

**National Water Resources Policy and Institutional Arrangements  
Executive Summary**

*The following information is a summary of the National Water Resources Policy and should be viewed along with the full Policy.*

**A. Water Resources Policy Foundation**

A number of warning signs point to increasing water resource problems in Sri Lanka. Competition and water shortages will increase as a result of highly variable rainfall and growing demand for water. Watersheds are being degraded, resulting in sedimentation of reservoirs and more serious floods and droughts. Water pollution from domestic, agricultural and industrial sources is contaminating surface and groundwater and affecting public health. Groundwater is being over-extracted in some areas, affecting the availability of water for others and for environmental values.

1. **Policy Objective** *The objective of water resources management is to ensure the use of water resources in an effective, efficient and equitable manner, consistent with the social, economic and environmental needs of present and future generations.*

Further objectives for water resources management are to:

- Facilitate national development
  - Conserve, and recognise the value of, scarce water resources
  - Ensure equitable sharing of water resources for meeting current and future demands of the population through an efficient allocation system
  - Recognise the national importance of water allocation to the irrigation sector in terms of such things as the amount of water allocated, number of users and potential for improved water conservation
  - Ensure flexibility of water allocation in a way which promotes social harmony and individual decision making
  - Safeguard investments in water resources development and other sectors of the economy by providing water rights and entitlements
  - Improve standards in the maintenance of safe quality of water sources required for various water uses
  - Ensure a healthy environment and sustainable use of both surface and groundwater resources using a comprehensive, river basin-oriented approach
2. **Scope** The National Water Resources Policy applies to all fresh and brackish water in Sri Lanka. It does not apply to marine water.
  3. **Policy Principles** All surface and groundwater are owned by the state and managed by the government in partnership with water users on behalf of all Sri Lankans. Water will be managed in a sustainable manner, recognising efficiency, equity and environmental objectives. Sri Lanka will take an open and participatory approach to water resources management and will base decisions on strong and co-ordinated resource information.
  4. **Sectoral Emphasis** The special role of the irrigation sector in Sri Lanka is recognised. Some key policy provisions, such as granting water entitlements to existing users, increasing the security of water allocation through monitoring and enforcement, the provision for government to pay the water management cost share for irrigation entitlement holders until

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they are able to do so, and an open and transparent approach to all aspects of water resource decision making will help to safeguard the interests of irrigation water users in balance with other sectoral water users.

The importance of the hydropower sector is also recognized. National and multi-basin plans will take into account the need for least-cost coordinated generation.

5. **Strategies** This policy takes an integrated approach covering all aspects of water resources management. Co-ordination will also be ensured with other natural resources and with other national policies.

The National Water Resources Policy will be implemented largely through planning at the national, multi-basin and basin / aquifer levels (which will be conducted or coordinated by the National Water Resources Authority) and through project and operational planning (which will be carried out by other water agencies). Basin and aquifer plans will be implemented in a progressive manner through declared, priority basins.

A permanent National Water Resources Authority, Water Resources Council and Water Resources Tribunal will be formed to carry out selected water resource management functions and to co-ordinate and guide the activities of other agencies which will also continue to play a role in this field.

#### **B. Water Rights and Allocation**

Until now Sri Lanka has not had a formal or adequate water allocation system. A great deal of water resource development has taken place, largely through public investment. Water resource allocation has been managed by the public agencies which have developed this infrastructure and which deliver water and services to sectoral water users. To a certain extent, conflicts have been resolved through interagency agreement. In the area served by the Mahaweli Authority a more formal planning and management system has been developed.

At the local level water allocation has been carried out by the management activities of the public, water service agencies and, in rural areas, through a system of traditional allocation procedures and rights.

These allocation mechanisms have failed to ensure water allocation which recognises the rights of existing users and flexibility to meet the needs of new users. Water is allocated either on the basis of agreed priorities and not in accordance with principles of economic efficiency. Environmental and small-scale social uses are suffering at the expense of larger, consumptive uses.

1. **Entitlements** The right to use water will be granted through water entitlements. Small-scale users and individual water users supplied through group schemes will be exempt from the requirement to hold an entitlement. Entitlements will be granted for a fixed period of time, based on the specific water use. Water user compliance with the terms of their entitlements will be monitored and enforced.
2. **Environmental and Social Water Requirements** Environmental, social and cultural water uses will be protected by reserving minimum flows and storage volumes. This reservation of water will be made before water entitlements are issued.
3. **Water Allocation Priorities** Water will be reserved to protect small scale water users, other social and cultural purposes and environmental values. Water entitlements will be issued to existing water users and, to the extent that further water is available, to new applicants.

During periods of drought the first priority for water allocation will be domestic use. Other water users will share the available supply in proportion to their normal entitlements.

4. **River Basin or Groundwater Plans** River basin plans will be developed to guide the allocation of water. Planning will be carried out in specified river basins and groundwater aquifers. Plans will be implemented through the issuing of water entitlements and through the actions of various government agencies responsible for water and other resources. A future policy statement will be developed to specify the details of river basin planning.
5. **Transfers** Voluntary transfers of water entitlements will be allowed between entitlement holders or from entitlement holders to those seeking to acquire water use rights. Transfers will be subject to approval under of approved guidelines in order to protect third parties and environmental values. Transfers will normally involve compensation paid by the new entitlement holder.
6. **Sub-sectoral allocation** The National Water Resources Policy outlines a system of bulk allocation of water to large users and group schemes. Existing arrangements will be used, or new arrangements developed, to allocate water within group schemes (such as urban or irrigation systems) to individual water users.

