

WATER AND SANITATION

IN

TANZANIA

**A REPORT FOR THE HUMAN
DEVELOPMENT INITIATIVE (HDI)**

By

Mrisho M. Kivugo

Dar es Salaam, Tanzania

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ACRONYMS AND ABBREVIATIONS

AWEC	Annual Water Engineers' Conference
CUMECS	<i>Cubic metres per second</i>
CCT	Christian Council of Tanzania
d	day
DANIDA	Danish International Development Agency
EEC	European Economic Community
FAO	Food and Agricultural Organization
ha	hectare
hr	hour
km	kilometres
km ²	square kilometre
l	litres
L	<i>Lake</i>
m	metres
m ³	cubic metres
MAJI	Ministry of Water, Energy and Minerals
mg	milligrams
mm	millimetres
NGO	Non Governmental Organization
No.	Number
O&M	Operation and Maintenance
S	Seconds
Tsh	Tanzania Shillings
UNICEF	<i>United Nations International Children and Education Fund</i>
VIP	Ventilated Improved Pit Latrine
VWF	<i>Village Water Fund</i>
VWC	Village Water Committee
HESAWA	Health through Sanitation and Water
UNDP	United Nations Development Programme
SIDA	Swedish International Development Agency
NORAD	Norwegian Agency for International Development
FINIDA	Finish International Development Agency
MWEM	Ministry of Water, Energy and Minerals
EU	The European Union
NUWA	<i>National Urban Water Authority</i>
IDWSSD	International Drinking Water Supply and Sanitation Decade
RWE	District Water Engineer
RDD	Regional Development Director
EIA	Environmental Impact Assessment

1. INTRODUCTION:

The ultimate objective of development is improving the quality of life. Of the basic requirements of life, water and sanitation services are extremely vital for survival. The purpose for conducting research in the area of water and sanitation for the Human Development Initiative is to be able to make an assessment of the current state of water and sanitation services in the country. Data and relevant information have been collected, analysed and presented in a statistical form to indicate the level of service coverage and to systematically reveal existing disparities from one area to another. It is intended that the analysis shall give some light on future resource targeting.

During the study, present level of political commitment to the sector have been reviewed through interview with high authorities as well as analysing budgetary allocations and clarifying goals/strategies which have been set by the sector. Where necessary proposal for realistic goals and strategies plus cost implications have been made.

The bulk of the work has been on data and information collection. Efforts have been put to collect as much data and information as possible on water and sanitation at district level. Fortunately water supply coverage data have already been compiled by the Regional Water Engineers. In some cases coverage for villages is also known. What is required to be done is to verify on site some of the information and to make some sense out of it for planning purposes. Much of the sanitation data is only on latrization. Even the latrization figures do not have any reference to the expected measure of hygienic conditions, like for instance, in the case of water service coverage, the yard stick is "25 litres of clean and safe water per capita per day within 400 meters from a homestead". Furthermore in most cases, sewerage disposal, waste water disposal, solid waste disposal and storm water drainage problems are not tackled in detail both in urban areas and rural areas.

In the future some research work need to look into these issues very critically if any meaningful conclusions are to be made in as far as sanitation services coverage is concerned particularly in urban areas.

It has been established that the side effects of economic adjustment process have taken a heavy toll on the welfare of the vulnerable groups and on the social service delivery system. This study reviewed these processes by looking at resources allocation to the sector, technologies adopted, institutional arrangements, manpower, beneficiaries and women involvement and environmental issues. Recommendations on each of these issues have been made in order to make decision makers able to target future resources for human development.

2. NATIONAL GOALS AND POLICIES,

Insufficient and polluted water supplies and poor sanitation cause the spread of water related diseases and also bring about high infant and child morbidity. The incident of water related diseases which include water-borne diseases, water washed diseases, water based diseases and insect vector diseases have been and are still very prevalent in Tanzania today, as shown in Appendix XV.

Besides the above mentioned human suffering, water is very basic for socio-economic development of any nation. Water is life. Without water, life cannot be sustained. Water is a major factor in commanding the progress of peoples civilization. Undoubtedly it plays an important role in the current energy, food, health and environmental crisis, because it is involved in hydropower generation, agricultural production, and above all water is a necessary commodity for both domestic and industrial uses.

Realising the aforesaid and to ensure that all Tanzanians have access to the basic amenities of life consistent with human dignity, in 1971 the Government of Tanzania launched a twenty year (1971 - 1990) Rural Water Supply Programme with the objective of providing clean, safe and adequate water to rural population within easy reach of 400 metres from a homestead. This goal coincided with the recommendations of the United Nations Global Water Conference in 1977 held at Mar del Plata, Argentina where the UN General Assembly during its 35th Session on 10 November 1980 proclaimed by its resolution A/RES/35/18 the period from 1981 to 1990 as the International Drinking Water Supply and Sanitation Decade (IDWSSD). The resolution called upon the member states to enhance their efforts in order to provide their population with adequate and safe drinking water and sanitation facilities by the end of the decade. (Ref. 14).

In Africa the Lagos Plan of Action aimed at the economic development of the continent over the period 1980 - 2000; fully endorsed the objectives of the IDWSSD and urged the member governments to undertake appropriate actions to achieve these objectives.

Tanzania being a staunch supporter of UN deliberations, fully endorsed the decade and incorporated it in the twenty year programme. Notable achievements which have been realized during this period include the following:-

- Establishment of the Water Resources Institute;
- Preparation of Water Master Plans for 17 Regions;
- Training of over 300 professionals which included: Civil Engineers, Mechanical Engineers, Electrical Engineers, Hydrologists, Hydrogeologists and Research Scientists;
- Construction of Zonal Water Quality Surveillance and Pollution Control Laboratories;
- Institutional changes have evolved with time to streamline sector functions; and above all,
- A Water Policy has been prepared and adopted.

The Water Policy was launched in November 1991 with the objective of guiding the development of the water sector. The policy sets guidance of optimal utilization of water resources in the country. Issues of appropriate and affordable technologies, sustainability, beneficiaries involvement, cost sharing and recovery, environmental considerations, operation and maintenance of water schemes, floods and drought mitigation and human capital development are emphasized in the policy. (Ref.1).

