expand their water resources data systems including:

- weather characteristics and hydrometeorological data forecasting;
- existing water use patterns in all sectors;
- surface water quantity and quality;
- groundwater availability, quality and accessibility;
- flood hazards;
- water demands for prospective economic development.

b) CIDA will support the planning and implementation of water resources projects which affect more than one country. Water ignores boundaries but national jurisdictions do not. Water resources data collection and water resources management are usually best organized on the basis of the entire watershed. An external support agency such as CIDA can often play a useful role in obtaining the cooperation of neighboring countries to arrive at beneficial agreements.

c) CIDA will encourage and support comprehensive water resource planning which reflects the multiple uses which will be made of the resources. Single purpose projects, narrowly conceived, are often sub-optimal. The Agency will promote water sector planning which takes account of inter-sectoral linkages, particularly those which involve forestry, fisheries, agriculture and other life support sectors.

d) Water resources are managed by people and they are the key to improved resources management. CIDA will accordingly encourage the development of projects which include institutional strengthening and human resources development in the management, conservation and protection of water resources.

e) CIDA will consider supporting the implementation of water resources management projects that it assisted in the planning stage. CIDA will help its partners in developing countries to implement priority water resources projects. This may often involve coordination with other external support agencies.

8.3 TO STRENGTHEN SECTOR INSTITUTIONS

People in developing countries must be the focus of development agencies such as CIDA. These people must be the implementors as well as the beneficiaries of CIDA's development programs. Water and sanitation projects can only be executed by competent institutions, including beneficiaries in local communities, public sector organizations at the local and national levels, and a variety of private sector organizations. CIDA programs accordingly will support human resources development and the strengthening of a range of sector institutions.

Strategies and Considerations

7. *Developing human resources as the key element in providing water and sanitation services.*

   a) CIDA will make projects subject to an HRD needs assessment during planning in order to identify the requirements for training and technical assistance, which will vary project by project. In general they should cover two main areas:

      i) training and education of project personnel to contribute to effective planning, implementing, operating and maintaining of the project;

      ii) training and education of project beneficiaries in order that they are able to participate in and benefit to a maximum degree from projects implemented.

   b) CIDA will support the strengthening of educational institutions which provide training for water and sanitation programs in developing countries.

   c) The training of trainers will be a central element in CIDA-supported HRD. The multiplier effect of training people who in turn train others is an important principle to capture. This may be in the context of support to training institutions or as separate initiatives in other projects such as the training of health and hygiene educators and of village animators.

   d) CIDA will support health and hygiene education of the beneficiary public as components of water and sanitation projects. Many projects fail because the public is not adequately prepared for the benefits expected to be achieved from the project. When benefits are not realized, support for the project wanes.

   e) CIDA will support environmental education of the public at large. In most cases, people are very willing and interested in looking after their environment if they have choices to make and are able to do so. In many large urban and national programs, however, the issues are quite complex

and not immediately obvious. In such cases CIDA would be willing to support educational and information programs.

f) Individual CIDA-supported projects will include specific skill training. Consistent with CIDA's overall policy to increase HRD, there is considerable scope within projects to increase human resource development at artisan, vocational and professional levels.

g) In appropriate situations, CIDA will assess the potential for sustaining the effectiveness of training institutions by the introduction of supported research components into sector projects. Liaison in such cases will be maintained with IDRC to avoid duplication and to ensure compatibility with its policies and programs.

8. *Making community participation a central theme of projects undertaken within low income communities.*

a) CIDA recognizes the vital importance of community participation as the foundation of effective development, particularly where public institutions have minimal impact. Thus, CIDA will seek to ensure that the mobilization of community initiatives and the training and support of community leaders are given prominence at all stages of sector project implementation. The establishment of an effective and competent organization to be responsible for operations and maintenance of facilities is considered to be of paramount importance.

b) Experience indicates that communities which learn how to organize themselves to provide essential services can build on these organizational capabilities for other development activities. Water and sanitation projects which foster the growth of effective local organizations can serve as catalysts for other community developments.

9. *Strengthening public sector agencies to enable them to provide services effectively.*

a) CIDA will help strengthen public institutions responsible for this sector, from national agencies to municipal and local governments. Their absorptive capacities should be realistically assessed and addressed before capital investments are made. In most cases, institutional strengthening will be required on a broad front in financial management, administration, organization, maintenance systems, inventory control, cost recovery, project management, personnel policy, staff development programs and public relations.

b) Projects will also emphasize the decentralization of responsibility and authority, to the extent practicable, for project implementation and for operations and maintenance from the central water authorities to local governments and beneficiary communities.

c) The strengthening of municipal government capacities to deal with the specific problems of service delivery and maintenance of infrastructure in urban areas will also be supported. In this respect particular emphasis should be given by CIDA to the secondary towns.

10. *Encouraging sector institutions to become financially viable so they can provide sustainable services.*

    a) In particular, projects will strengthen the financial viability and autonomy of implementing agencies as the key to provision of self-sustaining services.

    b) Projects will maximize cost recovery while ensuring that the financial burden on the lower income communities is not excessive. With the exception of refugee and extreme poverty situations, full recovery of operation and maintenance costs should be achieved. Utility operations should have appropriate tariffs for cost recovery. In other cases the community itself should take prime responsibility for operating and maintaining its own facilities. In all cases cost recovery mechanisms should be appropriate to local situations which reflect the ability and willingness of the beneficiaries to pay.

11. *Strengthening private sector organizations in developing countries.*

    a) Emphasis in projects will be placed on strengthening the private sector's capacity to support sector projects through upgrading management, marketing, manufacturing and service delivery skills of businesses involved in the sector, including consultants, manufacturers, contractors and artisan teams.

    b) Project implementation in developing countries will rely more heavily on the private sector for project promotion and management for operation and maintenance.

8.4 TO IMPROVE THE PLANNING AND IMPLEMENTATION OF WATER AND SANITATION PROJECTS

External support agencies including CIDA have several decades of experience in assisting water and sanitation projects in developing countries. As a result of this collective experience, CIDA is better able than ever before to appreciate the factors affecting the success of sector projects. In order to make most effective use of the limited resources which CIDA can commit for water and sanitation programs, the Agency will adopt strategies to make projects more effective.

Strategies and Considerations

12. *Clearly defining project objectives to focus directly on meeting people's water, sanitation and hygiene needs.*

    a) The proposed beneficiaries should be explicitly defined at the outset of the planning process. Clear statements are required of the specific problems, existing or future, facing the people.

    b) Project objectives need to be defined and quantified in terms of the benefits to the people to be served. Project planners should always be aware that objectives should not be expressed in terms of systems or facilities to be built since such activities are simply the means to meet the true objectives.

13. *Formulating projects within a comprehensive planning framework.*

a) Plans should exist for implementing all components of a project before CIDA will consider supporting some or all of the project. When a dam and reservoir are proposed for a multi-purpose water project, for example, CIDA will want to understand how all intended facilities will be financed and built before agreeing to support any component of the system. Similarly the Agency prefers to support a water distribution system for a community only when definite plans are made to dispose of all resulting wastewater.

b) People should have the highest level of water supply and sanitation services that they want, can afford and have the capacity to sustain. Basic services should be subsidized in low-income communities which are unable to afford their total capital cost.

c) CIDA generally prefers to support water supply and sanitation projects using cost effective technologies which can be operated and maintained locally. A range of technologies and associated costs should be considered before selecting those which best suit the needs and resources of the beneficiaries.

d) Community beneficiaries should be involved at all stages of project development: planning, design, implementation, operation and maintenance. Every opportunity should be taken to draw on community resources for project success, while at the same time strengthening community capacities through training and the provision of technical assistance and organizational support.

e) Sanitation and hygiene education should be integrated into water supply projects with the objective of maximizing health benefits. To this end, strong links between the water, health and education sectors are required. Such projects should also include marketing, promotional and educational efforts to raise awareness of health issues and to create a demand for facilities and their proper use and maintenance.

f) CIDA supported projects will respond to local needs for solid waste management and drainage facilities, as appropriate.

14. *Stressing women's roles in all stages of project development.*

a) To a far greater extent than in the past, projects will be designed to enable women to participate in decision-making and management or support capacities.

b) Women should be directly involved in the community participation components of projects in order to enhance project success in the social acceptance and proper use of the facilities, as well as their continued upkeep, operation and maintenance. This applies particularly to projects in the rural areas and low-income settlements in urban areas.

15. *Recognizing that human resource and institutional development require long-term support, and accordingly undertaking projects within the framework of long-term commitments.*

a) CIDA will support projects which will form part of long term programs with both near-term and long-term objectives. This will ensure continuity and consistency in programming which is particularly beneficial to institutional and human resource development.

b) CIDA encourages the deferral of the construction of new works until the potential for rehabilitation of existing infrastructure is fully exploited and effective systems for operation and maintenance of the facilities are assured.

c) CIDA will review its sector support program periodically, at least every three years, in countries where substantial and long-term assistance is being provided. Such reviews will include evaluations of completed and ongoing projects and dialogue with sector authorities about future policies and programs.

16. *Collaborating closely with other external support agencies involved in this sector.*

a) CIDA welcomes opportunities of co-financing projects with multilateral and bilateral agencies. Components to be supported by CIDA will be selected to match the Canadian resource base. CIDA grants can also be used to support institutional and human resources development projects in parallel with international bank funding of larger procurement and construction contracts.

b) CIDA actively supports inter-agency cooperative efforts aimed at improving methodologies for project planning and implementation, for institutional strengthening and for HRD. Some such projects will be global or regional in nature, such as the UNDP/World Bank programs in low-cost water supply and sanitation. Others will be country specific in conjunction with related activities of multilateral or other bilateral development agencies.

17. *Providing feedback for the improvement of ongoing and future projects by routinely monitoring and evaluating sector projects.*

a) The results obtained from such monitoring and evaluation will be shared with CIDA's development partners who are involved in the project or similar projects.

b) Sector programs should benefit by the sharing of experiences in project implementation between countries and other external support agencies. CIDA will participate in such collaborative activities with the aim of improving the projects it supports.

8.5 TO ENHANCE THE USE OF CANADIAN RESOURCES

More than 100,000 Canadians are currently active domestically in water and sanitation programs in all parts of the country. Because Canada is predominantly urbanized, more Canadians are active in providing sector services for municipalities of all sizes than in providing services for rural residents. CIDA can provide superior assistance to developing countries by ensuring that the projects and programs it supports take maximum advantage of the entire spectrum of available Canadian resources.

Strategies and Considerations

18. *Directing support to projects which are well matched with available Canadian resources.*

    a) CIDA will strive to incorporate the most relevant Canadian resources into specific projects. There is no one formula which can be universally applied. Needs are different in different countries and capabilities are different among different organizations in Canada. This means that project planners must be in close touch with and responsive to the Canadian resource base if they are to match the needs and resources.

    b) Continuity in programming in a given country in the water and sanitation sector will facilitate matching of needs and resources since both CIDA and the recipient country will come to appreciate the Canadian resource base.

19. *Making better use of Canadian expertise in the public sector.*

    a) Up to now the public sector has not been extensively involved in water projects, and yet most of the expertise in several areas of the sector is to be found in various government departments and agencies. This public sector expertise includes environmental protection regulations, institution building, finance and administration, operations and maintenance. The greatest numbers of sector experts in Canada's public sector work with municipal governments, who are seldom able to release staff for overseas assignments. Now that there is increased attention to improving the management of projects, it will be important for project planners to devise ways and means which permit the involvement of public sector expertise to assist in implementing such projects.

    b) Mechanisms such as "twinning" arrangements, attachments and training visits between developing country partners and Canadian government organizations will be among the procedures to be considered.

    c) CIDA will promote dialogue with public sector organizations and associations, including CWWA, FCM and labour unions, in order to find mechanisms to facilitate the use of Canadian experts to assist sector projects in developing countries.

20. *Forming more effective teams between Canadian development partners, to respond to specific project needs.*

    a) Many projects in the water and sanitation sector are quite complex and require resources which are often beyond the capability of single Canadian organizations such as consultants, manufacturers, contractors, public sector agencies, training institutes and NGOs. CIDA needs to promote the pooling of these resources into "teams" which will result in the most effective delivery of the Canadian assistance required. Contracting methods should permit, if not encourage, the formation of teams or consortia of different organizations.

21. *Encouraging Canadian development partners to develop long-term policies for sector participation.*

    a) CIDA's mechanisms for supporting unsolicited initiatives through the Special Programs Branch and the Business Cooperation Branch are quite flexible and can support NGOs, institutions and private companies in many ways. CIDA will also:

        i) Encourage private consultants, contractors and manufacturers to undertake initiatives of their own such as joint ventures with developing countries' firms, technology transfer arrangements and offshore branches.

        ii) Encourage Canadian training institutes and NGOs to develop ongoing plans for programs supporting water and sanitation sector activities in developing countries, including:

            - courses and seminars
            - links with developing countries' institutions and organizations.

        iii) Discourage Canadian organizations from opportunistic, one-time involvements in sector projects in developing countries. Instead CIDA will encourage all its Canadian development partners to form their own policies, strategies and programs for long-term involvement if they wish to assist sector projects in developing countries.

8.6 TO DEVELOP AND IMPLEMENT A COMMUNICATIONS STRATEGY FOR THE WATER AND SANITATION SECTOR

The Government is committed to placing new emphasis on informing the Canadian public about international development. The water and sanitation sector is an ideal focus for these efforts. Every community in Canada has people working effectively in this sector. Furthermore, hundreds of individual Canadians have returned from working on water and sanitation projects abroad and many others are working there today. By emphasizing communications with Canadians about CIDA's water and sanitation programs, the Agency can improve the quality of the domestic resource base, as well as build support for development assistance in this and other sectors.

Strategies and Considerations

22. *Keeping CIDA well informed of sector developments in Canada and in developing countries.*

    a) *CIDA, particularly the Professional Services Branch, will strive to keep itself well informed of the capacities, strengths and experience of all segments of Canada's water and sanitation industry so that an accurate picture is maintained of the Canadian resource base.*

    b) *CIDA will also keep well informed of sector policies, programs, needs and experience in the developing countries where CIDA is, or expects to be, involved in providing assistance. Sectoral overviews will be prepared when appropriate to analyze or update the information base.*

    c) *There are many other ESAs active in the water and sanitation sector whose analyses and experience can benefit CIDA. The Agency will accordingly participate regularly in programs to share information and experiences with other ESAs.*

23. *Maintaining an active dialogue with CIDA's development partners.*

    a) CIDA acknowledges that there is abundant experience and expertise among its Canadian partners active in the water and sanitation sector and that no single organization, including CIDA, can pretend to have a monopoly on good ideas and relevant information. CIDA will develop procedures for periodic reviews of ideas and experience, along with mechanisms to share information among sectoral experts on a regular basis. Initiatives from CIDA's development partners towards such objectives will be encouraged.

24. *Featuring water supply, sanitation and hygiene in CIDA's development education program.*

    a) All CIDA's programs depend ultimately on the approval of the Canadian public. Support for CIDA programs in the water and sanitation sector should be based on the Canadian public being well informed of developing countries' needs, of CIDA's strategies and programs and of the experiences of CIDA and other ESAs in sector projects. CIDA needs to develop information programs based on a regular and systematic dialogue with various segments of the Canadian public on sector issues, programs and experiences. CIDA will encourage initiatives to develop and improve such dialogue and public information programs.

REFERENCES AND BIBLIOGRAPHY

REFERENCES AND BIBLIOGRAPHY

AfDB (1986). **A proposal for the fourth general increase in the Bank's capital.** Abidjan: African Development Bank, Cote d'Ivoire.

AQTE (1986). **Produits et services domaine de l'eau.** Quebec: Association Quebecoise de Techniques de l'Eau, Quebec, Canada.

AsDB (1986). **Water supply and sanitation sector strategy review.** Manila: Asian Development Bank, The Philippines.

Beyer, M. & Balcomb, J. (1987). **Water and sanitation in UNICEF 1946-1986.** UNICEF History Series, Monograph VII. New Work: UNICEF.

Biswas, A.K. (1984). "Monitoring and evaluation of an irrigation system". **International Journal of Water Resources Development,** 2(1): 3-25.

Biswas, A.K. (1986). "Improved efficiency in the management of water resources: An overview". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources,** United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

BMZ (1984). **Water supply and sanitation projects in developing countries: sector paper - Guidelines for the planning and implementation of bilateral cooperation projects of the Federal Republic of Germany in the Drinking Water and Sanitation Decade.** Bonn: Federal Ministry for Economic Cooperation, Federal Republic of Germany.

Briscoe, J.; Feachem, R.G. & Rahaman, M.M. (1986). **Evaluating health impact: Water supply, sanitation, and hygiene education.** Ottawa: International Development Research Centre, Canada.

Cairncross, S.; Carruthers, I.; Curtis, D.; Feachem, R.; Bradley, D. & Baldwin, G. (1980). **Evaluation for village water supply planning.** The Hague: International Reference Centre for Community Water Supply and Sanitation, The Netherlands.

CIDA (1984a). **Elements of Canada's official development assistance strategy 1984.** Hull: Canadian International Development Agency, Canada.