### C. Demand Management

1. **Transferable Water Entitlements** Establishment of transferable water entitlements will promote water conservation and improved water allocation.
2. **Water Management Cost Sharing** Basin water resource management costs will be shared with water users in a transparent manner. These costs will be shared on the basis of such things as the entitlement holder's quantity of water use, ability to pay, and the consumptive or non-consumptive nature of the water use. Information on the value of water in different types of use will be reflected in basin plans. Government will pay the current share of water management costs for the irrigation sector through a transparent subsidy, in recognition of the low level of returns in this sector. As returns for irrigated agriculture grow in the future, as irrigation system control and maintenance is improved and as water delivery is made more reliable, it is expected that the irrigation sector will have greater ability to share in the cost of water resource management.
3. **Regulatory Control** Water entitlements will be an important tool in demand management since unauthorised water use will be controlled. Entitlements may also contain terms and conditions regarding water conservation measures which entitlement holders must implement. Water conservation agreements may also be developed to specify more general water conservation activities or those falling outside the scope of water entitlements.
4. **Water Saving Technology** Water measuring devices will be required as a condition of water entitlements. Water saving technology and research will be promoted.
5. **Education and Awareness** Public education and awareness programs be used to develop awareness of the value of water resources and activities which can be taken to conserve water. Water resource managers will be trained to improve water use efficiency through their own actions and in co-operation with water users. Technical assistance on water conservation will be given to users on request.
6. **Capital Investment, Operation and Maintenance** Water conservation will be promoted in all publicly-funded water management projects and programs. Capacity building, proper financial accounting, asset management and rehabilitation of schemes will be used to promote water use efficiency.

7. **Information and Demand Management Performance** Information on water resource demand will be used in planning. Achievements in meeting demand management targets will be made public.

#### **D. Groundwater Management**

Groundwater is widely used for domestic, small-scale irrigation, industrial and other uses in Sri Lanka. There are many types of both shallow and deep groundwater aquifers, each with its own characteristics and management needs. In addition to providing a ready source of water for consumptive purposes, shallow aquifers play an important role in discharging water to rivers and other water bodies during low flow periods. They also support wetlands and native vegetation.

The major groundwater issues are related to the fact that groundwater is essentially an unregulated resource. Ownership and management responsibilities for groundwater are not clearly defined. Although groundwater studies have been conducted and well-drilling data collected, there has been no ongoing monitoring and co-ordinated information system for groundwater. Intensive urban, industrial, tourism and other development has contributed to over-use and contamination of some aquifers. Subsidy programs to promote the development of shallow "agro-wells" has also resulted in heavy use of shallow groundwater in parts of North Central and North West Provinces.

1. **Sustainable Management of Groundwater** The rate of groundwater replenishment and other distinctive features of aquifers will be taken into account in groundwater planning and management. A long-term perspective will be used in its management.
2. **Co-ordination of Surface and Groundwater Management** Surface water and groundwater, particularly in shallow aquifers, are closely related resources. They must therefore be managed in an integrated manner. All of the policies applied to surface water will also apply to groundwater management. In areas where there are special, urgent groundwater issues, planning and management of groundwater may go ahead without full river basin planning.
3. **Management of Small-Scale Groundwater Use** Small users will be exempt from the requirement to hold entitlements, but local governments will be encouraged to register small wells and to apply guidelines on well density in groundwater management areas. Information on groundwater and water conservation will be provided to groundwater users.
4. **Groundwater Information Management** Groundwater data collection and information management will be strengthened, focussing on priority aquifers.
5. **Groundwater Quality** Groundwater quality and other environmental objectives will be pursued in co-ordination with national and provincial environmental agencies.
6. **Awareness and Participation** Greater awareness of groundwater resources will be promoted through co-operative programs. Stakeholders will be encouraged to participate in planning and monitoring of the resource.
7. **Strategic Approach** Groundwater management will be focussed on priority aquifers. Action plans will be developed and implemented by appropriate national and other government agencies in a co-ordinated manner.

### **E. Information Management**

Water resources data and information are essential for the effective management of the resource, including policy development and planning, water management operations, project planning, public awareness and education, and investment planning. A number of water management agencies collect data, primarily for their own use as well as some sharing with other agencies and release to the public. Data is collected on both an ad hoc and project basis or on an ongoing basis in some areas.

However, the data and information system is inadequate in terms of consistent data standards, accuracy and accessibility of data and information. A number of aspects of the data collection, storage, processing and distribution system suffer from inadequate procedures, resources and training. In general, the current data and information system is not adequate to meet the needs of the integrated water resource management system recommended throughout this policy or the needs for efficient operations in the water sector.

#### **1. Data Ownership**

Water resources data collected by national government agencies are the property of the state.

#### **2. Data Co-ordination and Sharing**

Data and information exchange and sharing will be ensured through a series of agreements between data collection agencies ("Custodian Agencies") and the National Water Resources Authority. These agreements will specify data collection and management standards, data and information access and pricing and compilation of data sets by the NWRA.

In exchange for data sharing from Custodian Agencies to the NWRA, a co-ordinated and mutually beneficial approach to strengthening the overall data and information system will be undertaken. Overall priorities will be identified in a co-operative manner and funds accumulated by the NWRA through charges for water information will be used to strengthen the capacities of the Custodian Agencies. Co-operating Custodian Agencies will also be given free access to data from the NWRA.