Despite all the shortfalls in meeting the target during the decade, the Government has been making domestic water supply and hygienic excreta disposal one of the major development priorities. The rural water supply coverage stands at 46.3 per cent and for sanitation it is 79% whereas for urban areas water supply coverage is 68.5 percent and for sanitation it is estimated at 97 percent. (Ref.22).

There were many problems which affected achieving the target set. These problems included inadequate financial resources, manpower, equipment and spare parts and above all overall decline in economic growth during the decade. In view of all these problems the target is now set at the year 2002.

Action Plan for the implementation of the 2002 target has been prepared with the objective of identifying resource requirements, the various actors and defining key indicators for programme realization. During the 1994 Budget speech it was reported that Tshs.445 billion would be required to realize the 2002 goal.

Most immediate crash programme which is in the pipeline include:

- Completion of water supply projects presently under construction,
- Undertaking distribution of water to various users from reservoirs which have already been constructed;
- Construction of new water sources in arid and semi-arid areas in the country,
- Rehabilitation and expansion of water supply schemes in all major urban centres (Regional and District headquarters).
- To give special consideration to regions which do not have donor assistance.
- Provision of water and sanitation to "Highway Settlement", and
- Enhancement of Sewerage and Drainage activities in urban areas. (Ref.13).

3. INSTITUTIONAL ARRANGEMENTS AND MANAGEMENT ISSUES

The purpose of this part of the write-up is to examine the institutional structures, administrative practices for supporting an effective and efficient water and sanitation services, division of responsibilities and inter-agency coordination and collaboration.

Water Sector has been shifted from one Ministry to another while its services and status grew as depicted by the historical chronology below:

1946: Water Development Department was established for the first time under Public Works Department. It comprised of three Section:

- The Geology Section with its headquarters in Dodoma
 - Hydrology Section with its headquarters in Arusha.
 - Irrigation Section with its headquarters in Dar es Salaam.
- 1955: Water Development Department was re-named the Water Development and Irrigation Department (WD & ID), with its headquarters at Ubungo, Dar es Salaam.
- 1959: Water Development and Irrigation Department was placed under the Ministry of Natural Resources.
- 1960: The "Division" was moved to a new Ministry of Lands, Surveying and Water.
- 1961: The Water Division was moved to the Ministry of Agriculture.
- 1964: The Water Development and Irrigation Department was moved back to the Ministry of Lands, Settlement and Water Development.
- 1969: The Division was placed under the Ministry of Agriculture, Food and Cooperatives.
- 1970: A new Ministry of Water and Power was formed.
- 1975: The Ministry of Water and Power was re-named the Ministry of Water, Power and Minerals.
- 1980: The Ministry was again re-named the Ministry of Water and Energy. Minerals became a Ministry of its own.
- 1985: The Water Sector was moved into the Ministry of Lands to form a new ministry of Lands, Water, Housing and Urban Development.
- 1987: *Ministry of Water* was established.
- 1990: Ministry of Water, Energy and Minerals was re-established.

From the above chronology it is evidently clear that the importance of water sector started to pick up some **political motivation during the 1970s** when the twenty year water programme was proclaimed - with the creation of a Ministry for Water and Power. Nevertheless the continued shifting of the sector from one Ministry to another coupled with sporadic changes of technical and administration top executives hampered effective and efficient delivery of services from managerial point of view.

The organogram for the present Ministry of Water, Energy and Minerals is shown in

Appendix 1.

According to the set-up, Commissioner for Water Affairs heads a "Division" made up of four "Sections" namely:

- (i) Water Research Section,
- (ii) Design, Construction and Material Testing Laboratory Section
- (iii) Operation, Maintenance and Water Laboratory Section and
- (iv) Sewerage and Drainage Section.

In view of the nature of the duties and responsibilities involved in Water and Sanitation Sector the Commissioner should head a "Department" and the Assistants or Directors to head "Divisions". Further, by virtue of the duties of the so called "Water Research Section" it should be named "Water Resources Division" with its duties to include Water Quality Investigations.

The responsibilities of the ministry in as far as Water and Sanitation is concerned are elaborated in the Water Policy and in brief they include the following:

- Water resources Planning development and management;
- Water resources investigations (hydrological, hydrogeological and water quality);
- Supplying safe and wholesome water in adequate quantities to rural and urban population of Tanzania (Mainland).
- Removing storm water and waste water from urban areas.
- Treating polluted water to acceptable levels before discharging it into natural streams, lakes and oceans.

Encouraging the public to conserve and promote the cleanliness of the environment in which they live.

The Ministry of Water, Energy and Minerals is the principal agency responsible for all water and sanitation activities in the country. Other Ministries which are also involved in water and sanitation activities are:

- Ministry of Health (AFYA) is mainly responsible for rural sanitation aspects;
- Ministry of Community Development, Women Affairs and Children - mainly responsible for community involvement, education and mobilization,

- Ministry of Lands and Urban Development is responsible for drainage and sanitation
- Ministry of Agriculture and Livestock and Ministry of Tourism, Natural Resources and Environment are responsible for forestry and environment protection.
- Ministry of Local Government is responsible for regional, district and village administration.
- Prime minister's Office - Co-ordination aspects

The regional and district water offices have their own organisational set-ups. Since the establishment of Local Government, Regional Water Engineers (RWE) are administratively answerable to the Regional Development Directors (RDD). The District Water Engineers are responsible to the District Executive Director (DED). Technically they get advice and consultation from the Ministry.

It has been observed that there are adverse and fragmented roles and responsibilities of different institutions and actors which are handling water and sanitation activities at different levels. The varied administrative practices and lack of **cross-sectoral and integrated approach** are hampering effective and efficient delivering of the expected water and sanitation services. **Research and development** activities to cater for water and sanitation needs have almost been neglected. Efforts have to be made to make the issues raised in the Water Policy document a reality.

The Water Policy is very articulate on the issue of linkages and information sharing, coordination of sector activities, community participation, privatization, distribution of roles and responsibilities of sector agencies, supporters and beneficiaries and integration.

This study made a broad overview of the institutional problem. It is recommended that a thorough and comprehensive study be made on institutional arrangements that would guarantee efficient and less bureaucratic operation of water schemes both in urban and rural areas. The present move to make urban water supplies self-sustaining operating under the umbrella of Executive Boards is an important step towards realization of the above objective.