CIDA (1984b). **Women-in-development framework.** Hull: Canadian International Development Agency, Canada.

CIDA (1984c). **Women-in-development and the project cycle - A workbook.** Hull: Canadian International Development Agency, Canada.

CIDA (1985). **Women, water and sanitation.** Hull: Canadian International Development Agency, Canada.

CIDA (1987a). **The business of development. CIDA: A guide for the business community.** Hull: Canadian International Development Agency, Canada.

CIDA (1987b). **Canadian international development assistance: To benefit a better world. Response of the Government of Canada to the report by the Standing Committee on External Affairs and International Trade.** Hull: Canadian International Development Agency, Canada.

CIDA (1987c). Canadian International Development Assistance: **Sharing Our Future.** Canadian International Development Agency, Hull, Canada.

Changnon, S.A. (1987). "An assessment of climate change, water resources, and policy research". **Water International, 12**(2): 69-76.

Comite national canadien pour la Decennie hydrologique internationale. **Participation canadienne a la Decennie hydrologique international - Rapport Final. Volume I: Resume des activites Ontario.**

Committee on Water Problems (1984). **Flood and drought management in the ECE Region.** Economic Commission for Europe.

Committee on Water Problems (1986a). **International co-operation on flood management.** Economic Commission for Europe.

Committee on Water Problems (1986b). **International co-operation on flood management. Addendum 1: Legal provisions contained in transboundary water agreements in the field of flood management.** Economic Commission for Europe.

Council on Environment Quality & Department of State (1982). **The Global 2000 report to the President of the U.S. Volume I: The summary report; Volume II: The technical report; Volume III: The Government's Global Model.** Pergamon Press.

CWS/WHO (1985). "Africa - Regional resource mobilization profile". **Regional External Support Consultation,** 25-28 November, Abidjan, Ivory Coast. Geneva: CWS/World Health Organization.

DAC (1985). **Improving aid effectiveness in the drinking water supply and sanitation sector: Conclusions and recommendations emerging from DAC Consultations.** Paris: Organisation for Economic Co-operation and Development.

DRIE (1982). **Realizing the potential: The Canadian consulting engineering industry.**

DRIE (1982). **Coming to grip with change: A report on the Canadian consulting industry.** Peter Barnard Associates.

Economic Commission for Eastern Asia. **Development of guidelines for efficient water management in the ECWA Region.** Baghdad: Science and Technology Division, Economic Commission for Eastern Asia, Iraq.

Economic Commission for Europe (1986). **Policies and strategies for rational use of water in the ECE Region.** New York: United Nations.

Elmendorf, M.L. (1981). **Women, water and the Decade,** WASH Technical Report No. 6. Arlington: Water and Sanitation for Health Project, Virginia, U.S.A.

Elmendorf, M.L. & Isely, R.B. (1981). **The roles of women as participants and beneficiaries in water supply and sanitation programs**, WASH Technical Report No. 11. Arlington: Water and Sanitation for Health Project, Virginia, U.S.A.

Estey, S.A.; Feachem, R.G. & Hughes, J.M (1985). "Interventions for the control of diarrhoeal diseases among young children: Improving water supply and excreta disposal facilities", **Bulletin of the World Health Organization, 63**(4): 757-772.

Falkenmark, M. & Lindh, G. (1976). **Water for a starving world.** Boulder: Westview Press, Colorado, U.S.A.

Feachem, R.; McGarry, M. & Mara, D. (1977). **Water, wastes and health in hot climates.** Toronto: John Wiley and Sons, Canada.

Glasgow, M. & Yansheng, M. (1982). **Water supply, sanitation and health education: Insights and trends.** New York: UNICEF.

Glenn, W.M. (1987). **Environmental protection industry - Inventory of Firms.** Corpus Information Services, Ontario, Canada.

Godfrey, M. (1986). "CARE International - African rural water supply strategies and experiences". Paper presented at **All-Africa Seminar on Low-Cost Rural and Urban-fringe Water Supply Systems**, October, Abidjan, Cote d'Ivoire.

Grover, B.; Burnett, N. & McGarry, M.G. (1983). **Water supply and sanitation project preparation handbook. Volume 1: Guidelines, Volumes 2&3: Case Studies;** World Bank Technical Paper No's 12-15. Washington, D.C.: The World Bank.

GTZ (1981a). **Water is life... Documentation on German Technical Cooperation in the Hydraulic Engineering and Water Resources Development Sector.** Eschborn: GTZ, Federal Republic of Germany.

GTZ (1981b). **Key Services. Water resources development, water supply and sewerage (Code No. 41).** Eschborn: GTZ, Federal Republic of Germany.

Gunn, A. & Ballance, R.C. (1983). **Maximum benefits to health... An appraisal methodology for water and sanitation projects.** Geneva: World Health Organization.

Hanke, S.H. & Fortin, M. (1985). **The economics of municipal water supply: Applying the user-pay principle;** Inquiry on Federal Water Policy Research Paper No. 21. Ottawa: Environment Canada.

Hodges, R.C. (1957). **India and Pakistan solve water sharing problem.** Canadian Georgraphic Journal, June 1957, Ottawa.

Inter-American Development Bank (1982). **Guidelines for the preparation of loan applications. Sector: Water supply.**

IDRC (1982). **Projects 1970-1981.** Ottawa: International Development Research Centre, Canada.

IDRC (1984). **Women's issues in water supply and sanitation: Attempts to address an age-old challenge.** Ottawa: International Development Research Centre, Canada.

IDRC (1986a). **Projects 1970-1986.** Ottawa: International Development Research Centre, Canada.

IDRC (1986b). **With our own hands. Research for Third World development: Canada's contribution through the International Development Research Centre 1970-1985.** Ottawa: International Development Research Centre, Canada.

IDRC (1987). **Seminar on the participation of women in water supply and sanitation programmes.** Ottawa: International Development Research Centre, Canada.

IDWSSD (1983). **Strategies for enhancing women's participation in water supply and sanitation activities.**

IDWSSD (1987). **The International Drinking Water Supply and Sanitation Decade: Review of mid-Decade progress as at December 1985.** Geneva: World Health Organization.

IIED (1981). **Water, Sanitation, Health - for all?** Earthscan Publication. Published by the International Institute for Environment and Development, London.

IIED & WRI (1987). **World resources 1986.** New York: Basic Books, Inc., New York, U.S.A.

Interregional Cooperation Programme of the WHO and the GTZ (1986). **Water supply and sanitation global sector development concepts.**

Isely, R.B.; Faiia, S.; Ashworth, J.; Donovan, R. & Thomson, J. (1986). **Framework and guidelines for CARE water supply and sanitation projects,** WASH Technical Report No. 40 prepared for CARE, New York. *Arlington*: Water and Sanitation for Health Project, Virginia, U.S.A.

Jonch-Clausen, Torkil (1986). "Water supply development with Danish support in Africa". *Paper presented at* **All-Africa Seminar on Low-Cost Rural and Urban-fringe Water Supply Systems,** October, Abidjan, Cote d'Ivoire.

Kalbermatten, J. (1987). **Report on the collaborative framework.** November 10, Washington, D.C.

Kalbermatten, J.M.; Julius, D.S. & Gunnerson, C.G. (1980): **Appropriate technology for water supply and sanitation: Technical and economic options.** Washington, D.C.: The World Bank.

Kalbermatten, J.M. & McGarry, M.G. (1987). "Beyond the Decade", Paper presented at the **International Drinking Water Supply and Sanitation Consultation,** Interlaken, Switzerland, 13-16 October.

Kassas, M.E. (1986). "Improved efficiency in the management of natural hazards: drought and desertification". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources,** United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

Khan, A.A. (1986). "Improved efficiency in the management of natural hazards: Floods". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources**, United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

Kurten, G. (1986). "FINNIDA and rural water supply in developing countries". Paper presented at **All-Africa Seminar on Low-Cost Rural and Urban-fringe Water Supply Systems**, October, Abidjan, Cote d'Ivoire.

Lagace, B. & Rogers, Jerome (1986). **Agriculture sector development issues.** Hull: Agro Strategies International, Inc., Quebec, Canada.

Lieser, P.; Faust, R.; Ahman, I.; Knipschild,W. & Lowes, P. (1985). **WHO/BMZ European donor consultation. Report by the Secretariat.** Bonn/Geneva: BMZ and WHO.

Low, T.G. (1985). **Drinking water supply and sanitation in the developing world.** Hull: Canadian International Development Agency, Canada.

McClelland, N. (1986). "Improved efficiency in the management of water quality". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources**, United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

McGarry, M.G. (1986a). "Improved efficiency in the management of technology: Technologies appropriate to the needs and resources of developing countries". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources**, United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

McGarry, M.G. (1986b). **Water supply and sanitation sector paper.** Abidjan: African Development Bank, Cote d'Ivoire.

McGarry, M.G. & Tam, D.M. (1986). **Water supply and wastes management impact evaluation guidelines.** Nairobi: United Nations Centre for Human Settlements, Kenya.

McJunkin, F.E. (1982). **Water and human health.** Washington, D.C.: U.S. Agency for International Development.

MacLaren, J.W. (1985). **Municipal waterworks and wastewater systems;** Inquiry on Federal Water Policy Research Paper No. 3. Ottawa: Environment Canada.

Ministere de Approvisionnements et Services Canada (1979). **Energie et environnement - Materiel fabrique au Canada.** Quebec: Industrie et Commerce, Quebec, Canada.

Ministere des Relations Exterieures; Ministere de l'Agriculture; & Ecole Nationale du Genie Rural, des Eaux et des Forets (1986). **Programmes Sectoriel d'Hydraulique villageoise. Elements d'informations et propositions d'orientations.** France.

Ministry of Foreign Affairs, Netherlands (1983). **Report and recommendations on domestic water supply activities undertaken by the Netherlands 1975-1980.** The Hague: Ministry of Foreign Affairs, The Netherlands.

Mounier, J.P. (1986). "Improved efficiency in the management of human resources". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources**, United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

National Demonstration Water Project (1982). **Safe water and waste disposal for rural health: A program guide.** Washington, D.C.: U.S. Agency for International Development.

National Economic Development Office (1987). **Selling British water industry expertise overseas.** London: National Economic Development Office, U.K.

NORAD (1985). **Just add water ?** Oslo: Norwegian Ministry of Development Cooperation, Norway.

ODA (1985). **Manual for the appraisal of rural water supplies.** London: Overseas Development Administration, U.K.

ODA (1986). **British aid for the Water Decade.** London: Overseas Development Administration, U.K.

The Ottawa Citizen (1987). **"Drastic Climate Shift Predicted"**, pp. A22, July 23.

Pearse, P.H.; Bertrand,F. & MacLaren, J.W. (1985). **Currents of change. Final report: Inquiry on Federal Water Policy.** Ottawa: Ministry of the Environment, Canada.

Perrett, H.E. (1983a). **Involving women in sanitation projects**, TAG Discussion Paper No. 3. Washington, D.C.: The World Bank.

Perrett, H.E. (1983b). **Monitoring and evaluation of communication support activities in low-cost sanitation projects**, TAG Technical Note No. 11. Washington, D.C.: The World Bank.

Perrett, H.E. (1983c). **Planning of communication support (information, motivation and education) in sanitation projects and programs**, TAG Technical Note No. 2. Washington, D.C.: The World Bank.

Perrett, H.E. (1983d). **Social feasibility analysis in low-cost sanitation projects**, TAG Technical Note No. 5. Washington, D.C.: The World Bank.

Perry, B.A. (1984). **Women and development. An annotated bibliography and resource guide for CIDA planners and project officers.** Hull: Canadian International Development Agency, Canada.

Peter Bernard Associates (1985). **Face aux changements - Rapport sur l'industrie canadienne des ingenieurs-conseils.** Pour le Ministere de l'Expansion Industrielle Regionale, Avec le concours de l'Association des Ingenieurs-Conseils du Canada. Ottawa, Canada.

R.L. Walker & Partners Ltd. (1982). **Canadian prospects for providing operational assistance to water supply and sanitation systems in developing countries.** Report presented to the Canadian International Development Agency, Ottawa, Canada.

Rybczynski, W.; Polprasert, C. & McGarry, M.G. (1978). **Low-cost technology options for sanitation. A state-of-the-art review and annotated bibliography.** Ottawa: International Development Research Centre, Canada.

Saunders, R.J. & Warford, J.J. (1976). **Village water supply: Economics and policy in the developing world.** Baltimore: Johns Hopkins University Press, U.S.A.

SCEAIT (1987). **For whose benefits? Canada's Official Development Assistance policies and programs.** Ottawa: House of Commons.

Schiller, E.J. & Droste, R.D. (ed's) (1982). **Water supply and sanitation in developing countries.** Ann Arbor: Ann Arbor Publishers, Michigan, U.S.A.

Secretariat for the Regional External Support Consultation (1986). **Report on Asia Regional External Support Consultation in connection with the International Drinking Water Supply and Sanitation Decade, Manila, 21-25 October 1985.** Manila/Geneva: Asian Development Bank/World Health Organization.

Shady, A.M. (1985). **Training opportunities in Canada for irrigation and drainage specialists.** Report presented to CIDA, Canada.

SIDA (1980). **Guidelines for SIDA-supported activities in International water resources development. Part 1: General overview; Part 2: Rural drinking water supplies; Part 3: The Swedish resource base.** Stockholm: Swedish International Development Authority, Sweden.

Statistics Canada (1982). **Survey of consulting engineering offices.**

Tam, D.M.; McGarry, M.G. & Brocklehurst, C. (1986). **Recent scientific and technological developments in the Canadian water and their possible relevance to developing countries.** Ottawa: Cowater International, Inc., Canada.

Tillman, G. (1981). **Environmentally sound small-scale water projects. Guidelines for planning.** Mt. Rainier: VITA, Maryland, U.S.A.

Trudel, L. & Tanguay, P. (1985). **Dossier d'information sectorielle sur l'equipement de traitement de l'eau.** Quebec: Ministere de l'Industrie et Commerce du Quebec, Quebec, Canada.

UN (1977a). **Report of the United Nations Water Conference, Mar del Plata, 14-25 1977.** New York: United Nations.

UN (1985a). **International register of agencies participating in the International Drinking Water Supply and Sanitation Decade.** New York: United Nations.

UN (1985b). **Estimates and Projections of Urban, Rural and City Populations, 1950-2025: The 1985 Assessment;** U.N. Publication ST/ESA/SER.R/58. New York: United Nations.

UN (1985c). **Progress in the Attainment of the Goals of the International Drinking Water Supply and Sanitation Decade: Report of the Secretary General**; U.N. Report A/40/108. Economic and Social Council, General Assembly, United Nations, New York.

UN Secretariat (1986). "Improved efficiency in the management of water resources: An overview". Paper presented at **Interregional Symposium on Improved Efficiency in the Management of Water Resources**, United Nations Headquarters, New York, 5-9 January. New York: Department of Technical Co-operation for Development, United Nations.

UN Secretary General (1977b). **Progress in the attainment of the goals of the International Drinking Water Supply and Sanitation Decade. Report of Secretary General.** New York: United Nations, Economic and Social Council

UN Secretary General (1985a). **Report of the UN Secretary General - The World Conference to review and appraise the achievements of the UN Decade for Women**, Nairobi, Kenya.

UN Secretary General (1985b). **Report of the UN Secretary General to the Economic and Social Council of the UN General Assembly**, March. New York: United Nations.

UNCHS (1984). **Environmental aspects of water management in metropolitan areas of developing countries.** Nairobi: United Nations Centre for Human Settlements, Kenya.

UNDP (1978). **Decade Dossier - International Drinking Water Supply and Sanitation Decade 1981-1990.** New York: Division of Information, United Nations Development Programme, U.S.A.

UNDP/World Bank (1987). **Water supply and sanitation: The Decade and beyond. Towards equitable and sustainable development - A proposed strategy.** Interlaken: Switzerland.

UNDTCD (1987). **Final report: Interregional Symposium on Improved Efficiency in the Management of Water Resources: Follow-up to the Mar del Plata Action Plan.** New York: Department of Technical Co-operation for Development, United Nations.

UNICEF (1980). **UNICEF co-operation in water supply and sanitation projects.** New York: UNICEF.

UNICEF (1986). **Statistical Review of the Situation of Children in the World.** New York: UNICEF.

UNICEF (1987). **Policy Paper for UNICEF Executive Board 1988 on Water Supply and Sanitation.** New York: UNICEF.

Verronneau, G.P. (1987). "Repertoire de l'acheteur". **La Revue Municipale**, Quebec.

Warner, D.B. (1981). **Social and economic preconditions for water supply and sanitation programs**, WASH Technical Report No. 10. Arlington: Water and Sanitation for Health Project, Virginia, U.S.A.

WASH (1981). **Water supply and sanitation in rural development**; WASH Technical Report No. 14. Arlington: Water and Sanitation for Health Project, Virginia, U.S.A.

Water Supply and Urban Development Department (1985). **Rural water supply and sanitation. Possibilities for collaboration with non-governmental organizations.** Washington, D.C.: The World Bank.