#### **3. Data and Information Access**

Data and information will be made available to water agencies through data sharing arrangements and to the public through both active awareness and educational programs and in response to requests. Consistent pricing of water data and processed water information will be encouraged.

### **F. Institutional Structure for Water Resources Management**

A new and permanent National Water Resources Authority (NWRA), a permanent Water Resources Council (WRC) and a Water Resources Tribunal (WRT) will be established at the national level. These bodies will be responsible for overall co-ordination of water resource management and for a number of specified functions.

#### **1. Functions of the NWRA** The functions of the NWRA will be:

- preparation of national water resources policy
- long-term national and river basin planning, including co-ordination of local input
- co-ordination and collection of water resource data and information management, water monitoring and commissioning of research

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- water allocation through the issuing of water entitlements
- advice to government regarding drought and flood management
- policy and monitoring regarding riverine activities
- public information and awareness

**2. Reporting Relationship and Structure** In order to make them effective in policy development, in water resource planning and regulation and in dispute resolution, the NWRA, WRC and WRT will be neutral with respect to sectoral interests and in a strong and authoritative position in government. These bodies will be parallel in terms of reporting directly to the chief executive of government (the President of Sri Lanka). The NWRA, WRC and WRT will together form the water sector apex body and as such, and in their areas of responsibility, will be considered to have a higher level of authority than other national water agencies.

The NWRA will report to a Board which will consist of seven members selected on the basis of clearly specified professional qualifications covering a range of water related specialities. The chief executive of the NWRA will be the Director General. Its internal divisions are expected to be a) Policy and Planning, b) Operations (water allocation, riverine control, information) and c) Corporate Services (administration and finance).

The NWRA will be responsible for co-ordination, planning, regulation and monitoring of Sri Lanka's water resources but will not be responsible for the planning, operation and maintenance of infrastructure, sectoral water delivery or for implementation of capital projects.

**3. Delegation and Contracting** The NWRA will delegate to, or work in partnership with, various national and other government agencies in order to carry out technical and decentralized functions. Policy development will be the responsibility of the NWRA but an open and consultative approach will be used. Technical aspects of national and river basin planning will be largely delegated or undertaken in partnership with agencies which have parallel responsibilities. Data and information will be managed in a decentralized system in which the NWRA will serve as coordinator. The NWRA will establish and coordinate the proposed system of bulk water entitlements, with appropriate responsibilities to the district or divisional level with appropriate capacity building and supervision. Where the NWRA lacks technical capacity or staff, it may also contract tasks to other government agencies or private or non-government groups.

**4. Water Resources Council** The Water Resources Council will advise the Minister on water resource issues and on the resolution of inter-provincial and interagency water disputes. It will co-ordinate activities in water resource management at the national level and will review and endorse draft policies and national and river basin plans. The membership of the WRC will consist of the following:

- seven secretaries of national ministries responsible for subjects such as water supply, irrigation, agriculture, and hydropower and (on a rotational basis) the subjects of fisheries, lands, plantations, industry, environment, finance and planning, provincial councils and social issues such as health, education and poverty alleviation
- heads of the Irrigation Department, Mahaweli Authority of Sri Lanka, Ceylon Electricity Board, and National Water Supply and Drainage Board
- nine non-government representatives, including two representatives of private water users, two representatives of farmer organisations, two representatives of non-government organisations active in the field of water resource management, two representatives of academic institutions concerned with water resources (including their social aspects) and one gender representative.

5. **Water Resources Tribunal** The Water Resources Tribunal (WRT) will be an independent appeal tribunal which will resolve issues relating to the administration of water entitlements by the NWRA. The WRT will be responsible to the Minister for administrative purposes but will have statutory independence. Its judgements will be final aside from appeal to the courts on matters of law. The WRT will be comprised of a legally trained Chairman assisted by a panel of technically qualified persons. Three or more members of the panel will be summoned on an ad hoc basis by the Chairman to hear appeals. The WRT will face time limits on rendering decisions and will have administrative procedures designed to ensure its efficiency.
6. **Relationship of NWRA, WRC and WRT to Other National Agencies** The NWRA, WRC and WRT will together form the water sector apex body responsible for coordination, planning, regulation and monitoring national water resources and resolution of disputes in the water sector. In their areas of responsibility they will be considered to have a higher level of authority than other national water agencies. Those other agencies will all be subject to the oversight and direction of the NWRA, WRC and WRT.
7. **Provincial and River Basin Water Resources Administration** River basin and major aquifer planning will be co-ordinated and technically supported by the NWRA and partner agencies. Priority river basins and aquifers will be identified for planning and management on the basis of water management issues and officially declared as "water management areas" and "groundwater sensitive areas."

River Basin Committees or Groundwater Committees will be established in declared areas. These committees will be responsible for identification of water management issues and preparation of terms of reference for plans. They will review draft plans prepared by the NWRA, conduct public consultation with the basin or aquifer area, recommend changes to the NWRA and monitor the implementation of plans. These committees will also review the implementation of river basin plans on an annual basis and will report to the WRC. River basin and groundwater committees will be composed of representatives of national water resources agencies, provincial and other levels of government and water users.

The Mahaweli Authority of Sri Lanka, like other water management agencies, will be subject to national water resources policy and river basin plans approved by the WRC and government and to the guidance, coordination and dispute resolution of the NWRA, WRC and WRT. The NWRA will delegate responsibilities and powers to the MASL or utilize the capabilities of the MASL through partnership arrangements. Delegation of regulatory responsibilities will be subject to the clear separation of regulatory and water use functions within the MASL.