4. FINANCING OF WATER AND SANITATION SECTOR

Financial resources allocated by the Government in the water and sanitation sector does not commensurate with actual sectoral needs. The Government has been short of fiscal resources for development and both water supply and more particularly sanitation have traditionally received very low priority in funding. Consequently there has been a considerable under-investment in these basic facilities.

The medium-term plans usually contain very encouraging statements on the importance of social objectives and often emphasize the need for larger financial allocations to these objectives, but in the annual budgets the actual allocations are invariably lower. Funds allocated for the Sector between 1969/70 and 1993/94 are given in Appendix IX.

4.1 Sector Funding

Funding has been one of the hindering factors in the development of the sector. The sector has not been accorded the priority it deserves. For example, it was estimated at the beginning of the Decade (1980/81) that a total of Tshs. 15.67 billion was required to supply the backlog of rural population by the year 1990. However, only a total of Tshs. 7.57 billion was made available. This has made it difficult to achieve sector objectives and plans Refer Table 1.

Table 1:

SECTOR FINANCIAL ALLOCATIONS FOR THE DECADE: 1980/81 -1989/90

ALLOCATIONS

YEAR	T.SHS.('000)	USA \$	EX. RATE
1980/81	427,219	51,472	8.3
1981/82	377,948	46,660	8.1
1982/83	316,716	32,318	9.8
1983/84	344,783	27,148	12.7
1984/85	489,508	27,666	17.7
1985/86	317,856	13,760	23.1
1986/87	616,596	11,812	52.2
1987/88	1,300,881	17,162	75.8
1988/89	2,033,820	21,252	95.7
1989/90	1,340,354	9,244	145.0
TOTAL	7,565,676	258,494	

Over the years, beginning the financial year 1969/70 through the year 1993/94, the Government has been allocating an average of 3.99% only of its development budget to the water sector (Refer Appendices IX and X. These annual allocations of funds for the sector programmes have been inadequate and diminishing, thus making it impossible to achieve the intended sector objectives. According to the review of the water sector performance, carried

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the 20 year programme was revised to extend to the year 2002. By the end of the 1991 the 20 year programme ended with 8,218,900 people, out of 19,138,600 or 42.9% in the rural areas, served with water. At the end of 1992 the number of rural people with water had been raised to 9,475,000 or 46% out of the total rural population of 20,559,000.

4.3 Resources Required for the (1993-2002) Programme:

The task ahead seems to be so enormous that the Government should mobilise all the available resources to release the set objectives. The National Population growth rate of 2.8% is causing an annual increase of 1,000,000 people. The estimated backlog of people to be served between 1993 and 2002 stands at 24,000,000. The current rate of serving only 700,000 per year will not get anywhere closer to achieving the set sector objectives by the year 2002. New approaches to planning, funding and sector monitoring are called for. The just prepared National Water Supply and Sanitation Programme (NWSSP), 1993 - 2002, requires an immense input in terms of funding. It is estimated that 44.5 billion shillings will be required each year in order to release the 1993 - 2002 sector development objectives. It is hoped that the Water Policy which was launched in 1991 will greatly assist in guiding the programme course of action so that each concerned party; the Government, various organisations and individuals can play their required role in making the programme a success. At the centre of the programme development is adequate O & M infrastructure so that the sector can be sustained.

According to the Plan, anticipated sources of funds are the Government, External Support Agencies (ESAs); NGOs, the Private Sector the Stakeholders and the Beneficiaries.

Table 2:

The External Support Agencies' participation in the National Water Supply programme so far is shown below:

DONORS PARTICIPATION IN THE NATIONAL WATER PROGRAMME

DONOR	NAME OF REGION	FUNCTION
SIDA	Mwanza, Mara, Kagera	PWMP and Construction of Schemes
FINNIDA	Lindi, Mtwara	PWMP and Construction Schemes
DANIDA	Iringa, Mbeya, Ruvuma	PWMP and Construction of Schemes
NORAD	Kigoma, Rukwa	PWMP and Construction of Schemes
AUSTRALIA	Singida	Construction of Schemes
CANADA	Dar es Salaam, Coast	PWMP Only
UNITED KINGDOM	Dodoma	Construction of Water Schemes
JAPAN	Kilimanjaro	PWWP only
WORLD BANK	Tabora	PWMP only
FRG	Tanga	PWMP and construction of Schemes
NETHERLANDS	Shinyanga, Morogoro	Construction of Water Schemes
UNICEF	Iringa, Mtwara	Construction Water Schemes

PWMP - Preparation of Water Master Plan.

Donors have played a very significant role in their respective areas of concentration with regard to:-

- Training,
- Community and
- Procurement of materials.

Another source of finance which has not been explored is the **Private Sector**. There is a need to spell out and address the role of the Private Sector in water and sanitation service delivery. Activities which can be promoted by the private sector need to be identified.

5. TECHNOLOGIES IN WATER SUPPLY AND SANITATION

At the beginning of the 20 year water supply programme, Tanzania had the ambition of supplying piped water to the whole population. Towards the end of the decade it became evident that this was a far fetched idea which would require many years and unattainable resources to achieve. To speed up the provision of water, least cost and appropriate technologies were recommended.

5.1 Water Supply

Technology selection for rural water supply schemes has to be made by the community itself having considered availability and quality of water resources, availability of materials and equipment, involved costs, expected life of water supply scheme and level of development of the community under consideration.

In accordance with the Water Policy, the most efficient sustainable and affordable technology should be adopted. Presently the following technological mixes are in use:-

- Gravity
- Shallow wells,
- Boreholes,
- Surface - pumped, and
- Rainwater harvesting

An ideal appropriate technological mix should possess the following qualifications.

- (i) the pumps, accessories, conveyance materials and spare parts should be manufacturable and readily available.

- (ii) the beneficiaries should find the project easy to construct, operate and maintain,
- (iii) the technology should be affordable,
- (iv) the technology should be socially, economically and technically acceptable,
- (v) technical skills should be available at grass root level.