Water Supply and Urban Development Department (1986). **Urbanization in the developing countries: Issues and priorities.** Washington, D.C.: The World Bank.

WCED (1987). **Our common future.** Oxford: Oxford University Press, U.K.

White, G.F.; Bradley, D.J. & White, A.U. (1972). **Drawers of water.** Chicago: University of Chicago, U.S.A.

Whyte, A. (1983). **Guidelines for planning community participation in water supply and sanitation projects.** Geneva: World Health Organization.

WHO (1983). **Minimum evaluation procedure (MEP) for water supply and sanitation projects.** Geneva: World Health Organization.

WHO (1986a). **The International Drinking Water Supply and Sanitation Decade - Review of national progress.** Geneva: World Health Organization.

WHO (1986b). **The International Drinking Water Supply and Sanitation Decade - Review of regional and global data.** Geneva: World Health Organization.

WHO/SDC (1987). **Draft Report on the International Drinking Water Supply and Sanitation Consultation,** Interlaken, Switzerland, 13-16 October.

Widstrand, C. (ed.) (1980). **Water and society: Conflicts in development. Part 2: Water conflicts and research priorities.** Pergamon Press.

World Bank (1976). **Village water supply: A World Bank paper.** Washington, D.C.: The World Bank.

World Bank (1982). **Sector support strategy paper: Water and wastes.** Washington, D.C.: The World Bank.

World Bank (1985). **Community water supply: The handpump option.** Washington, D.C.: The World Bank.

World Bank (1986a). **Community water supply.** Washington, D.C.: The World Bank.

World Bank (1986b). **Rural water supply and sanitation: Time for a change.** Washington, D.C.: The World Bank.

World Bank (1986c). **World development report.** Washington, D.C.: The World Bank.

World Water (1986). "Five-point Plan for Africa agreed by 30 countries at Abidjan". **World Water,** p. 6, November.

World Resources Institute (1986). **Tropical Forests: A call for action.** The report of an international task force convened by the World Resources Institute, the World Bank and the United Nations Development Programme.

Wright, A.M. & Courtney, J.M. (1986). **Strategic sanitation planning.** Washington, D.C.: The World Bank.

Appendix A

PARTICIPANTS IN FORMULATION OF DEVELOPMENT ISSUES PAPER

Appendix A

PARTICIPANTS IN FORMULATION OF DEVELOPMENT ISSUES PAPER

Many people have been involved in preparing this development issues paper. The basic responsibility has rested with staff members of the Water Sector in the Infrastructure Division of the Professional Services Branch at CIDA.

Most of the work in researching and writing the document has been delegated to consultants. The main role was assigned to Cowater International Inc., whose team included Mark Baron (Project Manager), Michael McGarry, Harry MacPherson, Jim MacLaren, Richard Hodges, Tam Diep, Andrea Doucet, and Stephanie Pyne. Two individual consultants helped considerably in researching data about past CIDA activities in the sector: Safdar Bokhari and Tom Low. Most of the typing was done by Patricia Clark.

Chapter 4 on Canadian experience and capability was researched by four consultants:

- Marcel Couture (Aquatech Ltee, Montreal)
- James MacLaren (Toronto)
- Colin Macfarlane (Ontario International Corporation)
- Dave Mortin (UMA Group, Calgary)

Editorial assistance has been provided by Tom Davey Consulting.

Guidance has been provided throughout the process by CIDA's steering Committee, comprising the following members:

CIDA Steering Committee

Hospice Alves	Specialist, Water Sector, Infrastructure Division, Professional Services Branch
William Bain	Senior Program Manager, International Financial Institutions, Multilateral Programmes Branch
Georges Barchechat	Deputy Driector, Programming and Systems, Francophone Africa Branch
Guy Carrier	Specialist, Water Sector, Infrastructure Division, Professional Services Branch
Michel DesGroseilliers	Francophone Africa and Programmes Analyst, Country Focus Coordination, Special Programmes Branch
Krystyna Dunska	Specialist, Water Sector, Infrastructure Division, Professional Services Branch

Peggy Florida	Regional Director, NGO and Anglophone Africa, Special Programmes Branch
Nancy Garrett	Health Specialist, Social Dimensions Section, Social and Human Resource Development Division, Professional Services Branch
Brian Grover	Director, Water Sector, Infrastructure Division, Professional Services Branch
Said Khiari	Director, Business Co-operation Policy, Policy and Systems Division, Business Cooperation Branch
Jim Kirch	Specialist, Water Sector, Infrastructure Division, Professional Services Branch
Alf McCabe	Specialist, Water Sector, Infrastructure Division, Professional Services Branch
Neil Mussell	Development Officer, Bangladesh-Burma, Asia Branch
Louise Ouimet	Deputy Director of Programming, Programming and Systems, Professional Services Branch
Ralph Roberts	Director, Forestry Sector, Natural Resources Division, Professional Services Branch
Ron Schatz	Senior Project Officer, Southern Africa, Anglophone Africa Branch
Ali Shady	Specialist, Agriculture Sector, Natural Resources Division, Professional Services Branch
Jack Shea	Senior Policy Analyst, Policy Coordination and Development Division, Policy Branch
Nancy Stiles	Country Program Director, Central America Region, Americas Branch
Connie Strang	Senior Policy Analyst, Policy and Information Directorate, Social and Human Resource Development Division, Professional Services Branch
Susan Taylor	Writer-Editor, Creative Services, Public Affairs Branch

A draft version of the paper was circulated early in 1988 inside CIDA and to a selected group of external reviewers. Valuable and welcome comments were received from the following:

External Reviewers

Steve Bonk	Director, Water Supply Division, Regional Municipality of Ottawa-Carleton; Also, President-Elect, American Waterworks Association
Tim Brodhead	Executive Director, Canadian Council for International Cooperation, Ottawa
Maurice Carel	Directeur, Centre Sahel, Universite Laval, Quebec
Christian Chevalier	President, Eurotech Inc., St-Robert, Quebec
Robert Craig	Directeur General, Club 2/3, Montreal, Quebec
Penina Coopersmith	Executive Director, Canadian Water and Wastwater Association, Ottawa
A.T. Davies	Acting General Manager, Water and Sanitation, City of Edmonton
Arnold Drapeau	Professeur, Ecole Polytechnique, Montreal
W.H. Gates	President, Canadian Water and Wastewater Association, Halifax
Derrick Harrison	Secretary, Western Canada Water and Wastewater Association, Calgary
Richard C. Hodges	Consultant, Ottawa
Andre Julien	Ingenieur, Tecsult International Limitee, Montreal
J.A. Knowles	Director, International Operations, UMA Group, Vancouver
Ed Kuiper	Professor, University of Manitoba, Winnipeg
Harold L. Macklin	Consultant, Marshall Macklin Monaghan, Toronto
J.W. MacLaren	Consulting Engineer, Toronto
Harry McPherson	Professor, University of Alberta, Edmonton
Walter Marshall	Former Chief, CIDA Water Sector, Nepean, Ontario
R.W. Miller	Chairman, WaterCan, Ottawa
Ismail Najjar	President, Hydrosult Inc., Montreal

Paul-Emile Paradis	Conseiller en commerce exterieur, Direction des biens industriels et projets internationaux, Ministere du Commerce exterieur et du Developpement technologique, Montreal
John Paulson	Associate, Wardrop Engineering Inc., Winnipeg
Francois Pierre	Commerce Officer, Department of Regional and Industrial Expansion, Ottawa
Alex Redekopp	Health Sciences Division, International Development Research Centre, Ottawa
Eric Schiller	Professor, University of Ottawa, Ottawa
Donald Sharp	Associate Director, Health Sciences Division, International Development Research Centre, Ottawa
O.T. Sigvaldason	Vice-President, Acres International Limited, Niagara Falls
R.W. Slater	Assistant Deputy Minister, Environment Canada, Ottawa
Donald R. Stanley	Chairman, Stanley Associates Eng. Ltd., Edmonton
Gaetan Thibeault	Ingenieur benevole, Club 2/3, Montreal
Pierre Vaillancourt	Coordonnateur, Soledarite Canada Sahel, Montreal
Brian Walker	Dayton & Knight Ltd., West Vancouver
Brian Wolff	Director, Overseas Operations, CARE Canada, Ottawa

Appendix B

BACKGROUND INFORMATION ON CIDA

Appendix B

BACKGROUND INFORMATION ON CIDA

Table of Contents

Appendix B

BACKGROUND INFORMATION ON CIDA[1]

B.1 WHAT IS CIDA?

The Canadian International Development Agency is the principal federal entity responsible for implementing Canada's Official Development Assistance (ODA) program. CIDA is a full federal government department, subject to the same rules and government-wide standards and practices as other government departments. It is subject to audit by the Auditor General and to subsequent examination by the Parliamentary Committee on Public Accounts. CIDA budgetary estimates are approved by Parliament. The Agency is headed by a President who reports directly to the Minister for External Relations and to the Secretary of State for External Affairs. CIDA, therefore, is bound by government-wide rules; other government bodies are often used to process many of its purchases.

CIDA is responsible for the delivery of about 75% of Canada's official development assistance. The other 25% is delivered to the World Bank through the Department of Finance, to international agencies through the Department of External Affairs, and by four development crown corporations: the International Development Research Centre (IDRC), Petro Canada International Assistance Corporation (PCIAC), the International Centre for Ocean Development (ICOD), and the International Centre for Human Rights and Democratic Development (ICHROD).

CIDA's assistance to Third World countries is delivered through several channels and the overall system is complex. It is designed to allow many Canadians - companies, universities, voluntary agencies, individuals, and public institutions - to play their part in responding to an equally complex set of needs and development partners around the world: multilateral institutions, banks, research bodies, governments, cooperatives, schools and colleges. Different rules apply to different parts of the system. The following is an explanation of CIDA's structure and main thrusts.

- The Business Cooperation Branch is responsible for providing a focal point in CIDA for Canadian companies who want to participate in international development. It supports Canadian business initiatives aimed at transferring technology as an important tool of development.

- Bilateral (or government-to-government) programs are administered by the Anglophone Africa, Francophone Africa, Americas and Asia Branches.

---

[1] Information in this Appendix is provided by various CIDA publications, including CIDA (1987c). Canadian International Development Assistance: Sharing Our Future.

- Special Programs Branch supports and encourages the initiatives of over 300 Canadian nongovernmental groups and institutions to play a greater role in international development.

- Multilateral programs are the avenue through which Canada supports various United Nations agencies, development banks, humanitarian institutions and other international organizations.

- Professional Services Branch is the linch-pin which identifies and links Canada's resources with the needs of the developing world.

Other Branches within CIDA - including Policy, Operations Services, Comptroller's, Personnel and Administration, and Public Affairs - provide day-to-day professional, technical and administrative support.

B.2 DEVELOPMENT PARTNERS AND DISTRIBUTION OF CANADIAN ODA

As noted above, Canadian development assistance is delivered through numerous programs administered by seven branches of CIDA and several other Agencies and Departments. Budgets for the various program channels are approved annually.

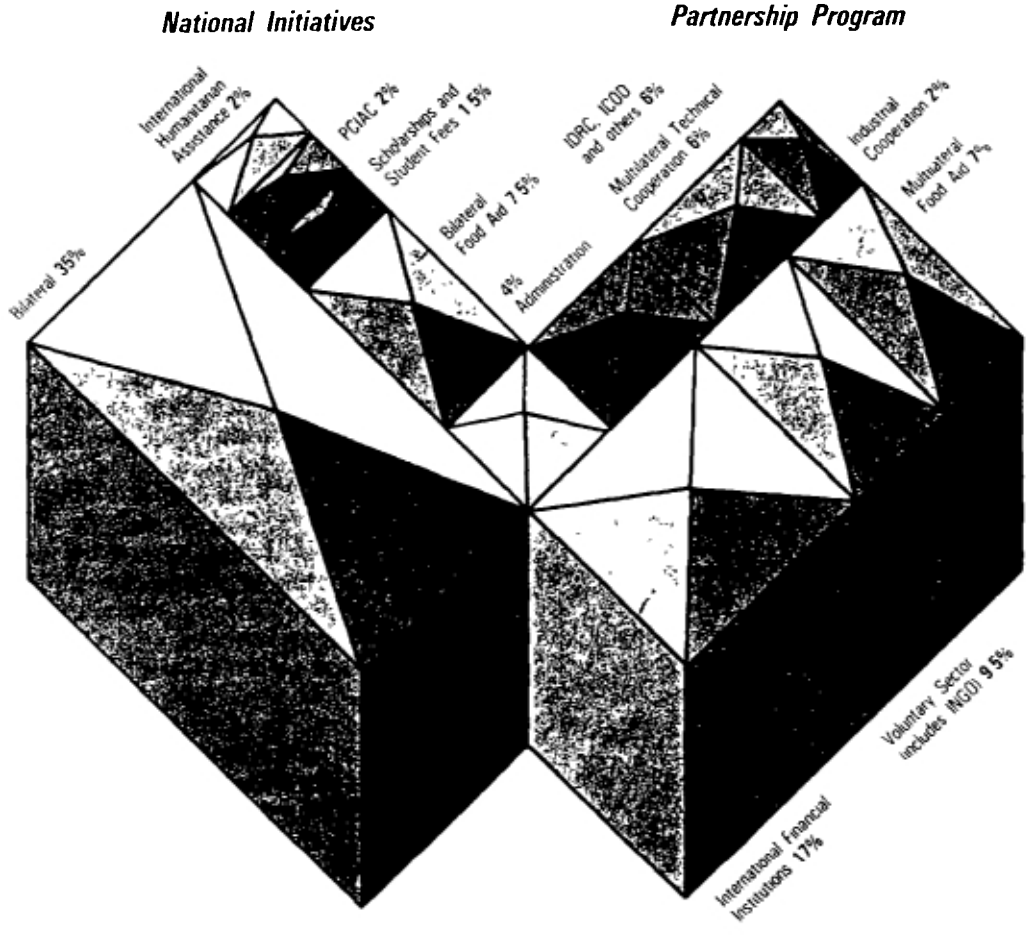
The Government of Canada's development partners include an array of organizations in Canada and in the developing world. Under the new Partnership Program the Government plans to allocate 50 percent of aid dollars to be channeled each year through the following groups, both Canada and international:

- o domestic and international non-governmental organizations;
- o non-governmental institutions;
- o development crown corporations (except PCIAC, which is included under the National Initiatives Program);
- o multilateral organizations, including food aid and international financial institutions; and
- o the business sector.

The other 50 percent of the aid dollars are to be administered by the various government programs. The largest single item in this category is the bilateral or government-to-government assistance.

The allocations of the ODA budget under the new strategy is shown pictorially in Figure B-1.

Figure B-1 :Distribution of Canadian ODA (CIDA, 1987c)



ODA allocations 1988–89 by percentage *(Total 100% – All numbers are rounded off)*			
National Initiatives		**Partnership Program**	
Bilateral	**35%**	Voluntary Sector (includes INGO)	**9.5%**
Bilateral Food Aid	**7.5%**	Industrial Cooperation	**2%**
PCIAC	**2%**	IDRC, ICOD, and others	**6%**
International Humanitarian Assistance	**2%**	Multilateral Technical Cooperation	**6%**
Scholarships and Student Fees	**1.5%**	International Financial Institutions	**17%**
		Multilateral Food Aid	**7%**
Total	**48%**	Total	**48%**
Administration			**4%**

Precise percentages will be available after Parliament approves the 1988–89 estimates.