8. **Groundwater Administration** In any declared water management or groundwater management area, all surface water and inter-connected groundwater will be planned and managed in an integrated manner and in accordance with the Groundwater Policy. The NWRA will contract and delegate many responsibilities for technical and decentralised functions. Groundwater Committees will be formed in the same manner as River Basin Committees.
9. **Water Quality Administration** The NWRA will fully co-ordinate its activities with those of the Central Environmental Authority and provincial environment agencies. Water quality issues will be considered along with water quantity in the river and groundwater planning process. River and groundwater plans will be prepared and publicly reviewed in a way which ensures they are comparable with broad environmental impact assessments. Issuance of water entitlements and monitoring and enforcement of compliance with entitlements will be co-ordinated with environmental licensing procedures.

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- 10. Watershed Management** The NWRA will not take on the responsibility to plan and manage all natural resources such as land, forests, soil, etc. However, it is recognised that water resource management and the protection of water sources cannot be separated from these other resources. The NWRA will therefore work in close co-ordination with other resource managers. It will also promote sound resource management in a way which benefits water users throughout river basins.



7 Consultants, Survey company and laboratories

1. List of Survey Companies

a. Engineering services including  
Water works design

- Water resources Board,  
1A, Gregory's Road,  
Colombo 7

- Water Supply and drainage  
board

- Central Engineering Consultancy  
Bureau, 415, Bouddaloka Mawatha,  
Colombo 7   Tele 01-696216  
                    Fax 01-687369

b. Topographic Survey

- Survey Department

c. Geological and Hydrogeological  
investigations for boring tests

- Water resources Board

d. Environment Impact assesment

- Central Environment Authority  
Maligawattea new town, Colombo 10  
Tele 01-449455   Fax 01-446749

2. Laboratories for water quality tests

- water Resources Board

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- Water Supply and drainage Board
  
  - Industrial Development Board  
615, Galle Road, Katubadda.  
Tele 01-605323
  
  - Ceylon Institute of scientific and Industrial Research (CISIR)  
798, Bauddaloka Mawata, Colombo 7  
Tel- 01/693807 Fax - 01- 686567
3. Unit Price of Hydrogeological Survey  
- Rs. 15,750 Including GST

4. Geological and Hydrogeological Investigation for boring test

- a. Senior engineer - Rs.35,000 P/m
- b. Engineer - Rs.17,500 P/m
- c. Assistant Engineer - Rs.15,000 P/m
- d. Secretary - Rs.12,000 P/m
- e. CAD Operator - Rs.16,500 P/m
- f. Driver - Rs.10,000 P/m
- g. Labourer - Rs. 8,000 P/m

\*Excluding Transport and Other facilities

5. Unit price for water quality test

- a. Senior chemist - Rs.30,000 P/m
- b. Chemist - Rs.25,000 P/m



## 9 WATER RESOURCES

### 9.1 Overview

Sri Lanka is well endowed with an abundance of surface water resources. The mean annual rainfall of around 2,080 mm. (Arulananthan, 1985) is almost three times the world annual average rainfall of 750 mm. Water is a crucial constraint in land development and agriculture because of "the inefficient management of available rainwater". Water Resources Management (WRM) in the context of water scarcity and increasing demand is therefore a major challenge. The term "Dry Zone" (used to denote the land outside the "Wet Zone" in the country's southwest quadrant) is a misnomer because "rainfall during certain months in the Dry Zone far exceeds that in any other area in Sri Lanka." (Land Commission, 1987).

About 70 percent of this rainwater is lost by surface evaporation and through transpiration by plants (evapo-transpiration); a portion seeps into the ground, while the remainder flows as surface run-off into reservoirs, lakes, marshes, ponds, streams, rivers and finally into the sea. In the Dry Zone where over 50 percent of total runoff is utilized, there is limited scope for major development of supplies (ADB-USAID, 1994). In the Wet Zone nearly 79 percent of the run-off escapes into the sea.

Harnessing of the rainwater for rice (paddy) cultivation and domestic use has been practised in Sri Lanka from ancient times. The other major uses of water at present are in power generation and in industry. About 70 percent of installed power generating capacity is in hydro-power plant, but in a year of normal rain more than 90 percent of the power generated is supplied from hydro sources.

Water related projects in Sri Lanka, mainly irrigation, hydro power generation and town supply schemes, presently absorb about 22 percent of total public sector investment.

#### Strengths:

Sri Lanka is rich in water resources that include 103 rivers, more than 20 major wetlands, a sophisticated system of major and minor irrigation systems and significant groundwater resources. The country's southwest quadrant receives rain from both monsoon periods and is referred to as the Wet Zone. The Dry Zone comprises roughly two thirds of the country that receives very heavy rain during the period mid October to mid-January and very little at other times. A part of this rainwater is impounded in reservoirs and used for irrigation during the dry season and for power generation. An Intermediate Zone has been demarcated between the Dry Zone and the Wet Zone. Minor (village) tanks which are present in large numbers in the Dry Zone serve the extremely useful function of recharging (groundwater) aquifers. This process is very effective when these (minor) tanks form part of a cascade system.