In mountainous areas - Kilimanjaro, Arusha, Usambara, Uluguru, Southern Highlands etc, supplying water by gravity is accepted as being appropriate although initial per capita investment costs are high. Shallow wells have principally been accepted as "least cost and appropriate" in most parts of the country. For semi-arid areas - Dodoma, Singida, Shinyanga, Tabora etc, where most of areas shallow wells and gravity technologies are not feasible or fail, options are deep and powered boreholes and dams. With these technologies, investment, operation and maintenance cost are very high.

In general, surface water contains heavy seasonal sediment loads and is bacteriologically unsafe. Surface water therefore, very often requires treatment, resulting into high investment and operation costs and high demand for skilled manpower. Ground water may not always be of a quality suitable for drinking water, but as a rule, it is safe compared to surface water. Apart from springs occasionally found in hilly areas, shallow wells and boreholes represent the most reliable ground water source. The construction of shallow wells or narrow diameter wells of greater depths requires machine powered equipment. Even the simplest type of drilling equipment, the percussion Rig, requires high initial costs and skilled personnel, and its operation is entirely dependent on the availability of spare parts and fuel. Shallow wells on the other hand do not have these demanding requirements, but have limited service levels and are feasible only where ground water is available at shallow depths. Careful consideration of all these factors needs to be done in making technological choices.

Rainwater harvesting techniques are being encouraged and are now taking up the ground pretty fast. Rainwater harvesting from roofs and ground catchments is now finding applications in arid and semi-arid areas of Shinyanga, Singida and Dodoma Regions. In March 1994, a Rainwater Harvesting Pilot Project was initiated in Dodoma with UNDP financial assistance. Besides roof catchments, the project looks at harnessing water from sandy rivers. The projects' immediate objectives are to test the applicability of rainwater harvesting management systems for their appropriateness both technologically, socio-economically and environmentally. The development objective is to improve the water supply situation in the project area and thereby to improve the quality of life of the rural population in Dodoma Region. The Dodoma experience is intended to be replicated elsewhere in the country with similar climatic features. The project is being carried out by Africare, a US - based Non-governmental Organization and is financed through UNDP.

During the decade in most cases the "appropriate technology" qualification was not met resulting in water schemes failing to function as envisaged. Surveys indicate that as many as 40 percent of completed schemes are inoperative. It has been established that reliability of a water scheme depends on technology, resource input, repairability, maintainability and management.

The Ministry has 69 drilling rigs of different makes out of which 47 are in good working conditions. During the last ten years (1985-1995), 1726 wells have been drilled, out of these 1011 have been successful giving safe and good quality water with a total yield of about 7072 m³/hour.

Water pumps in rural water supplies are of various types and makes. The most widely used pumps are the low speed, positive displacement reciprocating pumps, the centrifugal pumps, the power include renewable energy, hydro power, diesel, manual and electrical.

Hand pumps are presently in wide use in rural water supply programme. Over 70 percent of these schemes are operational. Their reliability depends on the pumps and the well and the water source. Drop in the water level particularly in dry season or complete drying up of the wells, as in the case of Shinyanga, Singida, and Mtwara accounts for over 20 percent of failures.

Windmills are in use in areas of relatively strong winds in Singida and Dodoma regions - although their efficiency has proved to be very low.

Other devices currently in use in rural water supply schemes include solar water pumps and hydraulic rums.

5.2 Sanitation

As water supplies improve in urban areas, the need for proper waste water disposal is becoming more critical and the advantages of planning both services at the sometime are apparent (Ref.18, p 279).

The choice of sanitation system is limited by the availability of water. Sewerage requires greater per capita amounts of water for carriage of wastes. Simpler forms of sanitation capable of operating with low level of water supply service and not requiring expensive household plumbing will be less costly than conventional sewerage and yet can provide the same health benefits.

Improved pit Latrines

Pit latrines are the most common excreta disposal system in Tanzania. The Ministry of Water, Energy and Minerals is conducting a project for developing and improving the Ventilated Improved Pit (VIP) latrine at Buguruni in Dar es Salaam. General designs of the latrine have been developed to make the unit odorless with minimum fly nuisance. (Ref.6).

The main characteristic of these improved designs is a 1m square, 3-8m deep pit offset slightly from the squatting plate and superstructure to accommodate an external vent pipe, which should be at least 75 mm diameter, painted black, ventilating air flow up the pipe is induced by convection and a gauze screen on the top of the vent prevents the emergence of flies and mosquitoes, which eventually fall back into the pit and die.

Septic Tanks

In urban areas houses with water connections, septic tanks provide a high level of service without the need of commitment of community funds for sewerage. However, disposal of septic tank sludge is still urban councils although they do not have facilities for septic sludge removal.

Other sanitation technologies are described in part 8 of this report.

6.0 WATER SUPPLY AND SANITATION SERVICE LEVELS

6.1 Water Supply Coverage

The national rural water supply programme and the Decade both aimed at attaining full coverage, 100 percent, by the year 1991. In 1980, a review was made on the implementation of the first half of the water programme and formed a data baseline for the decade. It was estimated that at the beginning of the decade 38 percent of the total rural population had been served with potable water.

Most recent figures reveal that rural water supply coverage is 46.3 percent while urban coverage stands at 67.5 percent.

Appendix III and IV show urban and rural water supply coverage, and Water Demand and Supply in all major urban centres in Tanzania-mainland. Appendix V shows data of village Water Committees and Village Water Funds which have been collected as of December, 1994. Appendix VI shows the condition of some of the water supply schemes in the country. Financial implications for urban water supplies are depicted in Appendix VII. (Ref.10).

6.1.1 Coverage Figures

The coverage figures contained in the appendices have to be used with caution. Usually the "coverage" figure of "service level" given are those for scheme design capacity against actual demand. In actuality the amount supplied is always below the capacity. Further, in urban areas where there are many industries and other major water consuming activities such as gardening, all the water supplied is assumed to be consumed by the population in that particular urban centre. Another factor which lowers down the coverage figure is due to low production and frequent breakdowns. Thus the true service level is very low.

In rural areas the coverage level problem is similar to that of urban centres. Once there is a scheme in a village of any capacity, it is automatically assumed that the entire population in the village is covered, let alone the frequent breakdown and failures of some schemes like shallow wells during dry season. This village level coverage gives rise to cumulative effect on the district, regional as well as on the national service coverage.