Appendix C

STATISTICS ON GLOBAL WATER SUPPLY AND SANITATION NEEDS

Appendix C

STATISTICS ON WATER SUPPLY AND SANITATION NEEDS

Table of Contents

Table C-1

STATISTICS OF WATER SUPPLY AND SANITATION COVERAGE IN ELIGIBLE COUNTRIES OF THE ASIA BRANCH (1985)

Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
			Water Supply			Sanitation				
			Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sani-tation
China	1,034,750	310	NA	NA	434,595	NA	NA	413,900	42	40
India	763,930	250	46,899	282,066	328,965	135,893	555,643	691,536	43	91
Indonesia	165,000	586	33,630	67,800	101,430	39,997	66,000	105,997	61	64
Bangladesh	100,000	136	13,676	42,142	55,818	13,650	79,540	93,190	56	93
Pakistan	93,800	390	4,618	48,806	53,424	13,100	62,880	75,980	57	81
Philippines	55,336	585	11,443	15,388	26,831	3,878	14,574	18,452	48	33
Thailand	51,796	729	5,678	13,218	18,896	2,878	21,918	24,796	36	48
Turkey	49,406	1,130	NA	NA	NA	NA	NA	NA	NA	NA
Korea, Rep.	41,056	2,032	2,581	7,195	9,776	0	0	0	24	0
Burma	37,115	188	5,702	21,400	27,102	5,995	22,370	28,365	73	76
Nepal	16,680	165	400	11,547	11,947	1,118	15,304	16,422	72	98
Sri Lanka	15,860	340	528	8,840	9,368	1,192	7,620	8,812	59	56
Malaysia	15,677	2,033	206	2,470	2,676	0	4,046	4,046	17	26
Papua New Guinea	3,343	649	22	2,472	2,494	4	1,890	1,894	75	57
Singapore	2,558	2,558	0	0	0	29	0	29	0	1
Bhutan	1,286	160	NA	901	NA	NA	0	NA	NA	NA
Fiji	702	1,700	NA	NA	NA	NA	NA	NA	NA	NA
Solomon Islands	267	510	NA	NA	NA	NA	NA	NA	NA	NA
Maldives	181	524	19	119	138	0	133	133	76	73
Western Samoa	163	660	10	40	50	5	20	25	31	15
Vanuatu	137	529	1	53	54	3	86	89	39	65
Tonga	97	354	0	1	1	0	37	37	1	38
Kiribati	64	450	NA	NA	NA	NA	NA	NA	NA	NA
Cook Islands	17	NA	0	1	1	0	0	0	6	0
Tuvalu	8	386	0	0	0	1	1	2	0	25
TOTAL FROM AVAILABLE DATA	2,449,229		125,413	524,459	1,083,566	217,743	852,062	1,483,705		
ESTIMATED TOTAL					1,100,000			1,500,000		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Table C-2

STATISTICS OF WATER SUPPLY AND SANITATION COVERAGE IN ELIGIBLE COUNTRIES OF THE ANGLOPHONE AFRICA BRANCH (1985)

Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
			Water Supply			Sanitation				
			Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sani-tation
Nigeria	97,090	760	0	57,115	57,115	NA	NA	NA	59	NA
Egypt	47,108	680	NA	NA	NA	NA	NA	NA	NA	NA
Ethiopia	44,517	140	1,302	36,775	38,077	168	NA	NA	86	NA
South Africa	32,432	2,010	NA	NA	NA	NA	NA	NA	NA	NA
Tanzania	21,940	197	355	10,730	11,085	246	7,741	7,987	51	36
Sudan	21,931	330	NA	NA	NA	NA	NA	NA	NA	NA
Kenya	20,375	290	NA	NA	NA	NA	NA	NA	NA	NA
Uganda	14,680	220	1,194	10,526	11,720	1,294	9,040	10,334	80	70
Mozambique	13,810	NA	1,550	10,310	11,860	1,170	9,910	11,080	86	80
Ghana	12,387	420	277	5,117	5,394	1,562	7,068	8,630	44	70
Yemen Arab Rep.	9,274	471	0	6,301	6,301	157	NA	NA	68	NA
Zimbabwe	8,581	650	NA	4,244	NA	5,344	NA	NA	NA	NA
Angola	8,573	560	258	5,623	5,881	1,401	5,545	6,946	69	81
Malawi	7,059	140	29	3,113	3,142	NA	NA	NA	45	NA
Zambia	6,720	373	775	2,036	2,811	775	2,311	3,086	42	46
Somalia	5,515	200	586	3,216	3,802	779	3,924	4,703	69	85
Sierra Leone	3,700	200	355	2,401	2,756	443	2,331	2,774	74	75
Jordan	3,512	1,560	NA	NA	NA	NA	NA	NA	NA	NA
Liberia	2,181	470	0	1,003	1,003	NA	1,282	NA	46	NA
Yemen PDR	2,086	540	NA	NA	NA	NA	NA	NA	NA	NA
Lesotho	1,496	484	66	913	979	146	1,128	1,274	65	85
Namibia	1,127	1,520	NA	NA	NA	NA	NA	NA	NA	NA
Botswana	1,088	749	37	468	505	16	616	632	46	58
Mauritius	998	1,020	0	0	0	0	79	79	0	8
Swaziland	650	810	0	513	513	0	415	415	79	64
Djibouti	430	276	161	86	247	73	90	163	57	38
Seychelles	65	2,250	0	2	2	0	0	0	3	0
Lebanon	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL FROM AVAILABLE DATA	389,325		6,945	160,492	163,193	13,574	51,480	58,103		
ESTIMATED TOTAL					226,000			243,000		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Table C-3

STATISTICS OF WATER SUPPLY AND SANITATION COVERAGE IN ELIGIBLE COUNTRIES OF THE FRANCOPHONE AFRICA BRANCH

Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
			Water Supply			Sanitation				
			Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sanitation
Zaire	30,500	271	5,600	14,900	20,500	NA	17,150	NA	67	NA
Algeria	22,583	2,530	2,257	3,391	5,648	3,009	4,522	7,531	25	33
Morocco	21,924	610	NA	NA	NA	NA	NA	NA	NA	NA
Cote d'Ivoire	10,072	620	NA	NA	NA	NA	NA	NA	NA	NA
Cameroon	10,000	810	1,710	5,320	7,030	0	6,900	6,900	70	69
Madagascar	9,986	232	408	6,447	6,855	NA	NA	NA	69	NA
Mali	7,914	142	861	5,692	6,553	155	6,135	6,290	83	79
Tunisia	7,341	1,277	0	2,374	2,374	623	2,912	3,535	32	48
Burkina Faso	7,014	185	628	1,861	2,489	611	5,571	6,182	35	88
Senegal	6,500	370	550	2,400	2,950	340	NA	NA	45	NA
Rwanda	6,331	280	53	3,190	3,243	58	2,711	2,769	51	44
Niger	6,115	258	642	2,630	3,272	NA	NA	NA	54	NA
Guinea	5,780	310	937	3,687	4,624	NA	NA	NA	80	NA
Chad	4,982	NA	NA	NA	NA	NA	NA	NA	NA	NA
Burundi	4,782	230	6	3,522	3,528	50	1,972	2,022	74	42
Benin	3,825	320	375	1,288	1,663	750	1,561	2,311	43	60
Togo	3,068	300	0	1,331	1,331	569	2,040	2,609	43	85
Cent African Rep	2,673	270	789	NA	NA	NA	NA	NA	NA	NA
Mauritania	1,888	363	179	NA	NA	601	0	601	NA	32
Congo	1,872	1,020	NA	NA	NA	NA	NA	NA	NA	NA
Gabon	997	3,340	NA	NA	NA	NA	NA	NA	NA	NA
Guinea Bissau	880	150	157	540	697	135	563	698	79	79
Gambia	749	241	4	304	308	NA	NA	NA	41	NA
Comoros	395	280	NA	NA	NA	NA	NA	NA	NA	NA
Equat. Guinea	373	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cape Verde	337	317	23	101	124	92	184	276	37	82
Sao Tome/Principe	108	362	24	39	63	30	61	91	58	84
TOTAL FROM AVAILABLE DATA	178,989		15,203	59,017	73,252	7,023	52,282	41,815		
ESTIMATED TOTAL					97,000			115,000		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Table C-4

STATISTICS OF WATER SUPPLY AND SANITATION COVERAGE IN ELIGIBLE COUNTRIES OF THE AMERICAS BRANCH

Country/ Territory	Pop. 000's (1985)	GNP Per Capita (US$)	Population (000's) without Services						% Population without Service	
			Water Supply			Sanitation				
			Urban	Rural	Total	Urban	Rural	Total	Water Supply	Sani-tation
Brazil	127,942	1,640	9,812	10,227	20,039	13,374	20,732	34,106	16	27
Mexico	77,900	1,095	11,112	12,258	23,370	15,693	24,037	39,730	30	51
Argentina	30,564	1,929	9,062	4,138	13,200	6,266	3,248	9,514	43	31
Colombia	26,525	1,112	NA	6,434	NA	NA	7,034	NA	NA	NA
Peru	19,698	585	3,398	5,956	9,354	4,138	6,261	10,399	47	53
Chile	12,172	2,408	237	1,405	1,642	0	1,897	1,897	13	16
Ecuador	9,378	724	946	3,085	4,031	1,118	3,179	4,297	43	46
Guatemala	7,963	1,535	323	3,014	3,337	816	2,867	3,683	42	46
Bolivia	6,429	470	562	2,441	3,003	1,513	2,615	4,128	47	64
Dominican Rep.	6,243	810	882	2,264	3,146	920	1,222	2,142	50	34
Haiti	5,269	320	579	2,698	3,277	813	3,349	4,162	62	79
El Salvador	4,773	1,143	759	1,434	2,193	444	1,357	1,801	46	38
Honduras	4,372	733	933	1,449	2,382	1,389	1,736	3,125	54	71
Paraguay	3,681	1,526	670	2,204	2,874	444	1,441	1,885	78	51
Nicaragua	3,272	850	447	1,247	1,694	NA	NA	NA	52	NA
Uruguay	3,004	1,660	NA	NA	NA	NA	NA	NA	NA	NA
Costa Rica	2,463	1,262	0	177	177	0	118	118	7	5
Jamaica	2,227	940	NA	NA	NA	NA	NA	NA	NA	NA
Panama	2,141	898	0	386	386	0	411	411	18	19
Trinidad/Tobago	1,176	6,010	0	18	18	0	18	18	2	2
Guyana	817	570	0	146	146	0	83	83	18	10
Suriname	402	2,570	0	10	10	0	0	0	2	0
Barbados	253	4,889	0	1	1	57	NA	NA	0	NA
Bahamas	231	7,556	0	NA	NA	0	NA	NA	NA	NA
Belize	162	1,130	0	56	56	25	0	25	35	15
Cayman Islands	21	13,000	0	0	0	1	0	1	0	5
Turks & Caicos	9	NA	1	1	2	NA	NA	NA	22	NA
British Virgin Il	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL FROM AVAILABLE DATA	359,087		39,723	61,049	94,338	47,011	81,605	121,525		
ESTIMATED TOTAL					97,200			139,500		

Note: Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Fig. C-1 : GNP vs. Population without Safe Water Supply

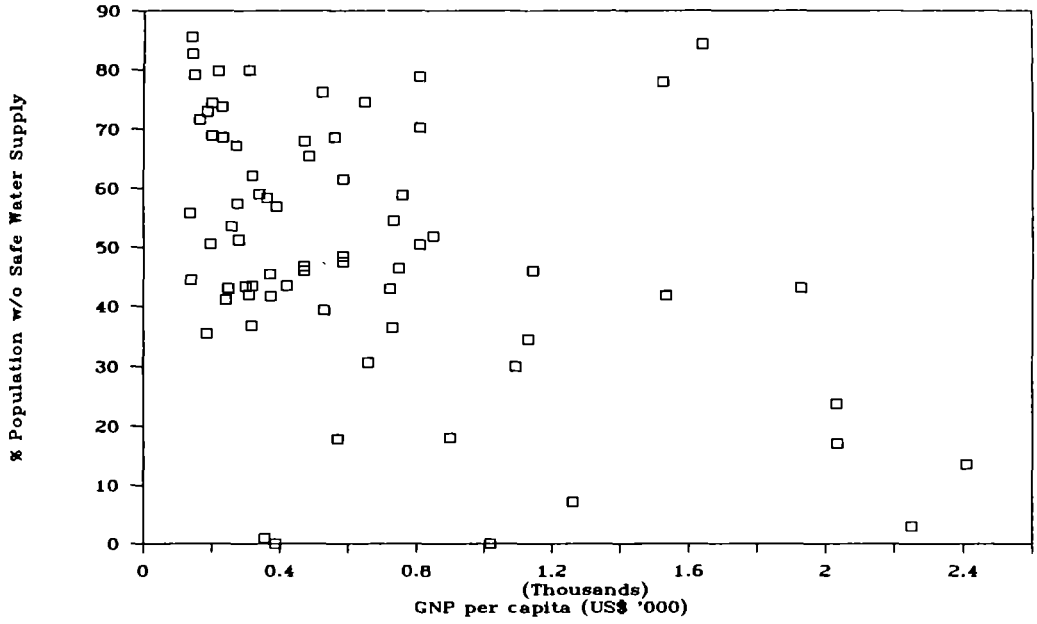
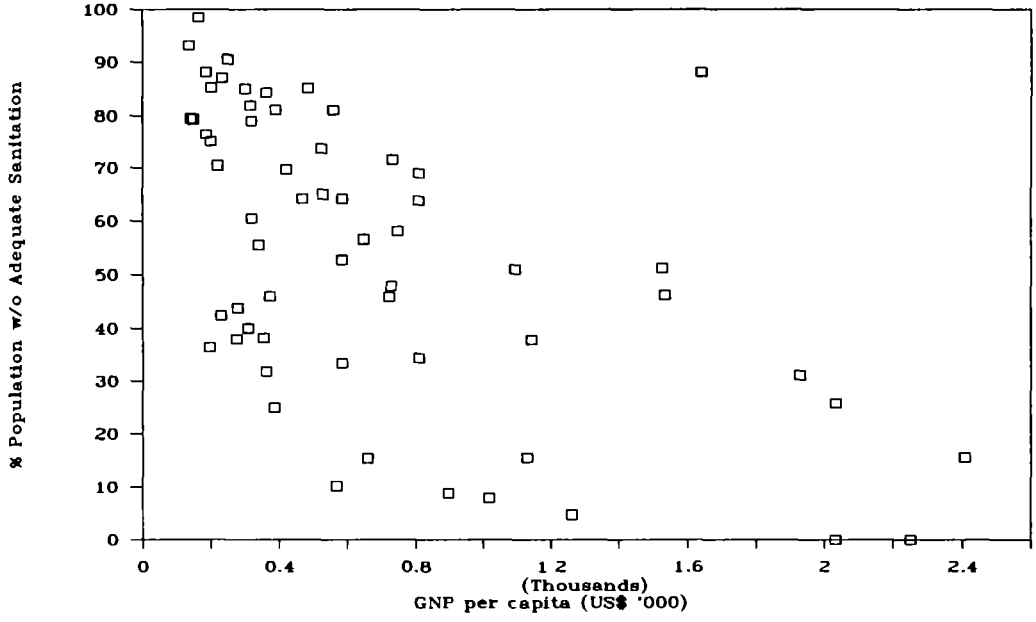


Fig. C-2 : GNP vs. Percentage of Population without Adequate Sanitation



Data compiled from:

- WHO/CWS (1987). "The International Drinking Water Supply and Sanitation Decade. Review of Mid-Decade progress (as at December 1985)".
- "World Bank Atlas 1987", using 1985 figures.
- and estimates from other sources.

Appendix D

DATA ON CIDA BILATERAL BRANCHES' WATER AND SANITATION PROGRAMS

Appendix D

DATA ON CIDA BILATERAL WATER AND SANITATION PROJECTS

Table of Contents

Appendix D

DATA ON CIDA BILATERAL WATER AND SANITATION PROJECTS

Notes to Tables in Appendix D

Table D-1

1. ***Projects.*** Missions financed by CIDA for the preparation or evaluation of specific projects are not listed.

2. ***Period.*** Periods given in this table refer to the fiscal years over which the project was implemented. For example, the period given as 71-75 means the project started in fiscal year 71/72 and was terminated in fiscal year 75/76. The time period for all projects is from 1968 to December 1, 1987.

3. ***CIDA Budget.*** For budgets, total CIDA disbursements are used wherever possible, otherwise total CIDA commitments are used. Budgets are shown in the year of project approval.

4. ***Sub-sector.*** Symbols used are the following:

WS	Water Supply
S	Sanitation
WRM	Water Resources Management

5. ***Population Served.*** Figures quoted in this column are taken from project documentation. The figures are not always reliable and their meaning is often not consistent. In numerous cases no figures are given, while in others the same figure is given for different project phases. In general, the number of persons served by the CIDA projects shown will exceed the total numbers indicated.

6. ***Outputs.*** The projects' outputs are given under the three headings of: Studies and Technical Assistance; Equipment and Infrastructure; Training.