The major freshwater wetland bodies include the irrigation and multipurpose reservoirs, the inland sections of rivers and streams, riverine marshes like the villus and seasonally flooded grasslands associated with the Mahaweli River and the numerous flooded paddy fields (rice paddies). Many of the important wetlands are situated in the coastal belt where the water is brackish. Coastal and marine waters are not discussed in this chapter, since they are dealt with in the chapter on "Coastal Resources".

Nearly all the country's major rivers have their sources in the central highlands and flow in a radial pattern into the sea, the notable exception to this pattern being the longest of them, the 335 km long Mahaweli Ganga which drains about a sixth of the country's total land area. The Mahaweli Development Program included the completion of four of the country's largest reservoirs, along with transbasin diversion irrigation systems and the establishment of downstream human settlements. Nearly half the country's total hydropower produced is generated by the Mahaweli system and Mahaweli lands yield one fifth of the country's total paddy production.

The quality of the groundwater is relatively good except in urban areas particularly where the layer of soil is thin and the water table high. These conditions promote pollution of the groundwater. Heavy use of agricultural chemicals has led to the groundwater in some areas like the Jaffna peninsula having a high nitrogen content.

**Weaknesses and Threats:**

Water demand is growing and major water conflicts are developing between different users. Irrigation is the major water user, followed by hydro-power generation, while a smaller portion is used in industry and for domestic purposes. Shallow wells are the sources of domestic water supplies in rural areas. The development of deep tube well technology has enabled the use of ground water for irrigation in parts of the Dry Zone.

One of the main causes for water conflicts and inefficient water allocation is the lack of coordination between the large number of government agencies concerned with water conservation including ministries and government departments. There is no system for allocating water. The approach to resolving conflicts relating to water is ad hoc and on a case by case basis. The institutional arrangement will become even more complex as decentralization of powers progresses since rivers are the most

important inter-provincial natural water sources. Unless clear principles are agreed upon now for allocation of the available water, major conflicts could develop later.

The other major threat is pollution of coastal and inland surface and ground waters by human and industrial wastes. Pollution is severe in many urban and coastal areas especially where the soil is shallow and the water table high. Groundwater pollution exacts a high cost in lowered human health and in expensive treatment measures such as boiling and filtering water before drinking. The rapid degradation of watersheds, particularly upper watersheds, is a threat to the sustainability of water resources.

**Opportunities:**

Water has traditionally played a central role in Sri Lankan cultural and religious activities. Historians studying Sri Lanka's ancient hydraulic civilization have marveled at its engineering technology and water resource management systems (NARESA, 1991; Dissanayake, 1992). The temple, the village and the tank (reservoir) were the cornerstones of the early "hydraulic civilization". The traditional concern for clean water needs to be restored in order to ensure that water resources are used efficiently. The government has established a Water Resources Council which will formulate a national strategy for water management and promote integrated water management.

**9.2 Issues**

**i) Diminishing Water Supplies**

There is evidence of a long term decline in rainfall in the Central Province. This seems to be a part of global climate changes related to global warming. There are also localized changes in water run-off rates and water yields as a result of land use changes. The loss of forest cover, and of topsoil through erosion has greatly reduced the capacity of the soil to absorb rainwater and the storage

capacity of the major reservoirs. Some research suggests that fast growing timber species like Pinus and Eucalyptus have affected water yield rates in certain key catchments. The net result is heavy run-off and flash floods during the rainy season and droughts during the dry season. The country has faced severe droughts during 1982-1983 and 1994-1995 when the failure of the monsoon rains led to a sharp drop in agricultural production, particularly in rice production during these years.

ii) **Lack of a rational system for water allocation between different users**

The increasing demand for water and the diminishing supplies require that water policy makers accord high priority to the economical and productive use of the available water resources. Water demand management is crucial to such use of water resources.

Competition for water is increasing between the irrigation, power, industrial and domestic sectors. Access to water generates significant economic and other benefits, so that bitter political and social conflicts arise in the absence of a clear and agreed system of water allocation. This can be seen at a micro level in many irrigation schemes where lack of water can condemn farmers to poverty and can lead to a significant degree of water stealing and vandalism of irrigation structures. Political conflicts have also arisen at the national level through lack of access to water as in the Hambantota district of the Southern Province where a shortage of water has hampered development. The most efficient unit of water allocation is the river basin. A clear allocation system for different water uses must therefore be developed for each river basin. This system of water allocation needs to be based on clear economic and social principles.

Competition for water is already apparent between users such as irrigation, power, industry and residential demand. More than 70 per cent of the available water is used for irrigation of rice (paddy) fields.

Paddy cultivation which is extremely water intensive is also the most extensively practised. The question is beginning to be asked whether the creation of such large reservoirs at such environmental cost to provide irrigation for paddy fields was a wise decision. The demand for water for the other users including the industrial and domestic sectors has also increased sharply over the years. Domestic water consumption is increasing as urban populations grow and new pipe borne water schemes come into operation. Hydro sources provide about 85 percent of the electricity presently consumed in Sri Lanka, although this proportion is expected to decrease with the installation of more thermal power generating units. At present there is sharp competition between irrigation and hydropower generation for the available supplies of water in certain Mahaweli areas. The timing of the release of water used for power generation is different to the time water is needed for irrigating the paddy fields. This competition is expected to increase in the years to come.

The lack of a rational system of allocation is hampered by conflicts between the large number of government agencies involved in water management. This includes Ministries in charge of the subjects of Agriculture, Irrigation, Power, Industrial Development, Environment and Forestry, Health and Local Government. The other agencies involved in water management are the Departments of Irrigation and Agriculture, the Central Electricity Board, the Water Resources Board, the National Water Supply and Drainage Board, the Central Environmental Authority (CEA) and the National Aquatic Resources Agency (NARA). More than 40 government agencies are charged with responsibilities for watershed and land management. Coordination of their activities and jurisdiction has proved difficult.