Therefore it is necessary to use the coverage figures for planing purposes with great caution. A village to village survey is needed to review the service level coverage. At the sometime a monitoring system should be systematically be instituted at all levels.

6.1.2 Dam Construction

Emphasis is put on construction of dams especially in semi-arid drought prone areas where there are no surface water sources. These regions include: Mara, Mwanza, Shinyanga, Tabora, Singida, Arusha, Dodoma, Kilimanjaro, Tanga, Coast and Mtwara.

During the last ten years (1985 - 1995) the following dams have been constructed:

- Kyarano dam in Mara Region,
- Mwisanga dam in Dodoma Region,
- Nakopi dam in Mtwara Region,
- Baraidi dam in Shinyanga Region,
- Kilimi dam in Tabora Region.

Since the beginning of 1993/1994 financial year, work has been resumed to complete construction of Mugumu dam in Tabora Region.

6.1.3 Major Rural Water Supplies

Major rural water supply schemes which have been undertaken by the Government during the last ten years (1985 - 1995) include the following:-

- Handeni Trunkmain in Tanga Region
- East Kilimanjaro Trunk main in Kilimanjaro Region
- Makonde Water Supply in Mtwara Region
- Bulenya/Nanga in Tabora Regions
- Nyamazugo/Sengerema in Mwanza Region,
- Utaruni in Kilimanjaro Region,
- Bagamoyo in Coast region,
- Wang'ing'ombe in Iringa Region,
- Hai Project is still under-construction and is shelled to be completed by 1996.

6.1.4 Other Rural Water Supplies

With assistance from different donor agencies, many rural water supplies including shallow wells and small piped schemes have been accomplished as indicated under chapter 4 on "Donors participation in the National Water Programme".

Besides the donors mentioned above there are other international financing agencies, NGOs and Private firms which are continuing implementing water supplies throughout the country. These institutes include: EEC, KFW, OXFAM, AFRICARE, WATER AID, CCT and other Church Organizations.

6.1.5 Urban Water Supplies

Urban population has been increasing from 2.3 million in 1978 to 4.5 million in 1988 and to 5.3 million at the end of 1993. The population increase indicate an annual growth rate of about 7 - 10%. Thus it can be estimated that about 16.0 million people would be living in urban areas by the year 2002.

The resulting consequences of rapid urbanization is the escalating water demand. Current water production for urban centres is estimated at 494,300 m³/day while the demand is close to 912,600 m³/day.

It is evident that financial resources allocated by the Government in the water sector is very inadequate compared to actual sectoral requirements. As a result practically all urban water supply schemes are not delivering the expected service levels. Immediate Works Programme to alleviate the problem has been started in some urban areas like Arusha, Iringa, Musoma, Mwanza, Bukoba, Kilwa-Masoko, Masasi, Kigoma-Vijiji, Newala, Nachingwea, Mbeya, Tanga, Tabora, Dodoma, Mbeya, shinyanga, Lindi, Morogoro and Moshi.

The Ministry is also looking for alternative water sources for the City of Dar es Salaam, Dodoma, Iringa, Arusha and Tanga. In an effort to assist solving the problem of urban water supplies, European Union (formally European Economic Community) has financed the rehabilitation and expansion of urban water schemes of three towns, Mwanza, Mbeya and Mtwara. The rehabilitation projects were carried out between 1984 - 1994. The last of the three water schemes completed was Mtwara in August, 1994. Water supply feasibility studies are also been carried out for other towns in order to improve the service levels.

Operation and Maintenance of urban water supply schemes in Tanzania face the following problems:

- (i) Lack of funding,
- (ii) Lack of personnel,
- (iii) Lack of expertise, and
- (iv) Lack of powers to implement water policies,

These problem have led to:

- (i) Inadequate quantities and qualities of water produced,

- (ii) Water being polluted in the distribution systems,
- (iii) Water being wasted through leakages,
- (iv) Water being stolen through unauthorized connections, and
- (v) Water being unaccounted for (not billed, not paid)(Ref. 25)

In 1993 the Ministry of Water, Energy and Minerals carried out a study on the financing of O & M of urban water supplies with a view of looking into proper institutional framework for managing urban water supplies throughout the country. The study recommended inter alia the establishment of **Urban Water Boards** with operational autonomy to collect and spend revenue accruing from water bills. The Boards also have mandate to set their own water tariffs. In 1994 Water Boards to run water supplies in Arusha, Moshi and Tanga Municipalities were formed. During this financial year (1995/96) it is planned that Morogoro, Iringa, Dodoma and Tabora will have similar institutional set up. It is reported that Arusha, Moshi and Tanga are already making significant improvement in revenue generation. (Ref. 26).

6.2 Sanitation Coverage

Average rural sanitation coverage is estimated at 79 percent and that of urban is 97 percent. Sanitation facilities used include central sewerage systems, septic tanks with soak pits, traditional latrines and to some extent the newly introduced Ventilate Improved pit (VIP) latrines.

Generally, sanitation services in urban areas throughout the country are very poor. In Dar es Salaam for an example, garbage is stack on streets and at open market places, sewage runs through in open gutters, latrines are filled up and very unhygienic, facilities for emptying pit latrines and for collecting solid wastes are inadequate thus creating major public health problems. It is for this reasons that the reported sanitation service level should be considered inaccurate unless one talks about latrinization only.

Out of the 62 urban centres in mainland Tanzania, only eight (8) towns have sewerage systems. Towns with sewerage systems are Dar es Salaam, Tanga, Mwanza, Moshi, Arusha, Dodoma, Tabora and Morogoro. With an exception of Dodoma, the rest are dilapidated and need urgent rehabilitation. (Ref.6).

Major constrains facing sanitation include the following:-

- inadequate funding,
- shortage of manpower,
- local customs and beliefs,

- in-sufficient water supplies,
- limited community education in public health and personal hygiene, and
- inadequate enforcement laws.