Table D-1*
SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS
(From 1968 to 1987)

ASIA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Afghanistan	00402+ 10781	Kabul Water & Sewerage	78-80	5,750	WS/S	600	- Engineering services for design & construction - Supervision of WS & sewage system of Kabul City	- for 20 deep wells for water supply - 5,000 cu.m. storage reservoir - 4 pumping stations - 2 treatment sites	- on-the-job training for Afghans - $350,000 for scholarships for study in Canada	Part of a $23 million IBRD-CIDA-WHO Project
Afghanistan	00602	Kabul River Water Development	78-79	2,254	WRM	N/A	- Master Plan for the development of the Kabul River Basin - Canadian specialist team	- drilling, surveying and hydrologic investigation equipment		Combined Water, Energy and Agriculture Project
Bangladesh	10732	Handpump Testing I	83-86	630	WS	30		- Canadian manufactured handpump for testing - Purchase of other pumps		Part of global project administered by UNDP-IBRD-UNICEF and Bangladesh
Bangladesh	10742+ 11319	Small-scale Water Construction I & II	86-88	14,900	WRM	1,500	- Management, procurement and engineering services by Canadian consultants for approx. 1,500 structures.	- Materials and fabrication of gates, sluices and small retention structures	- 200 Bangladesh trained through seminars, courses at Asian Institute of Technology - Field workshops & study tours in Canada	- Irrigation & drainage project - Part of $ 60 million IDA Project
Bangladesh	13963	Handpump Testing II	83-86	996.6	WS	40	- Continuation of Project 10732			
India	00103	Groundwater Hydrogeology	71-75	984	WRM	N/A	- 22 person-years of Canadian expertise in hydrogeology and geophysics - Hydrogeological map of the Deccan Plateau	- Drilling equipment, hydrologic survey equipment, vehicles, supplies.	- On-the-job training for selected Indians	Project located in Hyderabad region of India

* See page D-1 for Notes to Table D-1

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ASIA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Indonesia	00114	Lombok Island Water Resources	71-75	1,297	WRM	N/A	- Canadian consultant team to prepare feasibility and pre-design documents for a water diversion in South-Central Lombok	- Survey, hydrologic data collection equipment and drilling supplies		Project led to construction of next phase #10096
Indonesia	10653+ 14260	Water Resources Training	77-90	5,000	WRM	N/A			- 53 fellowships - 50 Professionals at Master's level. - 3 Ph.D level - all at University of Manitoba - Training seminars in Indonesia for 250 professionals.	- Part of a continuing program to upgrade the staff of Water Resource Development Dept. of Works, Indonesia.
Indonesia	00514	Bengkulu Water Design	78-83	1,206	WRM	N/A	- 4 Canadian long-term experts. - Hydrological and climatological data base for the region. - Geotechnical studies of the area.	- Survey and data collection equipment. Geotechnical investigation equipment.	- Training of 4 counterpart professionals in water resource surveying.	- Principal purpose of project was strengthening of the local irrigation unit.
Indonesia	00515	Central Java Water Design	78-83	2,218	WRM	N/A	- As for Bengkulu Project #00514.	- As for #00514.	- As for #00514.	- As for #00514 above.
Indonesia	00516	Sumbawa Water Design	78-83	4,800	WRM	N/A	- 10 Canadian long-term experts. - Assessment of water and land resources of the area for irrigation.	- 10 hydrometric stations - 50 water wells - surveying and data collection equipment.	- Training of 10 counterpart professionals.	
Indonesia	10644	NTT Water Design	83-86	551	WRM	N/A	- 1 Canadian hydrogeologist - 1 agronomist - 1 geotechnical expert - 1 driller	- Spares for drilling rigs and some water measurement devices.	- Training of 10 Indonesians from Public Works Department in Water Resource engineering with PFRA Regina.	- Project located in NUSA Tenggara Timur Province.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ASIA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Indonesia	12033	NTT Water Resources	86-92	28,600	WRM	2,000	- Canadian consultant team for design and implementation of a comprehensive water resource program in the Province.	- Drilling, surveying, drafting and laboratory equipment.	- Short-term courses in water resource management and technical missions in Canada.	- Project aims to strengthen the Water Resource Development Dept. of NTT Province and to construct 6 small scale irrigation schemes.
Indonesia	10655	Lower Solo River Development	80-87	12,025	WRM	N/A	- Canadian consultant team for a technical feasibility of the Solo River Basin for irrigation, flood control and groundwater source identification.	- Surveying, hydrologic data collection equipment and drilling supplies to carry out the feasibility study.	- On-the-job training in data collection, analyses and design of water resource systems.	
Indonesia	10096	Lombok High Level Diversion	81-87	18,400	WRM	1,500	- Canadian team for design and construction supervision.	- Construction equipment and materials for 26 km of main canal, 2 feeder canals and rehabilitation of secondary canals.	- On-the-job in construction of civil works.	- Part of a $47.0 million project funded jointly by CIDA and Indonesia.
Pakistan	00611	Punjab Water & Sewerage	81-81	111	WS/S	N/A	- 2 Canadian specialists to advise Punjab Public Health Dept. in water supply and sanitation fields.		- Training of some Pakistan Public Health officials for six months in Lahore.	
Pakistan	08309	Sind Water Supply - UNICEF	83-86	318	WS/S	15		- 2,750 latrines, 55 public washhouses, 2 schools provided with clean water and latrines.	- Local materials and labour utilized. Canada transferred funds to Unicef.	- Project monitored and evaluated by Unicef, Canada and Pakistan.
Pakistan	11305	Punjab Sanitation - UNICEF	83-86	7	WS/S	N/A				- Continuation of above project #08309 in the Punjab area.
Pakistan	11334	Baluchistan Drilling Rigs	85-87	440	WS	5		- Spare parts to keep existing drilling rigs in operation in Baluchistan Province.		

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ASIA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
South Vietnam	00081	Qui Nhon Water Supply	74-75	523	WS	213	- 9 person years of Canadian expertise for design of potable water system for city of Qui Nhon.	- Hydrological survey equipment - 2 vehicles		- Project only partially completed due to changes in socio/-political situation in Vietnam.
Sri Lanka	10707	Maduru Oya Reservoir	80-86	76,800	WRM	300	- Canadian consulting team and contractor for design and construction.	- Equipment & materials for a rock filled dam, 2 irrigation outlets and establishment of human settlement for 20,400 families.	- On-the-job training for workers and engineers.	- Irrigation and hydro project.
Sri Lanka	10699	Ancient Bund & Arch Dam	82-83	21.6	WRM	N/A	- Canadian archeological study of an ancient dam discovered on the location of Maduru Oya Project.			- Canadian funds used to excavate the ancient dam. Now a historic monument.
Sri Lanka	00303+ 10114	Right Bank Canal - System B	83-88	60,000	WRM	N/A	- Canadian consulting team and contractor for design and construction.	- Equipment & materials for an earth-filled dam and 88 km of distribution canals.	- On-the-job training in construction and design.	- Irrigation and hydro project.
Sri Lanka	10695	Field testing of handpump	83-86	270	WS	5		- 25 Canadian and several other handpumps purchased and tested in the field.		- Project located on Kalutara and Vayunya regions. - Part of Global UNDP/IBRD Project.
Sri Lanka	10702	Water Resources Management	82-86	3,147	WRM	N/A	- Canadian expertise to develop sound water management techniques in the Mahaweli region.	- Computer equipment for data management and simulation.	- Training of 7 Sri Lankans in Canada and USA, short courses, conferences, study tours. On-the-job training in data collection & management.	
Asia				151		N/A	Evaluations and small studies.			
Total for Asia				241,400		6,208				

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
(From 1968 to 1987)

ANGLOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs: Studies & Tech. Assistance	Outputs: Equipment & Infrastructure	Outputs: Training	Comments
Egypt	11876	Giza Water & Sewerage Study	84-87	1,700	WS/S	1,500	- Master plan for water supply/sanitation. - Feasibility study for one priority project.		- Study tour in Canada for 7 Egyptian professionals.	
Ethiopia	10992	Rural Water I, Southern Region	77-86	10,000	WS	206	- Establishment of Water Resource Authority. - Upgrading of hydrometric network. - Implementation of 5-year plan.	- Hydrogeological survey equipment. - Drilling and digging equipment for 214 wells and boreholes.	- On-the-job training of Ethiopians. - 20 students trained in India. - 2 Ethiopian managers trained in Canada.	- Potable water supplied to 206,000 people. - Project led to Stage II (#11874).
Ethiopia	11874	Rural Water II, Southern Region	86-91	14,052	WS	300	- Canadian Community Participation Advisor. - Canadian Hydrology Lecturer.	- Drilling, digging and water supply equipment and materials for 500 water systems.	- Field training for Ethiopians. - Courses in water technology in Ethiopia, formation of community groups.	
Ghana	10131	Accra/Tema Water	74-84	14,620	WS/S	1,000	- Design and construction supervision of a treatment plant. - 3 Canadian cooperants to assist Ghana in financial and technical management.	- Pumping station and 4 sewage pumps. - Equipment and materials for a 60 mgd water treatment plant.	- On-the-job training of Ghanaians in construction, operation and maintenance of sewage plant.	- Part of a larger WS/S project funded jointly by CIDA, IDA and AfDB.
Ghana	10132	Upper Region Water Supply I	71-78	8,000	WS	800	- Hydrogeological mapping of Upper Region. - Project management for design & construction, drilling and mapping.	- 1,100 wells with pumps for rural areas. - Water supply infrastructure for 3 urban centres.	- Training of Ghanian personnel in well construction and water supply installation/maintenance.	- This project led to project #10981.
Ghana	10969	UNDP/IBRD Handpump Testing	84-87	448	WS	20		- 140 Canadian (Moyno and Monarch type) handpumps. - 60 VLOM type handpumps purchased from developing countries.		- Part of a global project administered by the UNDP/IBRD.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ANGLOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Ghana	10971	Water Utilization II (Upper Region)	83-88	3,607	WS	750	- 22 person-years of Canadian tech. assistance for project management, pump maintenance and community health education.	- Spares for pumps, 5 land rovers, 200 bicycles.	- 110 person-years of Ghanian staff trained in pump maintenance and health education.	
Ghana	10974	Norrip I - Community Infrastructure	81-84	3,685	WS	500	- Canadian advisors for pump/piping installation and maintenance/community development.	- Pumps/piping and electrical equipment for 8 towns in Northern Region of Ghana.	- Community development and health/sanitation education for a target group of 500,000 people.	- Project led to phase II (#11499).
Ghana	10977	Upper Region Water Supply III	81-85	8,052	WS	400	- Canadian Instructor for training workshops/ classes.	- Existing handpumps in Upper Region maintained and/or more reliable pumps installed.	- Upgrading of Ghanian staff in pump maintenance and operation.	
Ghana	10978	Ghana Water & Sewerage Corporation (GWSC) Planning Advisor	79-88	808	WS/S	N/A	- 1 Canadian cooperant stationed in Ghana since 1980.		- GWSC Headquarter staff receive help, advice and training from the Canadian cooperant.	
Ghana	10981	Upper Region Water Supply II	77-81	9,175	WS	800	- Project management through Canadian CEA in drilling and construction.	- 2,500 boreholes fitted with pumps.	- On-the-job training for Ghanians. - 6 Ghanians trained in Canada.	
Ghana	10982	Rural Water Utilization I (Upper Region)	78-83	2,000	WS/S	800	- 35 person-years of Canadian cooperants for community development.	- 500 latrines. - Maintenance equipment for 2,500 pumps.	- Village handpump caretakers trained. - 50 trained Volunteer Village workers in health education.	
Ghana	11499	Norrip II	87-91	4,300	WS/S	200	- 1 person-year for water component involving drilling equipment.	- Equipment and materials for boreholes and handpumps to serve 200,000 people.	- On-site training in borehole location, drilling techniques and equipment maintenance.	- This is part of a multi-purpose village development project of over $56 million.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ANGLOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Kenya	10955	Rural Water Supply (Western Region)	77-83	5,947	WS	100	- Management & construction supervision through 30 person years of Canadian experts.	- Materials, equipment and spares for 25 water system rehabilitation.	- Training workshops for 941 Kenyans at a college in Kenya. - O & M manual prepared and 80 Kenyans received on-the-job training.	- Project located in the Western Province and Nyanza Province.
Kenya	11512	Rural Water Supply (Central Kenya)	84-89	1,389	WS	80	- Management and construction supervision of 4 rural water supply systems.	- Material for 5 main storage tanks and 5 km of piping.	- Formation and training of 5 village communities in operation and maintenance.	- Project located in Central Kenya; administered by the Canadian Hunger Foundation.
Malawi	10914	Rural Piped Water	78-84	1,597	WS	142		- Materials and fittings for tanks, pipes etc for 5 water schemes.	- Malawi personnel trained as field assistants for pipe laying and fitting.	
Mauritius	10909	Rodnques Water Supply	75-79	850	WS	25	- Project monitoring and site visits by Canadian Consultant.	- Excavation and drilling equipment. - 25 pumps, 58 km of piping, 15 storage tanks.		
Nigeria	11867	Lagos State Water Supply	87-89	4,672	WS	4,000	- Design of the Lagos State Water Supply System. - Aerial photography.			- Part of a $700 million project jointly funded by IBRD, Gov'ts of France, Canada and Nigeria.
South. Afr. Dev. Coord. Conf.	13511	Hydrologic Assistance	87-89	2,200	WRM	N/A	- Provision of Canadian expertise and equipment to prepare a hydrologic data base for the Region.	- Hydrologic survey equipment vehicles, computers.	- On-the-job training in surveying, hydrologic investigation.	

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ANGLOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Sudan	13296	Drought Reclamation	86-87	550	WS	40		- Infrastructure for a pumping station on the Rahad river in Western Sudan. - Repair of main delivery pipe in Qala-en-halal.		- CIDA contribution administered by EURO Action Accord. - Country focus project.
Sudan	13297	Oxfam - LRCS Water	86-87	105	WS	200		- Water Supply equipment to serve 3 refugee camps in 5 villages in Western Sudan.	- Training of refugees in water supply system maintenance by Local Red Cross and Oxfam.	- CIDA contribution administered by Oxfam UK as part of a larger project of $517,000. - Country focus project.
Sudan	13413	UNICEF WAU Sanitation	86-87		WS/S	475		- Water supply and sanitation in Bahr El Ghazal Province	- Health and sanitation training.	
Swaziland	10875	Rural Water Supply I	76-81	565	WS	45	- 1 Canadian Water Engineer. - 4 water technicians. - Establishment of a Rural Water Supplies Unit.	- Water supply infrastructure provided by United Kingdom.	- 4 Swazi Engineers trained in Canada.	- Project located in the rural areas around Mbabane and Manzini.
Swaziland	10873	Rural Water Supply II	81-86	4,400	WS	45	- 40 Person Years of Canadian expertise in water supply installation and maintenance.	- Water supply infrastructure provided by United Kingdom.	- 6 Swazi Engineers and 4 civil technologists trained in Canada.	- Project resulted from success of phase I (#10875).
Swaziland	10870	Groundwater Survey	84-91	8,459	WRM	720	- Groundwater survey of Swaziland. - Water Resources Master Plan. - 8 Person Years of Canadian expertise.	- 2 drilling rigs and equipment for exploratory drilling.	- 2 qualified Swazi drilling teams trained.	- Canadian assistance for establishment of a National Water Authority.
Tanzania	10865	Water Resource Development Coastal Region.	71-81	2,700	WRM	500	- Development of water resource Master Plan for the Coastal Region. - 12 Canadian Specialists in Hydrology and Hydrogeology.	- 2 percussion drills, 8 vehicles. - Hydrological, meteorological and laboratory equipment.	- On-the-job training for Tanzanians in surveying and drilling.	- Wells to supply water to 100,000 villagers were also completed.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
ANGLOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Tanzania	10862	Dar Es Salaam Water Supply - Lower Ruvu System	72-83	34,150	WS/S	1,100	- Canadian consulting services for design and construction supervision. - Canadian contractor.	- Equipment and materials for a water reservoir, 25 mgd water treatment plant and 64 km of water supply piping.	- On-the-job training for Tanzanian staff hired by Canadian consultant and contractor.	
Tanzania	00607	Residual Equipment - Lower Ruvu System	76-77	332	WS/S	1,100		- Provision of equipment for continued operation of the Lower Ruru plant.		- Grant funds to purchase equipment for operation of project #10862.
Tanzania	12844	Spare Parts II	86-93	3,000	WS/S	N/A		- Restoration of pumps, ganges, sludgelines and upgrading of laboratory, underdrain systems etc. for the Lower Ruru Plant.		- Part of a $15.0 million CIDA project to supply spare parts to Tanzania for agriculture, transportation and water.
Tanzania	10808	Mindua Dam	83-84	3,840	WS	100		- Equipment and materials for the completion of Mindu Dam which provides water to the town of Morogoro.		- CIDA co-funded this larger World Bank Project of $34 million. CIDA funds monitored by IDA.
Tanzania	11835	Tanzania Canada Wheat Project	86-91	3,000	WS	3	- Canadian specialist in water supply design and construction.	- Material and equipment to supply water to 6 farm complexes.	- On-the-job training in construction.	- Part of a larger CIDA agricultural project of $49.9 million.
Uganda	12270+ 13758	Water & Sanitation - Luwero Triangle	82-87	638	WS/S	330	- Expertise provided internationally from several donor countries.	- CIDA contribution made to UNICEF for rehabilitation of 1200 existing wells and springs and for construction of latrines.	- 54 health inspectors, 200 health assistants and 20 technicians trained.	- CIDA's contribution to a joint project by USA, Australia, Red Cross and UNICEF-total value of $2.0 million. Project implemented in the Luwero Triangle.
Anglophone Africa				2,559		N/A	Evaluations and small studies.			
Total for	Anglophone	Africa		161,400		14,336				

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
(From 1968 to 1987)

FRANCOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Burkina Faso	10323	Micro Project	82-86	4,000	WS/S	50	- Canadian experts for management and procurement.	- Materials for approximately 25 wells, 1 barrage, pumps, and 3 elevated storage tanks.	- Projects completed largely by local community participation.	- 13 Projects located in various areas of the country. Project led to a planned phase II value $5 million.
Cameroon	10060	Water pipelines Yaounde	84-89	14,480	WS/S	700	- Canadian design and construction supervision of a water supply system for Yaounde.	- 110 km of main and secondary pipes, fittings, materials for storage reservoirs.	- On-the-job training in construction.	- Part of a larger $50 million Aid Program jointly with Gov't of France.
Cote d'Ivoire	00604	Line of Credit - Forexi	78-80	4,949	WS	60	- Canadian Procurement Agent.	- Well drilling equipment spares, trucks and work safety equipment.		- Line of credit project for supply of Canadian equipment.
Cote d'Ivoire	10474	Rural Water Supply	75-80	4,922	WS/S	N/A	- 5 Canadian Engineers, 7 technical supervisors and 10 technicians.	- Equipment and materials for 2,400 water points (wells, dugouts etc.) and a water quality testing laboratory.	- Water quality animators trained in 122 villages. - 11 engineers trained in water quality.	
Cote d'Ivoire	10042	National Village Water	80-85	1,866	WS/S	120	- Project essentially a continuation of project #10474.			- Project was part of a program in rural water supply and sanitation.
Cote d'Ivoire	10467	Handpumps	83-87	727	WS/S	5	- Project monitored by a World Bank consultant. (Canadian National)	- Purchase of 30 various types of pumps and testing of these pumps in 17 regions of the country.	- Training of local people in upkeep of pumps and in sanitation practice.	- Part of a World Bank/UNDP multi-country project.
Cote d'Ivoire	11948	Recycling Study	84-87	330	S	N/A	- Canadian consultant for the feasibility study.	- Project is a feasibility study in sanitation and resource recycling for the City of Abidjan.		- Project located in Abidjan. Part of UNDP/World Bank project on resource recovery.
Gambia	10488+ 00601	Gambia River Basin Study	77-85	81	WRM	N/A	- 2 Canadian consultants as part of a team for a study of the soil, water and other resources of the Gambia Basin.			- Part of a joint CIDA-USAID and Gambia Project for which Canadian input was specialist assistance.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
FRANCOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Mali	10457	Water Supply	78-87	4,800	WS/S	25	- Canadian consultants for water supply design and water quality laboratory techniques.	- Drilling and piping material to supply 3 villages with potable water. - Equipment for a water quality testing laboratory.	- On-the-job training in lab testing techniques.	- Laboratory located in Bamako. - Water supply for Djenne, Dire and Douentza.
Mali	00409+ 11308	Kaarta - I & II	79-90	5,200	WS	350	- Canadian specialist in water and natural resource development.	- Materials and equipment for drilling of 250 wells to supply water for Kaarta. Pumps and accessories.	- In drilling and equipment maintenance.	- Water sector involvement is part of a $53 million integrated rural development project funded by CIDA.
Mali	12075	Rural Water Dogon	85-89	1,698	WS	52	- Project implemented by World Relief Canada in the Koro and Bandiagara Region (Dogon Plateau).	- 40 new wells. - Rehabilitation of 140 existing wells. - Drilling equipment, supplies and construction materials.	- Water committees formed and trained. - Construction by local personnel - mostly with supervision by WRC.	- Country focus project. - 25% of project budget is for dry-land farming, 75% for water wells.
Morocco	10036	Solid waste Disposal	78-84	10,800	S	800	- Canadian design and construction supervision of a garbage treatment plant for the City of Fes.	- Construction equipment and materials for a compost treatment plant (details not known).		
Morocco	13877+ 13780	Rural Potable Rural	86-91	5,000	WS	200	- Canadian Procurement Agent.	- Provision of photovoltaic pumps for 225 water points in the country.		
Niger	00304	Rural Water Supply	74-75	1,503	WS	40	- 1 Canadian consultant as advisor, 1 hydrogeologist and 7 technicians for well drilling.	- Material and equipment to construct water points (on dugouts, wells) at 115 locations in South East Niger.		- Project implemented by Local Authority (OFEDES) with local labour.
Niger	00506	Village Wells N'Guigmi	75-76	68	WS	10	- Essentially as project #00304 except it is in the Guigmi Region.			- Project implemented by Local Authority (OFEDES).

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
FRANCOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Niger	10408	Village Water	83-89	11,978	WS	75	- Canadian consultants for design and construction of wells. - Canadian supplier of equipment.	- 250 wells equipped with pumps. Well drilling equipment.	- Local health and sanitation committees formed. Maintenance personnel trained.	- Project implemented by Local Authority (OFEDES). - Project located in the Maradi and Zinder Regions.
OMVS	10301	Manantali Dam	86-87	33,000	WRM	N/A	- Canadian technical design and procurement.	- Supply of gates and construction equipment.		- Equipment for multi-purpose dam which was financed by international consortium.
Rwanda	10396	Rural Water for Valleys of Mutra	82-87	1,500	WS/S	5	- Canadian consultant for water supply design and filtration plant design.	- Drilling, wells, pumps and filtration plant for a community of 5000 people in Mutra.		- Part of a $15.5 million irrigation project funded by CIDA.
Rwanda	11712	Community Development Club 2/3 Phase I	84-85	762	WS	70	- Design and construction of water systems by NGO Club 2/3. - Evaluation by Canadian consultants.	- Phase I and II provided 100 km of water supply pipeline and exploited 70 sources of water, material and equipment for wells, pipes provided by Canada. Phase III will build additional water points for 70,000 people.	- Club 2/3 carried out extensive animation program in hygiene and water system maintenance.	- Projects located in 4 communities - Nyakinama, Nyamutera, Ruhordo, and Kigowbe.
Rwanda	12691	Community Development Club 2/3 Phase II	85-87	560	WS	60	- Same as above.	- Same as above.	- Same as above.	
Rwanda	14193	Community Development Club 2/3 Phase III	87-89	633	WS	70	- Same as above.	- Same as above.	- Same as above.	
Togo	00105	Water Supply Lome	75-78	3,239	WS	N/A	- Canadian team for a feasibility study to provide water for Lome and 9 other adjacent communities.	- Well drilling and hydrogeological investigation equipment. Survey and mapping equipment.		

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
FRANCOPHONE AFRICA BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Togo	11756	Village Water Suppply	84-87	6,500	WS	65	- Design, construction supervision and community development by CUSO.	- Well drilling and pipes for 250 water points equipped with pumps etc.	- 200 village water communities formed and trained. - 38 animators trained in health and sanitation.	- Country focus project. - Projects located maritime region.
Tunisia	10024	SIDI SAAD Dam	74-84	54,903	WRM	300	- Canadian procurement agent and monitor.	- Essentially a Dam Project for flood control and irrigation for which CIDA provided machinery and equipment.	- On-site construction training.	- CIDA contributed to this $150 million project jointly funded by World Bank.
Tunisia	13949	Sanitation Goma II	87-91	1,438	S	N/A	- Provision of 3 Canadian sanitation and Slaughter House Specialists and 1 economist to ensure good management of the Abattoir for 3 years.		- Canadian specialists will train local operators and coordinate slaughterhouse activities.	- Essentially a tech. assistance project.
Tunisia	13728	Water Supply - Mudzi Pela-Burnia	86-88	28.2	S	N/A				
Francophone Africa				2,575		N/A	Evaluations and small studies.			
Total for Francophone Africa				177,540		2,997				

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
(From 1968 to 1987)

AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Anguilla	11571	Water Development I	85-88	1,421	WS	7	- Canadian specialists to prepare feasibility study, design and tenders for a water supply system of Anguilla Institutional Support.	- Drilling and hydrogeological survey equipment.	- 1 trained Anguillan professional. - 4 trained survey crew.	
Antigua & Bermuda	00308	Water Spare Parts Funds	73-77	50	WS	12		- Funds allocated for purchase of urgently needed spare parts for water system maintenance.		
Barbados	02023	Water Resource Development I	71-75	2,600	WS	See # 10162		- Materials for 240 km of water supply pipe, 7 storage tanks, and some electrical switch gear for pumps.		- Canada contributed materials towards the Barbados 20 Year Plan for water supply development.
Barbados	00403	Water Resource Development II	75-80	3,080	WS	See # 10162		- As for project #02023.		
Barbados	00111	Water Resource Development Technical Assistance	74-78	94	WS	N/A	- 1 Canadian professional to assist Barbados in the implementation of projects 02023 & 00403.			
Barbados	10162	Water Development III	81-87	6,500	WS	250		- 1 concrete reservoir, 3 water storage tanks, pipes and fittings, electric and mechanical equipment.		- As for projects #02023 and 00403.
Belize	00106	Feasibility Study - Belize City	71-73	680	WS/S	40	- Canadian consultants team for a feasibility and preliminary design of water supply and sewerage system for Belize City.			

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Belize	10159	Construction - Water & Sewerage	74-86	14,650	WS/S	40	- Canadian consultant team for design and construction of a water supply and sewerage system for Belize City.	- Equipment and materials for a trunk water transmission line, water distribution system, sewerage lagoons, solid waste collection and disposal system.	- Minimal on-the-job training in this phase I project due to lack of funds.	
Belize	11097	Water & Sewerage II	83-88	18,723	WS/S	40	- Construction supervision. - Development and implementation of suitable operating procedures.	- Equipment and materials for sewer connection system. - Completion of water and sewerage construction.	- Development and implementation of an accelerated training program in O+M of water supply and sewerage systems.	- Emphasis in Phase II would be on training of Belizian personnel.
Antilles Regional	00502	CIDA/PAHO Institutional Development I	78-78	745	WS/S	N/A			- Provision of fellowships to 7 recipient countries to upgrade technical and management skills in water supply and sanitation systems.	- Antigua, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent received awards.
Antilles Regional	00308	Water Spare Parts	73-75	183	WS/S	N/A		- Provision of spare parts for pumps, pipes, etc. as requested.		
Leeward & Windward Regional	12161	CIDA/PAHO Management Training II	79-83	365	WS/S	N/A	- Establishment of a Project Management Office in Barbados. - Steering committee of PAHO/CIDA and 4 EEC countries established.		- Training courses, seminars, workshops in operation and maintenance of water utilities in 7 EEC countries. 200 personnel per year trained.	- Training courses held on a rotating basis in each of the 7 countries with participants from all 7 countries.
Leeward & Windward Regional	11073	CIDA/PAHO Management Training III	83-87	255	WS/S	N/A			- Training component is essentially a continuation of the activities of Phase II Project #12161.	- Project managed through the Caribbean Development Bank.
Dominica	01656	Water Development I	69-73	334	WS/S	75	- Canadian consultant for design and construction supervision.	- Materials and equipment for primary mains in a gravity water supply system for Roseau.	- Construction completed with local labour.	- Project led to phase II #00081. - CIDA cooperated with PAHO/WHO.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Dominica	00081	Water Development II	71-74	1,120	WS/S	75		- Materials and equipment for a treatment plant, storage tanks and distribution system for the Island.	- Design and construction by local staff.	- CIDA/PAHO/WHO cooperated to develop a design and master plan.
Dominica	00308	Water Spare Parts	73-77	44	WS	75		- Funds to purchase spare parts for operation and maintenance of WS/S systems.		
Dominica	12996	Immediate Needs	85-87	500	WS/S	75	- 3 Canadian specialists for water supply system repairs, data base, audits and bulk water sales study.	- Spare parts for urgently required water supply system repairs.	- On-the-job training in repairs, loan detection and financial management.	
Dominica	13319	Water - Rehabilitation II	86-88	4,690	WS/S	75	- 3 Senior Canadian managers to advise Dominica on operation and maintenance and financial management.	- Replacement of old water supply and distribution systems on the Island.	- On-the-job training as in project #12996.	
Ecuador	00122	Guyas River Basin I	67-72	1,260	WRM	N/A	- Canadian expertise for feasibility study of the hydro and fisheries potential of the River Basin.		- Training of Ecuadorian personnel in the exploration of resources.	- Project led to phase II. - Project located in Babahoyo and Daule-Peripa districts.
Ecuador	00123	Guyas River Basin II	72-74	2,808	WRM	N/A	- Canadian expertise for final design and construction supervision of an irrigation/flood control dam.	- Purchase of Canadian materials and equipment for construction of dam.	- On-the-job training in construction.	- Part of a larger World Bank funded multi-purpose project.
El Salvador	00601	Rural Pipelines	77-80	1,218	WS/S	50	- Canadian expertise for design and construction supervision of rural water supply and sanitation systems.	- Line of credit for the purchase of pipes, fittings and drilling equipment to serve 160 rural communities.	- Construction done by local manpower.	- Part of a larger project co-funded by the Inter-American Development Bank.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Grenada	01901	Anandale Water Program	69-71	764	WS	15		- Equipment and materials for a locally designed water supply system for Anandale including 1.5 mg treatment plant.		- Project led to phase II #00401.
Grenada	00308	Water Spare Parts Fund	73-78	28	WS/S	15		- Funds transferred for the purchase of water supply and sanitation infrastructure spare parts.		
Grenada	00401	Water Development II	74-79	2,597	Ws/S	30	- Canadian consultants for supervision of construction.	- Equipment and materials for a water supply system for 4 rural areas including 3 treatment plants.	- Design and construction by local Water Authority.	
Grenada	13660	St. George's Outfall Sewer I	86-87	14	S	N/A	- Canadian consultant study to define sanitation requirements for an outfall sewer of St. Georges.			
Grenada	13659	St. George's Outfall Sewer II	86-88	1,500	S	10	- Canadian expertise for design and construction.	- Construction equipment and materials purchased by CIDA funds.	- On-the-job training.	- Not finalized yet but will include construction of an outfall sewer for St. George's.
Guatemala	10277	Potable Water (Dons)	78-85	1,943	WS	512	- Canadian consultant for planning, design and construction of rural water supply systems. - 1 Canadian cooperant.	- Pumps, drilling equipment, pipes, fittings and vehicles to supply 40 rural communities.	- Local village communities formed for operation and maintenance of water systems.	- Projects located in 40 rural communities affected by earthquake disaster.
Guatemala	10008	Potable Water (Pret)	78-85	3,500	WS	512		- Loan for purchase of additional equipment and materials by Guatemala.		- Essentially the same as above project.
Guyana	10155	Linden Water Plant	71-84	2,173	WS	70	- Canadian consulting firm for design and construction supervision.	- Equipment and materials for 4 treatment, filtration and chlorination units of 4 mgd total capacity and storage tanks, valves, controls, etc.		- Project aimed at improvements to the old water supply system serving Mackenzie, Wismar and Christianburg.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Guyana	11057	Water - Drilling	74-83	1,015	WS	N/A		- Provision of 2 drill rigs, 2 trucks, 1 hydraulic loader, 2 compressors, well casings and spares from Canada.		
Haiti	00410	Hydraulic Studies	74-79	2,400	WRM	180	- Canadian specialist team to investigate the hydro-electrical resources of Haitian Rivers. - Hydrologic data base development.	- Small amount of hydrometric survey equipment.		- This led to the design and implementation of several subsequent projects in Energy Sector in Haiti.
Haiti	11778	Study Group on Development	86-89	2,900	WS/S	N/A	- Canadian multi-disciplinary team, to study the potential for future CIDA involvement in Haiti, including water supply and sanitation.	- Computer equipment to establish a corporate memory/ data base.		
Honduras	11683	Rural Potable Water	83-86	3,327	WS/WRM	90	- Planning and design of potable water systems and water shed management by Canadian NGO.	- Distribution tanks, pipes, construction equipment to serve 180 rural communities with potable water.	- Project implemented by voluntary labour, community groups formed and training in health education undertaken.	- Watershed management in 48 rural communities. - Country Focus Project implemented by CARE/Canada.
Honduras	13757	Integrated Water Systems	87-90	3,400	WS/S	60	- SANAA.	- Drilling equipment, pipes.		- Procurement project.
Jamaica	00103	Harbour View Sewerage	65-74	819	S	20	- Canadian consultants for design and construction supervision of a sewerage system in a Kingston suburb.	- Materials for treatment works, pumping station, house connections to serve 3,000 houses.		- Project also assisted by UNICEF.
Jamaica	00139	St. Mary's Water Project	67-74	1,183	WS	100	- Canadian engineering services for design and construction supervision.	- Provision of pipes, pumps, motors and fittings for a water supply systems at St. Mary's Parish in N. East Jamaica.		