Irrigation is the responsibility of the Department of Irrigation and the Mahaweli

Development Authority. Hydropower is generated by the Ceylon Electricity Board and the Mahaweli Authority. The Mahaweli Authority controls seven major reservoirs that have an installed generation capacity of more than 670 MW and supplies irrigation water for more than 120,000 hectares of paddy lands. The National Water Supply and Drainage Board supplies water for domestic and industrial use. The Water Resources Board administers the subject of ground water supplies and engages in the installation of tube wells and the construction of dug wells on a commercial scale. The International Irrigation Management Institute is involved in research on water use and its managerial aspects. The National Aquatic Resources Agency (NARA) is engaged in research on water quality and aqua-culture. NARA, the National Building Research Organization (NBRO), the Sri Lanka Institute of Fundamental Studies (IFS), the Central Environmental Authority (CEA) and the Ceylon Institute of Scientific and Industrial Research (CISIR) have capability in water analysis and other aspects of water supply and use including pollution. There is however little coordination between them. The management of water data and information is critical for sound water resources management. This function is however often ignored and uncoordinated.

The focus on the use of water for development activities, mainly irrigation and hydropower generation and for domestic use resulted in the establishment of a number of institutions and the enactment of a number of laws concerned primarily with water. More than 50 legislative Acts presently deal with different aspects of water. The ambiguity and overlap of authority shown in these statutes have resulted in duplication, confusion and ultimately ineffective law enforcement and regulation. This complex

situation has been further complicated by the devolution of powers to Provincial Councils to enact their own parallel statutes.

While the scope of existing environmental legislation is wide enough to provide adequate environmental safeguards, the standards set are unrealistic and the institutional capacity is inadequate to enforce them. These factors and the lack of resolve to regulate through decentralized authority have made such regulation ineffective.

As the population grew and the demands of development increased, the existing institutions were pressurized to focus more on development and less on conservation and sustainable use of the country's water resources. The linking of the right to water with the rights to land has also adversely affected the long term prospects for water resources by enabling local authorities and individual officials to make arbitrary decisions on water extraction that have adverse impacts on water resources. Regulation and law enforcement have suffered particularly where decisions of a legal nature are enforced through a delegated or decentralized arrangement. This fact is illustrated by the limited achievements of such arrangements like the District Agricultural Committee (DAC) and the Mahaweli Water Panel in the areas of environmental conservation and pollution control. The emphasis even at the central policy making level has been on monitoring the development process and providing policy support for such development. Although there is provision to address environmental policy issues comprehensively the organizations responsible for such activities, because of their nature and functions, view environmental concerns as being of little importance. The development programs of many state agencies therefore contribute not only to over-exploitation of water, but also to its degradation.

Even in the water services sub-sector, for example in water supply, environmental issues are considered only as far as the immediate periphery of the operation of the service, not beyond to the water source itself.

Rational water allocation is also hampered by failure to understand the complex nature of the water cycle and underground water flows. Because water can be reused many times, the concept of water "use" is a very complex issue. For example, as much as 70 percent of the surface run off is estimated to be "used" for irrigation. However about 10 percent of the water used for irrigation seeps down to replenish groundwater supplies (Mosley, 1977).

### iii) Low Efficiency of Water Use

The current pattern of water use within each sector (irrigation, power generation, domestic, industrial etc.) is often not efficient, that is, rarely does each unit of water generate the maximum economic benefits. Low efficiency of water use increases the fast increasing water deficit in the Dry Zone and forces development of new water sources. Such development not only requires heavy capital investment but also increases the stresses on the environment. Efficient water use is particularly important in irrigation, the largest consumer of water, where demand for water already exceeds supply throughout the Dry Zone. Present irrigation water use efficiency is rated to be only about 50 percent of what is feasible.

The Accelerated Mahaweli Development Project Area alone has an estimated deficit of 200 million cubic metres. The effects of this deficit are felt particularly by farmers and the environment in the lower reaches (tail-end) of the distribution system, but not only by them. They are experienced by all

farmers who fail to produce two crops of rice in a year because of a lack of irrigation water. There are at present 535 major irrigation schemes, each serving more than 80 hectares and nearly 18,000 minor irrigation schemes.

One of the main concerns is that paddy is a relatively low value crop, although it does have other benefits such as its long storage life. Government agricultural policy has always focussed on the goal of self-sufficiency in rice. Pursuit of this goal has resulted in a sharp reduction in the extent of forestlands and the inundation of large extents of productive and potentially productive cropland to create irrigation reservoirs. The view is now expressed that it would have been more prudent to channel at least part of that investment into rain-fed agriculture. Reform of irrigation systems is needed to improve their efficiency.

### iv) Lack of management of groundwater resources

Surface waters have often been used to their limit in the areas of low rainfall. Recourse has then been made to the use of groundwater. Lift irrigation through the use of tube wells has been practised without regulation in the Jaffna peninsula, the North Central Province and the North Western Province, particularly in Kalpitiya. Effective monitoring is essential to avoid over extraction of groundwater and its pollution. Polluted ground water sources (aquifers) are extremely difficult to clean.