Generally it can be stated that during the last ten years (1985-1995). The following have been achieved in as far as sewerage is concerned:

- (i) Feasibility studies, detailed designs, and construction and rehabilitation of sewerage systems have been done in 8 major urban centres, namely, Dar es Salaam, Tanga, Mwanza, Arusha, Moshi, Dodoma, Morogoro and Tabora.
- (ii) Solid Waste Management and Pollution Study of the City of Dar es Salaam has been carried out with the world Bank financial support and was completed in 1988.
- (iii) Environmental Sanitation Project dealt with mainly designing and construction of VIP latrines in Dar es Salaam, Tanga, Moshi, Arusha, Morogoro, Singida, Tabora, Mwanza, Kigoma and Dodoma.

Over 630 VIP latrines have so far been constructed.

- (iv) In 1987 Sewerage and Sanitation Policy was approved by the Government.

7.0 WATER RESOURCES

7.1 Surface Water Investigations

Tanzania is endowed with plenty of surface water resources in lakes, rivers and other existing wetlands. It has been estimated that the annual runoff to the oceans is about 74 km³.

This runoff flows through various drainage systems, major of which include the Pangani, Wami, Ruvu, Rufiji, and Ruvuma river drainage systems; Lakes Victoria, Tanganyika and Nyasa drainage systems and internal drainage systems of Lakes Rukwa and Eyasi and the Bahi depression. Major drainage basins and natural lakes are shown on Appendix XX and the Table below:

Table 3:

RIVER SYSTEMS

DRAINAGE NO.	MAIN DRAINAGE SYSTEM	RIVER/LAKE SYSTEM	CATCHMENT AREA KM2	TOTAL KM2
1	INDIAN OCEAN DRAINAGE SYSTEM	PANGANI RIVER BASIN	56,303	450,674
		WAMI/RUVU RIVER BASIN	72,930	
		RUFJI RIVER BASIN	177,415	
		RUVUMA & SOUTHERN COAST RIVERS	103,716	
		LAKE NYASA BASIN	30,310	
2	INTERNAL DRAINAGE SYSTEM TO LAKE EYASI AND BUBU DEPRESSIONS		153,802	153,802
3	INTERNAL DRAINAGE SYSTEM TO LAKE RUKWA		88,178	88,802
4	ATLANTIC OCEAN DRAINAGE SYSTEM		137,900	137,900
5	MEDITERRANEAN SEA DRAINAGE SYSTEM		79,569	79,569

For efficient and effective utilization of this abundant surface water resources in economic and social activities, a continuous and adequate hydrological monitoring system is required for precise quantification and qualification of the resource.

The existing hydrological network for the entire country is poor, inadequate, non uniform in standard and lacks proper operation and maintenance. The Hydrological Services Unit, the Government's organ responsible for the collection, processing and analysis of hydrologic data and the operation, maintenance and development of the hydrological network

is not allocated the required funds to meet requirements of an adequate proper hydrological network system.

In order to have precise, representative and reliable data of the various hydrological variables required in the design and operation of various water resources development systems for water supply, irrigation, rainwater harvesting, flood water mitigation and hydropower generation, a need exists to:

- (i) rehabilitate and standardize the existing hydrological network,
- (ii) expand the existing hydrological network to adequately cover the entire country,
- (iii) develop a system of operation and maintenance for sustaining the network through adequate funding,
- (iv) encompass newer convectional technologies of hydrometry, telemetry technology and transmission network to build a real time water resources and environmental monitoring data base system within the country.

7.2 Ground Water Investigations

The first step in groundwater development is to determine the location of suitable aquifers. This will often involve reconnaissance surveys of a given region using geological maps, aerial photographs, ground observations and geophysical surveys to detect characteristics indicative of water-bearing strata. Once an aquifer has been located the next stage in development is to assess the hydraulic properties of the aquifer that determine how fast water move into, through, and out of subsurface strata; the storage and yield of the aquifer, and how the water table varies naturally and under obstruction conditions. The main properties are represented by the hydraulic conductivity, transmissivity, and the storage coefficient of the aquifer. The determination of aquifer properties is normally assessed using pumping tests on wells drilled at optimum locations in the aquifer. The test well is pumped at a constant rate and observation on draw down of the piezometric surface or water table is made at observation wells located at a distance from the pumping well. Pumping test can be steady state or transient. In the steady state method the pumping test is carried on until water levels in the observation wells approach equilibrium conditions. In the transit state method, observation of water level are made against time; and are more commonly used since they enable the determination of the transmissivity and the storage coefficient for the aquifer. (Ref. 18. p.124).

Ground water is a potential resource to Tanzania. It is estimated that ground water from boreholes, shallow wells and springs contributes more than 25% of the total domestic water consumption. The common ground water yielding aquifers in the country include:

basement complex rocks, with boreholes yielding up to 3l/s although average discharges vary between formations.

- karroo sediments (sandstones and conglomerates) which yield water to boreholes particularly where fractured, the yields range between 0.1 and 5 l/s, although boreholes in Tanga have produced over 15 l/s.
- coastal sediments, limestones within the sequence have produced between 1 and 6 l/s, sandstones have proved less productive yielding up to 2.5 l/s whereas marks and shells are unproductive.
- alluvial deposits of sands and gravels occurring in alluvial plains, deltas and river courses yielding between 0.2 l/s and 2 l/s.

Although the significance of ground water resources is undeniable, the occurrence of the resource in the country is not well established as the existing hydrogeological data collection system is poor and inadequate. At present efforts are mainly concentrated on boreholes drilling and shallow wells construction using very limited inappropriate defective equipment and facilities. Data records of boreholes and shallow wells are incomplete and not comprehensive. Most of the existing boreholes and shallow wells are not functioning due to lack of proper operation and maintenance facilities which include skilled personnel and funds to purchase fuel and spare parts for the installed machinery.

In order to fully utilize the abundant existing ground water resource in the country a need exists to:

- (i) fully establish the extensive and intensive occurrence of the resource through adequate proper hydrogeological investigation system.
- (ii) improve and expand boreholes data information,
- (iii) set up a boreholes/wells water level monitoring system,
- (iv) set up a data base of the various groundwater variables and boreholes information,
- (v) develop a system of utilizing non renewable energy resources such as the existing physical energy resources of wind flow for extracting ground water,
- (vi) train the beneficiaries, especially, women on how to operate and manage boreholes and shallow wells.

7.3 Water Quality Investigations:

The country has established temporary water quality standards but due to a variety of both management and technical problems, water supplied to consumers for various requirements by almost all the functioning schemes is normally raw, without any treatment and generally of poor quality.