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs: Studies & Tech. Assistance	Outputs: Equipment & Infrastructure	Outputs: Training	Comments
Jamaica	01101	Minor Water Supply	70-74	189	WS	7		- Canadian pumps, distribution mains, standpipes to serve water to several small rural communities.		- Design and construction of systems by the local Water Authority.
Jamaica	01102	Port Antonio Water Supply	70-77	480	WS	5	- Canadian procurement agent.	- 4 pumps, 3 km main and distribution piping, materials for construction of a Water Treatment Plant.		- CIDA supplied materials only for a water supply system to serve Port Antonio area.
Jamaica	00101	Water Resources Development	70-77	1,299	WRM	10	- Canadian specialists for the design and construction supervision of 5 water supply systems.	- Design only of 2 reservoirs, 5 new wells and main water pipes serving 5 small towns.	- Construction financing and on-the-job training provided by other donors.	- Project located in Montego Bay, Spanish Town Svanna-La-Mar, Dornoch, Morant Bay.
Jamaica	00116	Technical Assistance	70-75	411	WS/S	N/A	- 10 Canadian engineers to fill management positions in the National Water Authority.		- Canadian engineers advised and trained counterpart engineers in O + M of water supply system and construction.	
Montserrat	02088	Water Storage and Distribution	69-75	1,986	WS	12	- Survey, design and construction management of a water supply system for the Island.	- 10 reservoirs, pumps and trunk pipes and upgrading of existing systems in entire island.	- On-the-job training in construction.	
Montserrat	00308	Water Spare Parts	73-75	50	WS	12		- Funds for purchase of pipes, fittings, pump spares etc. for maintenance of existing systems.		
Montserrat	11486	Water Protection and Repair	84-88	492	WS	12	- Canadian technical expertise in sandblasting, painting and pipe protection.	- Painting of 18 reservoirs. - Cathodic protection systems. - Repairs and steel pipe protection.	- Training in specialized steel reservoir painting and sandblasting.	- Project aims at keeping operational, the systems constructed by CIDA funds under project 02088.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs			Comments
							Studies & Tech. Assistance	Equipment & Infrastructure	Training	
Nicaragua	11682	Rural Water and Health	84-87	1,535	WS/S	10	- Canadian planning, design and implementation through CARE Canada.	- 10 new village water systems, wells, pumps, standpipes. - 333 latrines. - Rehabilitate 13 old water systems.	- Formation of 25 local construction committees. - Training of 45 community health promoters.	- Project implemented by CARE Canada in the rural Matagala District.
Nicaragua	12019	Line of Credit - Water Supply	84-88	7,500	WS	200	- Canadian procurement agent.	- Miscellaneous water distribution equipment (pipes, pumps, spares) as requested by the Nicaraguan Water Authority (INAA).		- Locations determined by Nicaragua. Purely a material supply project.
Peru	11522	Water Supply and Sewerage	83-84	90	WS/S	6	- 1 Canadian cooperant. - WUSC staff for design and implementation.	- Materials for 1 reservoir, main and connection pipes to connect 6 Pueblo Jovenes to the Lima Water Supply and Sewerage System.	- All construction done by local labour.	- Project located in 6 small communities. WUSC was executing agency.
Peru	13395	Potable Water	85-86	95	WS/S	11	- Same as 11522.	- 10 Pueblo Jovenes served and linked to the main Lima system.	- Same as 11522.	- Essentially as extension of project 11522 by WUSC.
Peru	12300	Rural Water Supply	86-88	1,401	WS/S	19	- 2 Canadian cooperants for management and procurement. - WUSC implementation agency.	- Reservoirs and water supply systems for Ancasch. - Water supply and sewerage connection to Lima for 11 Pueblo Jovenes.	- Training in maintenance of water supply systems in Ancasch.	- Projects located outside Lima and in Ancasch.
St. Kitts & Nevis	00108	Water Resource Development	70-73	432	WS	40	- 2 Canadian professionals as cooperants. - Groundwater survey by Canadian consultant.	- Well drilling equipment, trucks, casings, piping etc. for over 100 exploratory wells on the Island.	- On-site training in well drilling.	
St. Kitts & Nevis	00308	Water Spare Parts	73	52	WS	10		- Pipes, fittings, drilling spares etc for the maintenance of existing water systems.		

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs: Studies & Tech. Assistance	Outputs: Equipment & Infrastructure	Outputs: Training	Comments
St. Kitts & Nevis	11044	Exploratory Drilling	80-89	3,040	WS	45	- Drilling advisory services by Canadian consultant.	- 1 drill rig. - Drilling supplies. - 3 trucks.	- Drilling techniques. - Equipment maintenance. - Drill crew supervision.	- 66 exploratory and production wells.
St. Kitts & Nevis	11281	Frigate Bay Sewerage	87-88	1,000	S	11	- Design of sewerage system for the Frigate Bay area.			
St. Lucia	00101	Water Development	69-72	1,603	WS	See # 00115		- Equipment and materials to construct transmission and distribution mains for Castries.		- Design and construction by local Water Authority.
St. Lucia	01050	Central Water Authority	70-71	15	WRM	N/A	- Canadian management consultant to study and report on the establishment of a self sufficient Water Authority in St. Lucia.			
St. Lucia	00148	Vieux Fort Water Resource	70-72	148	WRM	N/A	- Canadian consultant to survey the level of water resources available in the Vieux Fort area.			
St. Lucia	00115	Rodney Bay Water	71-72	309	WS	50		- Pipe fittings and valves, 4 booster pumps to construct a water pipeline from Castries to Rodney Bay (8 km).		- Design and construction by local Water Authority.
St. Lucia	00308	Water Spare Parts	72-77	34	WS/S	N/A		- Water supply spare parts to keep existing systems operational.		
St. Lucia	00401+ 00402	Vieux Fort Development	74-79	1,100	WS/S	25	- Canadian engineering design and construction supervision for expansion of water treatment facilities for Vieux Fort area.	- Materials and equipment for an expanded water treatment plant.	- On-the-job training.	- Aerial survey and mapping of Vieux Fort area.

Table D-1 SUMMARY OF CIDA BILATERAL WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS BRANCH

Country	Proj. #	Title	Period	CIDA budget ($000)	Sub-Sector	Pop. Served ('000)	Outputs: Studies & Tech. Assistance	Outputs: Equipment & Infrastructure	Outputs: Training	Comments
St. Lucia	11039	Roseau Dam Pre-feasibility	83-85	105	WRM	N/A	- Canadian consultant to study water demand and need for future construction to meet water requirements of the N.W. Region.			
St. Lucia	11032	Roseau Dam Hydrological Data	83-85	86	WRM	N/A	- Hydrologic data for 2 years for Roseau Basin water quality and sedimentation study.	- Levels, staff groups, lab equipment.	- Some training in data collection by Canadian consultant.	
St. Lucia	11547	Roseau Basin Development I	84-88	2,645	WRM/WS	50	- Canadian design and tender documents for Millet River supply system (intake treatment plant and pipeline).		- 1 Project manager. - 8 surveyors. - 2 technical assistants.	- Project located in the North West region of St. Lucia.
St. Vincent	01047	Water Development Assistance	69-74	1,194	WRM/WS	60	- Canadian consultant for a resource study and master plan for water development of the Island.	- Materials to meet construction requirements for additional water mains for Kingston.		
St. Vincent	00308	Water Spare Parts	73-77	62	WS/S	83				
St. Vincent	00305	Water Development II	73-79	2,460	WS	83	- Canadian consultant for design and construction supervision for a water supply system on the Island.	- Two reservoirs, main and secondary distribution pipes for Kingston. - Treatment facility, pumping station and distribution for N.W. coastal area. - Reservoir and primary distribution for South Coast.	- On-the-job training.	
Caribbean				1,344		N/A	- Evaluations and small studies.			
Total for		Americas		120,040		2,172				

Table D-2
INVENTORY OF BILATERAL WATER AND SANITATION PROJECT EVALUATIONS
ASIA BRANCH

Country	Project Title	Project No.	Mid Proj. Eval.	End of Proj. Eval.	Proj. Audit	End of Proj. Report	Impact Eval.
Afghanistan	Kabul River Valley Dev.	108/00602				X	
Sri Lanka	Maduru Oya Reservoir Complex	0010155				X	
	Ancient Bund and Arch Park	0010699				X	
India	Groundwater Hydrogeology	468/00103				X	
Indonesia	Water Resources Training	0010653				X	
	Lombok Water Resources- Phase II	0010657				?	
	Timor Island Water Resources	0010658				X	
	Bengkulu Water Design Unit	472/00514				X	
	Central Java Water Design Unit	472/00515				X	
	Lower Solo River Dev	472/10655				X	
Pakistan	Punjab Water and Sewerage	714/00611				X	
	Baluchistan Water Supply	714/00805				X	
	Tando Adam-Ind. Water Mngmt	714/00806				X	

* Information contained in this table was provided by CIDA's Corporate Memory Unit.

Table D-2

INVENTORY OF BILATERAL WATER AND SANITATION PROJECT EVALUATIONS (Cont'd)

ANGLOPHONE AFRICA BRANCH

Country	Project Title	Project No.	Mid Proj. Eval.	End of Proj. Eval.	Proj. Audit	End of Proj. Report	Impact Eval.
Ethiopia	Rural Water Supplies	0010992	X			X	
Ghana	Accra/Tema Water Supply	0010131					X
	Upper Region WS- Phase I	0010132	X	X		X	
	VRA Management Audit	0010972				X	
	Upper Region Evaluation	0010975	X				
	Upper Region WS- Phase II	0010981				X	
	Rural Water Utilization Proj	0010982	X			X	
	Water Supply Project Eval	400/00804	X	X			
Kenya	Rural Water Supply	0010955	X			X	
Malawi	Rural Piped Water	0010914				X	
Swaziland	Rural Water Supply- Phase II	0010873	X				
	Swaziland Rural Water Supply	0010875	X			X	
Tanzania	Hydrology Study	0010816				X	
	Dar Es Salaam Water Supply-Lower Ruvu System	0010862				X	
	Water Resource Dev- Coast Region	0010865				X	

Table D-2
INVENTORY OF BILATERAL WATER AND SANITATION PROJECT EVALUATIONS (Cont'd)
FRANCOPHONE AFRICA BRANCH

Country	Project Title	Project No.	Mid Proj. Eval.	End of Proj. Eval.	Proj. Audit	End of Proj. Report	Impact Eval.
Cameroon	Water Supply - Kumbo	232/01411	X				
	Wells - Kousseri	232/08001				X	
Gambia	River Basin Study	0010488				X	
Ivory Coast	Pnhv Phase III	0010042	X				
	Rural Water - Phase II	0010474		X			
	Line of Credit - Forexi	500/00604				X	
Mali	Water Supply	0010457		X			
	Waste Disposal Trucks	608/00401				X	
Morocco	Solid Waste Disposal	0010036				X	
Burkina Faso	Bambakari Dam	960/00502				X	

Table D-2
INVENTORY OF BILATERAL WATER AND SANITATION PROJECT EVALUATIONS (Cont'd)
AMERICAS BRANCH

Country	Project Title	Project No.	Mid Proj. Eval.	End of Proj. Eval.	Proj. Audit	End of Proj. Report	Impact Eval.
Barbados	Water Supply Improvement Phase II	176/00403				X	
Belize	Water and Sewerage Construction	001059	X	X		X	
Leeward and Windward	Water Sector Evaluation	0011079				X	X
	Water Mngmt Training Phase II	0012161	X			X	
Ecuador	Guyas River Basin Phase I	342/00122				X	
Grenada	Water Development Phase II	420/00401				X	
Guatemala	Potable Water in Rural Area	0010277		X		X	
Guyana	Linden Water Supply System	0010155		X		X	
	Water Drill Rigs	0011057		X		X	
Jamaica	Water Resources Dev Survey	504/00101				X	
	Port Antonio Water Supply Scheme	504/01102				X	
Montserrat	Water Storage and Distribution	656/02088				X	
Nicaragua	Int. Rural Water and Health Edu.	0011682	X				
Peru	Evaluation of Project 0011522	0012213		X			
	Eau Potable - Phase Pont	0013395				X	
Saint Lucia	Vieux Fort Water Development	868/00402				X	
Saint Vincent & Grenadines	Water Development-Phase II	872/00305				X	
	Water Development Assistance	872/01047				X	

Appendix E

DATA ON CIDA SPECIAL PROGRAMS BRANCH'S WATER AND SANITATION PROGRAMS

APPENDIX E

DATA ON CIDA SPECIAL PROGRAMS BRANCH'S WATER AND SANITATION PROGRAMS

Table of Contents

Table E-1

NGO WATER AND SANITATION PROJECTS BY YEAR AND BY CONTRIBUTION

(excluding Country Focus Projects)

Year	No. of New Projects	CIDA Contribution ($ million)	Total Value of Projects ($ million)
79/80	14	1.20	4.30
80/81	56	2.00	6.10
81/82	52	3.57	10.40
82/83	105	7.30	22.30
83/84	114	8.95	21.71
84/85	86	4.92	13.40
85/86	43	1.62	4.60
86/87	65	6.00	14.30
TOTAL	535	35.56	97.1

Fig. E-1

NGO WATER AND SANITATION PROJECTS : CIDA'S CONTRIBUTION VS. PROJECT VALUES

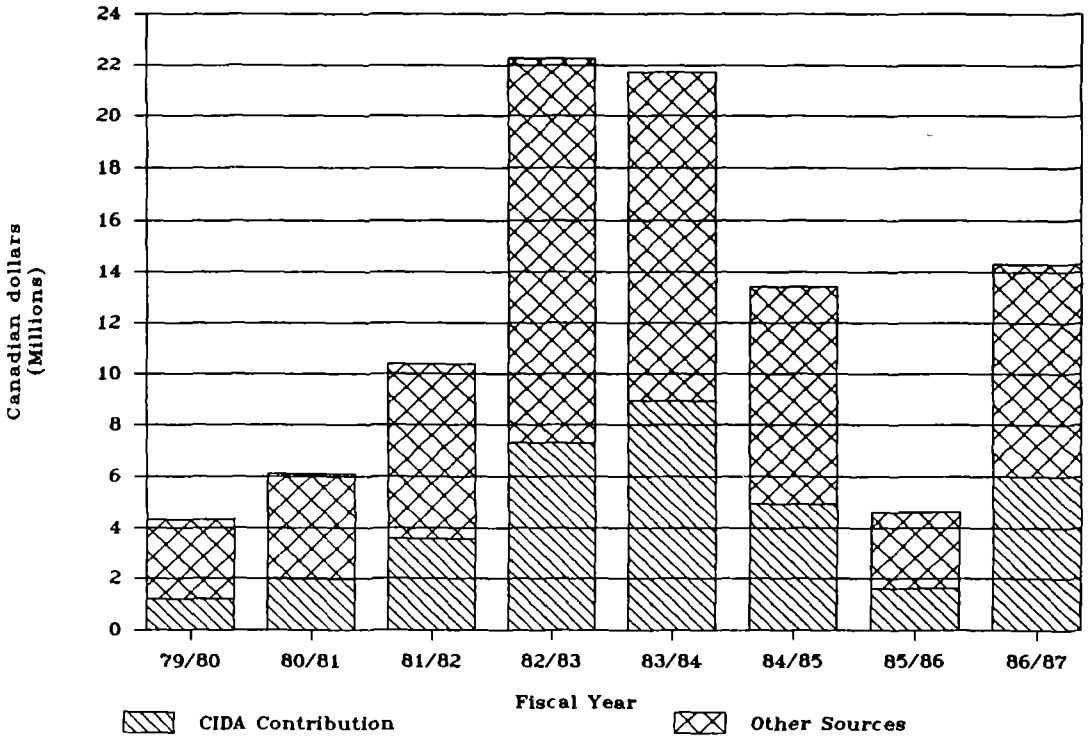


Table E-2
CIDA CONTRIBUTIONS TO NGO ACTIVITIES IN WATER AND SANITATION
(excluding Country Focus Project Funding)

Year Approved	Asia			Anglophone Africa			Francophone Africa			Americas			TOTAL		
	No. of Projects	CIDA $ ('000)	Total $ ('000)	No. of Projects	CIDA $ ('000)	Total $ ('000)	No. of Projects	CIDA $ ('000)	Total $ ('000)	No. of Projects	CIDA $ ('000)	Total $ ('000)	No. of Projects	CIDA $ ('000)	Total $ ('000)
79/80	0	0.0	0.0	5	184.5	421.8	1	200.0	747.1	8	814.6	3,141.5	14	1,199.1	4,310.4
80/81	18	256.7	855.1	14	1,304.2	3,107.1	10	134.3	213.2	14	315.4	1,959.1	56	2,010.6	6,134.5
81/82	13	1,647.9	4,508.8	15	871.9	3,541.9	6	179.4	266.5	18	866.5	2,041.9	52	3,565.7	10,359.1
82/83	18	1,780.0	4,916.9	36	2,411.7	6,122.7	17	804.0	1,735.5	34	2,288.0	9,548.1	105	7,283.7	22,323.2
83/84	31	1,895.9	3,900.5	43	2,604.9	6,412.3	13	926.6	2,236.8	27	3,520.4	5,157.8	114	8,947.8	21,707.4
84/85	16	760.6	1,897.7	32	848.6	1,644.1	8	267.8	539.3	30	3,049.8	9,362.9	86	4,926.8	13,444.0
85/86	10	357.5	577.7	14	765.4	2,845.4	11	121.0	272.1	8	373.7	868.1	43	1,617.6	4,563.3
86/87	15	684.7	1,384.8	16	1,042.5	3,071.6	11	2,272.7	5,004.7	23	2,014.1	4,846.2	65	6,014.0	14,307.3
TOTAL	121	7,383.3	18,041.5	175	10,033.7	27,166.9	77	4,905.8	11,015.2	162	13,242.5	40,925.6	535	35,565.3	97,149.2