When the rate of extraction of groundwater exceeds the rate of replenishment of the aquifer, saline or brackish water flows in to fill the vacuum. The chloride content of the water thereby rises. Intensive agriculture leads to the leaching of some of the excess fertilizers and pesticides into the

soil and thence into the groundwater. Studies have shown contamination of the aquifers in Kalpitiya and Jaffna. At present no agency is responsible for groundwater management and very little data is available on groundwater quality and availability.

v) **Declining water quality**

Water pollution is becoming a major problem in certain urban and agricultural areas. The quality of water in irrigation tanks and other water bodies has been affected by the inflow of excess chemical fertilizer which promotes eutrophication and algal growth. Beira Lake presents an example of such eutrophication caused by algae thriving on the sewage flowing into the lake. Pollution of water sources from non point sources such as paddy fields agricultural plots and plantations is difficult to control.

Faecal contamination of groundwater is reported from many districts, especially from densely populated urban areas and areas where the layer of soil is thin. The recent rapid industrial development has resulted in the release into the environment of untreated or inadequately treated effluents and even solid wastes thrown into canals, streams, rivers and other water bodies. Natural fluoride levels have been found to be high in certain areas of the Central Province, posing a serious threat to human health. Shrimp farms in the North Western Province are another source of water pollution are discussed in vi)

vi) **Health Problems Associated with Water**

The sources of drinking water in Sri Lanka are:

- Pipe borne water
- Protected wells
- Unprotected wells and
- Other sources (tanks, streams etc.)

The ground water in nearly all urban areas is polluted and few users boil or otherwise sterilize their drinking water. Many of the wells are situated close to toilets or are shallow with a relatively thin layer of soil, which is inadequate to filter the harmful microorganisms. Typhoid (enteric) fever and cholera are among the dangerous water borne diseases. Stagnant pools of water provide breeding places for mosquitoes which transmit malaria, filaria, dengue fever and encephalitis. The rapidly increasing level of surface water pollution is a serious health hazard. Poor storm water drainage in urban areas is an irritant and a health hazard. Recommendations for reducing the incidence of water borne diseases are contained in the chapter on Environment and Health.

vii) **Shrimp Culture**

Shrimp farming is a rapidly expanding industry in the North Western Province. A recent survey estimated the total number of farms to be about 925 covering an area of about 2,300 hectares. These farms discharge their effluents to the same water bodies that are the water sources. Shrimp farms also tap ground water to reduce the high salinity levels of the water in the ponds especially during dry weather.

viii) **Inland fisheries development**

The irrigation and multi-purpose reservoirs in the Dry Zone provide habitats for freshwater fish. Freshwater fish production increased sharply with the introduction of cichlid (e.g. Tilapia) and cyprinid fish (e.g. Chinese carp) varieties from abroad. These sources now provide about 20,000 metric tons of fish per year representing 20 percent of the total fish catch.

Government patronage for the freshwater fishery was withdrawn in 1990 and fish



breeding and stocking stations were closed down. Patronage was restored in 1995 and today there are 14 fish breeding centres. Ornamental fish exporters in Colombo give the juveniles of some of their export species for inland farmers to rear to the adult stage and then buy back stocks. This has become a useful additional source of income for farmer families.

There is still much scope for breeding both food fish and ornamental fish in inland waters that needs to be exploited. Fish is the major source of protein in Sri Lanka. In spite of the opportunities available for fish culture in inland waters, and for capture of sea fish, a high proportion of children suffer from chronic or acute protein malnutrition.

### 9.3 Recommendations

- i) **Create a single body to guide and coordinate the activities of the different institutions involved in the supply, use and management of water.**

It is now accepted that user based allocation of water will be more effective and efficient. Translating this concept into action requires significant institutional changes. The first step in this direction will be to set up a central authority that will develop Terms of Reference for itself and for each other agency dealing with water use. All the agencies should pay particular attention to water demand management.

The government has implemented the recommendation to "establish a National Water Resources Council supported by a full-time Secretariat. This Council would be a high level advisory body consisting of government agencies and groups concerned with water resources. It would be responsible for the development of a national water resources policy, water resources law and a (water resources)

Masterplan". (ADB/USAID) The National Water Resources Act which is under preparation will define the principles governing the management and allocation of water resources.

It has been recommended that the subjects and functions must be assigned to the appropriate ministries and that ministries performing similar functions must be amalgamated (ADB, USAID, 1994). A similar rational division of labour has been recommended for the Water Supply and Sanitation Sector. The functions of individual organizations need to be clearly defined to avoid overlapping.

- ii) **Formulate a set of national principles for water allocation and apply them in allocating water from any of the major river basins**

Water has been termed a "unitary resource" characterized by complex inter-linkages with many elements of the economy, society, and the bio-physical environment. A set of principles governing water allocation therefore needs to be drawn up in consultation with the concerned government agencies and the water user groups. To ensure comprehensive water resources management, water must be managed holistically and efficiently. Water resources management must take account of interdependencies among sub-sectors; it must simultaneously conserve aquatic ecosystems and the wider bio-physical environment. Efficiency is important because water is an increasingly scarce resource, which must therefore be used efficiently. Management of the watershed or catchment is crucial to the management of the water supplied by it. Water quality, the severity of floods, and the duration of low water flows are all adversely affected if the watershed is not sustainably managed. The watersheds of the country's 103 rivers,

as stated earlier, cover more than 90 percent of the country's total land area.