The Tanzania Temporary Standards of physical and chemical quality of potable water compared with standards of other countries and the World Health Organization are shown in Appendix II.

The main reasons for supplying water of such quality include:

- non-availability of water treatment facilities,
- improper functioning of the installed treatment facilities due to inadequate operation and maintenance,
- non availability of treatment chemicals due to lack of funds,

Worn out distribution system (s) causes overland flow, sewerage and foul sewerage to infiltrate into distribution system.

Generally, monitoring of the country's water resource is not adequate. Some periodic surveillance of the water qualities at the intakes of large water supply schemes for domestic requirements is done.

The Government participates in the Global Environmental Monitoring Systems (GEMS/WATER) programme. The programme deals with normal water quality control in five selected water sources in the country. Statistical data on water quality from such sources are processed at the World Data Bank in Burlington, Canada in order that the results can be interpreted globally and later on be used by riparian states in monitoring subsequent changes in water quality as a result of environmental pollution.

For a proper assessment of the country's water resource and the supply of water of the required qualities to consumers a need exists to:

- establish a continuous water resources quality and polluters monitoring system.
- establish a data base of the various water quality parameters for the country's water resources.
- develop a system that will ensure proper operation and maintenance of water treatment facilities and the supply of the required chemicals.
- create awareness in the society for need for environmental protection of water supply schemes.
- intergrade management of water resources and liquid and solid waste as the pre-requisite to providing safe drinking water supply and healthy sanitation. Deep changes in attitudes and behavior are necessary to effectively provide a safe water supply country wide. (Ref.21 p 74)

7.4 Basin Management and Legal Aspects on Water Resources Management

The Minister responsible for Water Affairs, under Act No.42 of 1974 and its amendment Act No.10 of 1981 under section 7 (i) declared nine (9) gazetted water basins, as per Notice No.13 of 13th January 1989.

These basins include Ruvu/Wami, Pangani, Rufiji, Ruvuma/Lukuledi/Mbamkuru, Lake Nyasa, Lake Rukwa, Lake Natron/Manyara/Eyasi, Lake Victoria and Lake Tanganyika. These basins are supposed to have an office located in the basin under the administration of a Basin Water Officer under the Ministry dealing with Water Affairs, through the Principal Water Officer at the Ministry. In addition the Basin to have a Basin Water Board with members not less than seven (7) and not more than ten (10). However, the Central Water Board which existed after both Act No.42 of 1974 and No.10 of 1981 will continue to exist up till all Basins have Basin Water Offices and Boards.

To date only two basins have at least started functioning:

- Pangani basin has its offices located at Hale in Tanga region.
- Rufiji basin has its offices located in Iringa township.

The main function of the Basin Water Offices is to manage and control the utilization of the basin water resources, through continual monitoring of the existing water resources and enforcing all relevant utilization and management laws.

The importance of Basin Water Boards to manage optimal utilization of water resources in the basins is now becoming more obvious than ever before.

Recent low water flows in rivers, drought and flood occurrences, water shortages and associated power capacity and energy shortages which had major impact in the economy, and many other water resource-related conflicts in the basins are in principal associated with poor water resources planning and management.

The rapidly growing population forces more people to share the available water for agriculture, livestock, hydropower generation and other development activities thereby causing serious conflicts.

It recommended, in this respect, that **integrated water resources management** should be promoted. Formation of Water Basin Boards for the remaining river basins should be expedited.

For the Water Offices and Boards to be able to manage their tasks and functions accordingly a need exists to establish a system that will guarantee continual finance to meet all expenses. All users of the water resources in each basin should pay fee depending on the activity/activities the user is doing and the degree and type of destruction the activity/activities is/are causing to the water resources of the basin.

8.0 SANITATION

8.1 Surface Water Drainage

In most urban areas, uncontrolled rainfall runoff causes serious problems. Drainage problems are accentuated by the construction of buildings, pavements, roads and other surfaced areas which restrict natural drainage and increase both the amount and the rate of rainfall runoff. The problems are further intensified by uncontrolled construction of buildings in flood prone areas such as the Msimbazi flood plain area in Dar es Salaam and non availability of proper basic facilities of roads, water supply, surface drainage waterways and sewerage in the surveyed areas such as Mbezi Beach, Sinza and Tegeta areas in Dar es Salaam, Kawekamo and Nyegezi in Mwanza and Mwakidila in Tanga. Moreover, the few existing surface drainage systems in the urban areas do not function due to blockage resulting from poor design and lack of proper operation and maintenance.

In order to overcome problems associated with surface water drainage in our urban areas, there is a need for the Urban Development Department in the Ministry of Lands, Housing and Urban Development, which is responsible for all urban development issues to coordinate with all sectors involved; namely, Water Department, Ministry of Health, Urban Councils and other Institutions concerned with environmental sanitation.

8.2 Sewerage, Treatment and Disposal

Most urban areas, though with high densities of population and structures, do not have proper appropriate and adequate sewerage collection system and sewerage treatment and disposal facilities. In most urban areas, more than 80% of the population live in unsurveyed areas such as Manzese, Vingunguti, Buguruni and Kiwalani in Dar es Salaam, Mabatini and Mkuyuni in Mwanza and Mwanjelwa in Mbeya, which are mostly served with traditional pit latrines of poor design and perpetually overflowing due to inadequate emptying facilities.

And most of the surveyed areas such as Sinza, Mbezi Beach and Tegeta in Dar es Salaam and Majengo kwa Mtei in Moshi are neither covered with central sewerage system nor sewerage collection system. The few existing stabilization ponds to which sewerage collection systems are connected such as Vingunguti and Mabibo in Dar es Salaam are not operating properly due to inadequate operation and maintenance.

Most industries such as those in Mwanza municipality discharge raw industrial effluent without any treatment in the existing natural drainage flowing into Lake Victoria, thus creating a situation which highly threatens the biodiversity equilibrium of the lake.

8.3 Septic Tanks

Most houses in both urban and rural areas utilize septic tanks for sewerage disposal. Although this facility is only suitable for single individual houses, in most urban areas it is also utilized for multi-store buildings like those at Ubungo, Ilala and Tandika National Housing and at many other high-rise building estates in Dar es Salaam and other urban

centers throughout the country. Due to inadequate operation and maintenance, most septic tanks in urban areas overflow causing sewerage to flow variously in the natural drainage, thus creating unhygienic conditions.