Table E-3
NGO - WATER/SANITATION PROJECTS SUPPORTED BY CIDA IN 1986/87

Country	Total Value of Projects $	Total CIDA Commitment $	Name of NGO	Title of Projects
Asia				
Fiji	79,970	51,469	World Vision	Motokana Community Development
India	33,634	23,634	Cdn. Rotary Committee Int'l Development	Anand-Nagar Water Project
India	4,000	1,000	Cdn. Rotary Committee Int'l Development	Wells for Drinking Water
India	33,000	24,000	Help a Village Effort	Village Wells and Water System
India	55,190	37,520	Sopar Limbour	Drinking Water for Bayyarans
India	36,766	23,920	Sopar Limbour	Potable Water for Naydupet
India	30,902	19,856	Sopar Limbour	Drinking Water for Butchireddypalem
India	102,717	62,377	Sopar Limbour	Drilling of 30 Wells
India	123,458	72,224	Sopar Limbour	Drinking Water for Madhira
India	45,584	30,592	Sopar Limbour	Drinking Water for Krishgnapuram
India	33,140	22,794	World Relief Canada	Bijang Area Drinking Water Supply
Nepal	549,730	250,000	UNICEF Canada	Water Supply and Sanitation
Philippines	81,856	30,000	Cdn. Rotary Committee Int'l Development	Water Expansion Project
Philippines	160,879	30,000	Cdn. Rotary Committee Int'l Development	District Water Supply
Sri-Lanka	13,905	5,299	Canadian Hunger Foundation	Village Water Supply Phase II
Asia	1,384,731	684,685		

Anglophone Africa

South Africa	100,000	75,000	Canadian Rotary Committee for Int'l Development	Water for Life
Ethiopia	1,623,377	360,000	SIM Canada	Water Resource Development
Ghana	5,466	2,400	Canadian Friends Services Committee	Fra-Fra District Hand-Dug Well
Kenya	87,340	57,136	Canadian Hunger Foundation	Village Wells
Kenya	149,100	99,450	Canadian Rotary Committee for Int'l Development	Deep Drilling Program
Kenya	186,118	56,640	Y.W.C.A. Association of Canada	Muguna B. Water Supply
Lesotho	139,361	90,444	Assoc. Pour Dev. Participe	Digging of 40 Wells
Lesotho	35,483	23,988	Assoc. Pour Dev. Participe	Water System - Hatsotsane
Lesotho	24,156	16,288	Assoc. Pour Dev. Participe	50 Water Tanks
Malawi	127,246	60,715	World Vision	Kaswamchenje Community Development
Mauritius	28,880	10,815	Presbyterian Church in Canada	Community Development
Uganda	10,034	8,025	Prodeva F.I.C. Inc.	Water Tank
Uganda	44,902	32,656	Prodeva F.I.C. Inc.	Water Distribution
Yemen	476,400	128,750	UNICEF Canada	Water and Sanitation
Zambia	27,120	15,360	Foundation Int'l Roncalli	Digging of a Well
Zimbabwe	6,600	4,800	Cdn. Friends Services Committee	Water and Sewage System
Anglophone Africa	3,071,583	1,042,467		

Francophone Africa

Cameroon	2,879,891	1,804,375	CARE Canada	Eastern Potable Water/Health Education
Cameroon	22,677	16,492	Fondation Int'l Roncalli	Latrines Construction
Cameroon	100,086	38,130	Oxfam Quebec	Potable Water Network
Cameroon	114,010	21,195	Presbyterian Church in Canada	Agyati Water Supply
Mali	6,600	4,800	Oxfam Quebec	Well-digging at Massako
Rwanda	12,100	8,800	Prodeva F.I.C. Inc.	Portable Water Tank
Senegal	1,668,287	293,287	Cardinal Leger et Ses Oeuvres	Hydraulic Equipment for Caritas
Senegal	39,284	28,570	Oxfam Quebec	Drilling at Mbelkhaoul
Senegal	124,000	32,000	Oxfam Quebec	Cleaning Water from Wells
Togo	6,000	2,000	Carrefour de Solidarite Int'l	Water Tower for Agriculture
Zaire	31,680	23,040	Prodeva F.I.C. Inc.	Solar Energy Pump
Francophone Africa	5,004,615	2,272,689		

Americas

Bolivia	1,627,500	560,000	CARE Canada	Integrated Rural Water and Health
Brazil	334,800	167,400	Emanuel Relief and Rehabilitation Int'l	Brazil Botumirim Community Development
Brazil	15,253	10,729	World Vision	Project Alagoinhas
Chile	38,324	27,872	Oxfam Quebec	Production of Water Pump
Colombia	78,040	25,920	Oxfam Quebec	Potable Water
Haiti	25,014	13,365	Assn. Que. Pour Avancement U.N.	Drinking Water at Desgrotte

Haiti	14,378	7,909	Assn. Que. Pour Avancement U.N.	Potable Water - Lefebvre
Haiti	45,721	18,533	Canadian Saints Outreach	Seven Community Spring Caps
Haiti	9,737	4,177	Canadian Saints Outreach	Younman Virgile Drinking Water
Haiti	13,439	5,417	Canadian Saints Outreach	Bibouze Spring Cap Project
Haiti	19,369	4,513	Canadian Saints Outreach	Labelle Drinking Water Project
Haiti	33,670	22,960	Christian Children's Fund of Canada	Pure Water Against Disease
Haiti	28,116	20,448	Fondation Crudem Can. - Haiti	Sanitary Inst. Project
Haiti	11,500	8,250	Fondation de la Salle	Drinking Water
Haiti	1,100	550	Fondation Guadeloupe	Well Digging
Haiti	5,239	3,810	Oxfam Quebec	Water Tanks - School of Decouze
Haiti	9,735	7,080	Prodeva F.I.C. Inc.	Water Pump
Haiti	16,372	11,907	Salvation Army	Pure Water Project
Honduras	10,500	5,250	Cdn. Rotary Committee Int'l Development	Encinal Water Project
Honduras	60,000	25,000	Terre des Hommes	Feasibility Study Water Supply - Phase II
Nicaragua	1,400,518	808,813	CARE Canada	Nic. St-Martin Water Project
Peru	973,528	215,000	CARE Canada	Rural Potable Water
Dominican Republic	74,528	39,148	Oxfam Quebec	Activities of NGO - Bon Samaritain
Americas	4,846,381	2,014,051		

Table E-4

OVERALL LIST OF NGO'S FOR WATER AND SANITATION PROJECTS (1979/1986) RECEIVING CIDA SUPPORT
(excluding Country Focus Project Funding)

Name of NGO	CIDA Contribution ($ '000)
CARE Canada	13,552
UNICEF Canada	4,555
CCODP	1,315
Rotary International	1,267
Canadian ORT	1,013
Unitarian Service Committee	910
Sudan Interior Mission (SIM)	832
Rotary Club of Guelph	708
Canadian Lutheran World Relief	671
World Vision	576
Baptist Federation of Canada	499
Sopar	485
Club 2/3 Inc.	433
Cardinal Leger	351
Adventist Development and Relief	337
Association pour le developpement participe	314
Canadian Hunger Fundation	295
BC Save the Children Fund	294
Hope International	269
Oxfam Quebec	236
World Relief Canada	214
Oxfam Canada	< 200
Inter-Church Fund International	< 200
Salvation Army	< 200
Match	< 200
Anglican Church of Canada	< 200
Mennonite Central Committee	< 200
Compassion of Canada	< 200
Terre des Hommes	< 200
South-Asia Pertnership	< 200
Horizons of Frienship	< 200
United Presbetarian	< 200
Leprosy Mission of Canada	< 200
Centre Missionnaire Oblats	< 200
Proveda FIC Inc.	< 200
Carrefour de Solidarite International	< 200
Canadian Saints International	< 200
Emmanuel Relief & Rehabilitation International	< 200
Christian Children's Fund of Canada	< 200
Fonds International Roncalli	< 200
TOTAL NUMBER OF NGOs LISTED = 40	

Table E-5
ICDS PROJECT-SPECIFIC FUNDING BY YEAR

Year	Country	ICDS Recipient	CIDA Contrib.	Total Value of Project
1986/87	Peru	UBC	$ 40,884	$ 158,217
1985/86	No water sector funds disbursed			
1984/85	Djibouti	Operation Int'l	$ 69,000	$ 127,925
	Togo	CUSO	2,000	25,000
	Peru	UBC	8,975	8,975
	Peru	WUSC	2,600	2,600
			$ 82,575	$ 164,500
1983/84	Peru	WUSC	$ 34,900	$ 865,737
	Togo	CUSO	23,000	25,000
			$ 57,900	$ 890,737
1982/83	Bangladesh	CUSO	$ 15,000	$ 20,000
	Botswana	CUSO	5,250	26,000
	Ghana	UBC	3,200	6,200
	Peru	WUSC	464,200	865,737
			$ 487,650	$ 917,937
1981/82	No water sector funds disbursed			
1980/81	Ghana	UBC	$ 2,900	$ 6,200

Table E-6
INGO PROJECT-SPECIFIC FUNDING BY YEAR

Year	Country	INGO Recipient	CIDA Cont.	Total Value of Project
1986/87	Multi-national	Int'l Ocean Instit.	**$ 210,000**	**$ 210,000**
1985/86	Niger	Europe Action Accord	10,000	324,400
	Sri Lanka	Sarvodaya Sh. In.	7,800	165,645
			$ 17,800	**$ 490,045**
1984/85	Niger	Europe Action Accord	$ 1,342	$ 324,400
	Indonesia	Foundation for Int'l Training	11,703	67,403
			$ 13,045	**$ 391,803**
1983/84	Niger	Europe Action Accord	$ 88,658	$ 324,400
	Indonesia	Foundation for Int'l Training	25,000	67,700
	Sri Lanka	Sarvodaya Sh. In.	65,000	165,645
			$ 178,658	**$ 557,745**

Appendix F

DATA ON CIDA INDUSTRIAL COOPERATION DIVISION'S WATER AND SANITATION PROGRAMS

Appendix F

DATA ON CIDA INDUSTRIAL COOPERATION DIVISION'S WATER AND SANITATION PROGRAMS

Table of Contents

Appendix F

DATA ON CIDA INDUSTRIAL COOPERATION DIVISION'S WATER AND SANITATION PROGRAMS

Note to Table F-1

This table lists recent CIDA Industrial Cooperation (CIDA INC.) Divisions's water and sanitation projects by the four regions: Asia, Anglophone Africa, Francophone Africa, and Americas.

WR	Water Resources
WS/S	Water Supply and Sanitation

Table F-1
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS
ASIA

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Bangladesh	009305	Flood Control-Eastern Rivers	85-86	293	WR	Northwest Hydraulic Consult Ltd.
	018491	Water Treatment	86-87	12	WS/S	Stanley Associates Engineering.
	019344	Pure Water Bottling	86	15	WS	Taconic Corporation Ltd.
China	014666	Geheyan Water Control Project	85-86	445	WR	Canadian International Project Managers Ltd.
India	007909	Water Sterilization	80-81	8	WS/S	Miraclear Water Ltd.
	007953	Water Conditioning Equipment	82-83	13	WS/S	Gaco Systems Ltd.
	000246	Production-Water Treatment Equipment	83-87	100	WS/S	Gaco Systems Ltd.
	014359	Water Treatment Equipment	85-87	15	WS/S	Ruxton Water Treatment Centre
Indonesia	008014	Manufacture-Water Treatment Plant	79-81	53	WS/S	BCA Industrial Control Ltd.
	008020	Package Water Treatment Plant Management	79-81	10	WS/S	Reid Crowther and Partners Ltd.
	008026	Water Supply Study	81-82	239	WS	Canrede Ltd.
	008103	Pollution Control Equipment	84-85	14	WS/S	Aqua Guard Sales Inc.
Malaysia	008249	Study-Water Resource/ Sewage	79-80	9	S	Canrede Ltd.
	000187	Groundwater Project	82-87	96	WS	Stanley Associates Ltd.
	018426	Waste Water Precipitation	86-87	230	S	Aqua Pura Technologies Inc.
	018642	Oil Pollution Control System	86-87	334	WS/S	Bennet Environmental Consultants
	018969	Waste Water Treatment System	86-87	92	WS/S	Environmental Monitoring and Control Ltd.

Table F-1
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS (Cont'd)
ASIA

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Thailand	009260	Oil Pollution Control	84-85	360	S	Aqua Guard Sales Inc.
	008996	Mathematical and Hydrology Model Bangkok Flood	85-86	182	WR	Acres International Ltd.
	015063	Water Supply Project	85-86	278	WS	Lalonde Girouard Letendre et Associes
Total	20			2,798		

Table F-2
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS
ANGLOPHONE AFRICA

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Egypt	007736	Manufacture-Water Purifiers	80-81	10	WS/S	Iomech Ltd.
	000251	Manufacture-Handpumps	83-84	60	WS	Monarch Industries Ltd.
	000528	Pumps - Can Tech 83	83-84	7	WS	SASS Manufacturing Ltd.
Ethiopia	007781	Water Supply Study	81-82	150	WS	AESL Ltd.
	005746	Water Treatment Study	83-84	180	WS/S	AESL Ltd.
	019256	Water Study	87-88	296	WS/S	AESL Ltd.
Kenya	008199	Joint Venture-Water Well Drilling	81-82	10	WS	Skyline Drilling Company
Nigeria	008542	Kand Water Supply and Sanitation	82-83	177	WS/S	Cansult International Ltd.
Total	8			890		

Table F-3
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS
FRANCOPHONE AFRICA

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Cameroon	015593	Concrete Pipe Plant	85-86	87	WS	Canron Inc.
	017339	Mineral Water	85-86	14	WS	Distribution Belle Eau Inc.
	018250	Mineral Water	86-87	44	WS	Distribution Belle Eau Inc.
	018460	Sand and Gravel from River	86-87	275	WR	Janin Construction Limitee
Ivory Coast	000368	Pump Installation	83-84	15	WS	Produits Energetiques Kaine Ltd.
	014160	Manufacture, Sewer Pipes	84-85	15	S	National Sewer Pipe Ltd.
	019062	Assistance Technical Forexi	87-88	259	WS	Hydrogeo Canada
Mali	008294	Water Pumps	80-81	10	WS	Polynergie Inc.
	008296	Handpump Testing	80-82	100	WS	Polynergie Inc.
Morocco	008500	Production-Water Pumps	81-82	10	WS	Monarch Industries Ltd.
	000442	Production-Water Purifiers	82-83	10	WS/S	Iomech Ltd.
	008509	Production-Water Pumps	83-84	5	WS/S	Energetiques Kaine Ltd.
Niger	008535	Drilling Services - Water Wells	81-82	10	WS	Skyline Drilling Co. Ltd.
Senegal	000227	Water Handpumps	83-84	50	WS	Produits Energetiques Kaine Ltd.
Tunisia	009030	Dam at El Haovareb	80	248	WR	SNC Inc.
Zaire	000117	Water Supply for Kalamie	83-85	259	WS	Tec Sult International Ltd.
Total	16			1,411		

Table F-4
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS
AMERICAS

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Caribbean	000590	Sewage Treatment - Can Tec '83 (Trinidad)	83-84	6	S	Ruxton Water Treatment Centre
	000591	Sewage Treatment - Can Tec '83 (Trinidad)	83-84	6	S	Photozone Ltd.
	000615	Sewage Treatment - Can Tec '83 (Trinidad)	83-84	6	S	ADIL Ltd.
	000629	Sewage Treatment - Can Tec '83 (Trinidad)	83-84	6	S	Memtek Corporation
St. Lucia	019501	Small Bore Sewerage Installation	86-87	113	S	Cowater International Inc.
Cayman Islands	020275	Small Bore Sewerage Installation	86-87	112	S	Cowater International Inc.
Colombia	006361	Incineration Study	84-87	287	S	SNC Incorporated
	015573	Water Treatment Equipment	84-85	15	WS/S	John Meunier Inc.
Dominican Republic	007666	Manual Water Pumping System	81-82	19	WS	Polynergie 1980 Inc.
	007673	Handpump Demonstration	82-84	99	WS	Produit Energetiques Kaine Ltd.
	014083	Well Construction - Tec Canada 84 Exibitors	84-85	7	WS	Descheners Drilling
Ecuador	006073	Water Supply Study, El Oro	85-87	195	WS	Proctor and Redfern Int'l Ltd.
Haiti	021615	Bottled Water	87-88	28	WS	Louis Morin Inc.
Jamaica	008171	Ice Making	84-85	9	WS	Delisle Ice and Coal Company

Table F-4
SUMMARY OF CIDA INDUSTRIAL COOPERATION'S WATER AND SANITATION PROJECTS (Cont'd)
AMERICAS

Country	Project #	Title	Period	CIDA budget ($'000)	Sub-Sector	Canadian Recipient Organization
Mexico	000279	Anaerobic Water Treatment System	82-83	11	WS/S	ADI Ltd.
	000452	Solid Waste Management	82-83	10	S	Tricil Ltd.
	008456	Water Treatment Equipment	84-85	12	WS/S	Gaco Systems Ltd.
Nicaragua	000473	Bluefields Water Systems	80-81	10	WR	J.L. Richards and Associates Ltd.
	000213	Bluefields Water and Sewerage Project	83-85	174	WS/S	J.L. Richards and Associates Ltd.
Trinidad & Tobago	00033	Water Purification System (Study)	83-84	27	S	Photozone Ltd.
	000221	Manufacture-Water Purification System	83-84	83	S	Photozone Ltd.
	015073	Water Treatment	85-86	50	WS/S	Water Quality Management Ltd.
Total	22			1,285		