Within a river basin, allocation of water by the users themselves backed by effective administrative support can be a very efficient method since the users have a direct stake in the efficient use of the available water. A user group could be entrusted with the management rights to a canal that feeds the area which the group is cultivating or where their industries operate. This group would allocate the water among themselves. The recovery of the costs involved in this allocation can come from a number of sources. In India such organizations having management rights to certain canals have sold subsidiary rights to the use of the water for purposes other than irrigation such as fishing or the rearing of livestock. (Meinzen-Dick and Jackson, 1995)

**iii) Implement reforms to ensure that water is allocated efficiently within each sector**

Water needs to be allocated in a manner that ensures the highest possible social benefit because of its scarcity, the high cost of diversion and the need for sustainability. The focus should be on allocating surface water. An incentive provided for water conservation would also encourage efficiency. The first step in increasing efficiency in the use of water is to recognize that water is an economic good and therefore has an economic value. Water must be incorporated into a market system and a realistic price assigned to it. This price must reflect its true opportunity cost.

Efficiency of water use can also be improved by the participation of beneficiaries and users during all phases of management, decentralization of decision making; by privatization of water sector enterprises; and by targeting economic

instruments such as service and water charges, and subsidies at user group level. Water sector management must be completely businesslike, and the standards of integrity and transparency expected by the community at large must be maintained.

Two major reforms are needed in the large user sector of irrigation. The focus must move away from large scale irrigation projects (for rice production mainly). These large irrigation schemes have absorbed 30 percent of the country's total public investment since 1970. There is a need to divert more resources to rain-fed farming, smaller irrigation systems such as cascade tanks, and for reducing the proliferation of Salvinia weed in tanks (reservoirs). Secondly, large scale irrigation must be managed like any other large utility such as electricity or pipe borne water. The Irrigation Department should develop a commercial approach to issues and strive to improve the attitude of the farmers who practise irrigation. Converting irrigation into a utility requires major reforms aimed at improving management.

**iv) Design and implement a program for monitoring water quality**

Monitoring the quality of water and analysing the data is important for planning, developing and managing water resources. While some data has been collected, there is no long-term comprehensive water quality monitoring program. Given the large number of institutions involved the program will have to be drawn up carefully, covering both ground and surface water.

**v) Develop a Strategy for groundwater management**

Underground aquifers, once polluted, can take generations to recover. The Water Resources Board takes groundwater samples when drilling new wells, but no

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systematic monitoring of groundwater takes place, nor are there any controls on groundwater extraction.

The need for a groundwater management strategy is greater than for surface water since surface water extraction is generally

controlled by government agencies, while groundwater extraction is by the private sector. Groundwater extraction is also much less visible and harder to regulate than surface water extraction.

1995      資料 3 - 13(1)

Name of the project	Source of fund	Cost (Rs) in Million
1. I.F.A.D.	I.F.A.D.	2.103
2. Mahaweli Zones	UNICEF	7.567
3. IBSP - Puttalam	UNICEF	2.835
4. IRDP - Moneragala	NORAD	0.990
5. Udawalawa Irrigation Development Programme	A.D.B.	0.894
6. NWS&DB - Valaichchenai	NWS&DB	0.211
7. IRDP - Batticaloa	UNICEF	0.925
8. IRDP - Badulla	IFAD	0.060
9. FORUT	FORUT	0.140
10. NORA	NORAD	0.220
11. UNHCR	UNHCR	0.160
12. UNICEF	UNICEF	5.420
13. GA - Ampara	G.A.	0.627

1996

Name of the project	Cost (Rs) in Million
1. NWP / WRDP	3.207
2. I.F.A.D.	1.513
3. IBSP - Puttalam	3.437
4. Mahaweli	6.327
5. IRDP - Badulla	2.203
6. NWS&DB	0.545
7. B.O.I.	0.225
8. G.A. - Vavuniya	2.081
9. IRDP - Moneragala	0.440
10. Udawalawa Irrigation Development Programme	0.514

15.12.00

RSW/sp

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1999

Name of the project	Cost (Rs) in Million
I.F.A.D.	2.105
A.G.A. - Vavuniya	2.694
I.R.D.P. - Badulla	0.920
National Water Supply & Drainage Board	0.005
Mahaweli Economic Agency - Walawe	0.246
I.R.D.P. - Badulla	0.469
UNICEF - Puttalam	1.105
D.S. - Vavuniya	0.390
International Committee of Red Cross	5.031

15.12.00

RSW/sp

1997      資料 3 - 13(3)

Name of the project	Cost (Rs) in Million
1. Mahaweli Economic Agency of the Mahaweli Authority of Sri Lanka	0.183
2. IRDP - Moneragala	0.079
3. National Water Supply & Drainage Board	0.125
4. N.W.P. / W.R.D.P.	1.734
5. I.F.A.D. Project	0.722
6. I.B.S.P. - Kachcheri, Puttalam	0.130
7. Government Agent - Vavuniya	2.202
8. I.R.D.P. - Badulla	2.180
9. G.A. - Vavuniya	0.678
10. FORUT	0.048
11. UNICEF	0.105

1998

Name of the project	Cost (Rs) in Million
1. Mahaweli Economic Agency of the Mahaweli Authority of Sri Lanka	0.225
2. IRDP - Moneragala	0.088
3. N.W.P. / W.R.D.P.	0.069
4. I.F.A.D.	1.419
5. A.G.A. - Vavuniya	3.346
6. I.R.D.P. - Badulla	1.214
7. UNICEF	1.214

15.12.2000

RSW/sp