In order to alleviate this problem, there is a need to apply the facility only to situations on which it is suitable, adhere to proper operation and maintenance and serve high rise buildings with central sewerage system.

8.4 Latrination

The pit latrine is the most common method utilized for excreta disposal in both urban and rural areas. Septic tanks are utilized in situations with adequate water supply.

In urban areas latrination is estimated at 97% (Ref. No.23). However most of the latrines have very unhygienic conditions. Latrination in the rural areas is not very extensive and the method used is mainly the pit latrine. In some parts of the country there are some people who because of traditional customs and beliefs do not use even the pit latrine.

It is recommended that efforts should be made to extend the use of Ventilated Improved Pit (VIP) latrine. This can be achieved through sensitization, demonstration and affordable designs. In some instances it may be necessary to carry out a detailed study on sanitary habits and cultural values pertaining to sanitation.

8.5 Solid Waste Disposal

Problem associated with solid waste disposal create unhygienic conditions in most urban areas. Practically all urban councils do not have adequate facilities to deal with solid waste collection and disposal. As a result garbage heaps are scattered all over cities and towns, creating terrible unhygienic and highly degraded environment.

In general sanitation problems including solid waste disposal could be alleviated by having proper management systems of handling solid wastes in urban areas. Urban councils should strive to establish manageable systems for handling both solid and fluid wastes. In this connection privatization and sensitization of the community is of prime importance.

9.0 MANPOWER FOR THE SECTOR

One of the decisive requirements for attaining the goal for provision of water and sanitation for sustainable development is to ascertain continuous availability of relevant human resources in sufficient numbers at all levels of service. Present and future manpower situation is shown in the table below:

Table 4:

PRESENT AND FUTURE (2002) MANPOWER SITUATION

Occupational Category	1988	2002
Engineers:		
Civil	149	200
Mechanical	26	176
Electrical	19	119
Drilling	1	10
Public Health	12	32
Hydrologists	43	50
Geologist/Hydrogeologists	50	100
Architects	1	5
Research Officers/Chemists	13	60
Planners/Economists	5	20
Sociologists	1	10
Accountants/Accounts Clerks	13	100
Manpower Officers	10	20
Technicians Grades I - IV	2540	3840
Craftsmen/Operators	6000	24000
Supporting Staff	3000	2500

Source: Ministry of Water, Energy and Minerals

In an attempt to alleviate the problem of shortage of professionals for the sector, a number of institutions abroad offered places for training as shown in the table below:

Table 5:

**PROFESSIONALS GRADUATING FROM OVERSEAS
(CIVIL, MECHANICAL AND ELECTRICAL)**

(1976 - 1987)

	COUNTRY/ YEAR	76	79	80	81	82	83	84	85	86	87
1	UK	4	7	4	7	4	3	3	3	-	2
2	INDIA	-	120	25	2	1	1	57	3	-	-
3	NETHER- LANDS	6	7	6	8	11	7	8	1	5	8
4	FINLAND	-	-	-	8	-	7	-	5	-	5

A total of 234 undergraduate engineers were trained at Roorkee University, India under a manpower crash programme between 1975 and 1986 with SIDA assistance. This input strengthened performance of the sector both at the Headquarters and in the Regions. An average of four qualified engineers are currently posted in each region. However a more serious shortage of engineers is eminent if immediate steps are not taken since the bulk of engineers trained in the crash programme in India has a very narrow age range, their retirement age is quite close at hand. This problem equally applies to hydrologists in which if no remedial measures are taken, there will practically be no professional hydrologist within the sector in few years to come.

Since top executive posts of the sector are manned by field professional, there is a need to acquaint them with managerial skills. Use of local management institutions like the Institute of Development Management (IDM) and the Eastern and Southern Africa Management Institute (ESAMI) should be promoted.

Most technicians, craftsmen and operators for the Water Sector are trained at the Water Resources Institute which was established in 1974. Prior to that, water technicians were trained at Dar es Salaam Technical College.

The Institute conducts two programmes, a three year course leading to the Full Technician Certificate (FTC) of the National Examination Council of Tanzania, and Craftsman training. Admission requirements for the FTC course are Form IV certificate or its equivalent with credits in Physics, Chemistry and Mathematics and Biology for the Water Quality option.

The number of Water Technicians who have graduated from the Institute since 1976 is shown option wise in the following table. Since its inception the Institute has lacked laboratories and workshops which are extremely important features for any technical institution if the training is to be meaningful.

Table 6:

The output of Water Resources Institute since its establishment in 1974.

YEAR	WORKS	HYDRO LOGY	HYDRO- GEOLOG Y	L.W.T	TOTAL	GIRLS	BOYS
1976	20	8	6	0	34	0	34
1977	36	10	16	0	62	0	62
1978	46	14	24	0	84	0	84
1979	NO EXAMINATION THIS YEAR. EXAMINATION MOVED FROM NOVEMBER TO MAY						
1980	52	20	33	0	105	7	98
1981	56	25	26	11	118	20	98
1982	49	21	25	13	108	12	96
1983	84	15	16	13	128	13	113
1984	75	9	15	12	111	7	104
1985	89	9	15	13	126	13	113
1986	42	0	13	12	67	11	56
1987	27	9	9	15	59	5	50
1988	26	9	9	15	59	9	50
1989	57	0	-	12	69	10	59
1990	47	-	-	11	58	6	52
1991	25	9	10	15	59	9	50
1992	42	7	11	12	72	9	63
TOTAL	773	165	229	148	1315	131	1184

The Institute has primarily been training for the needs of the Ministry of Water, Energy and Minerals. Time is now ripe for liberalizing the training. Training programmes could be developed to cater for not only the Ministry but for other institution and the private sector. It is quite possible to promote the institute to serve as an international institution such as "SADC" Training Institute for the water and sanitation sector.

Sanitation training courses are currently being carried out at Ardhi Institute where courses such as *Environmental Engineering, Rural and Town Planning, and Land Management and Valuation* are conducted. Training needs for sanitation need to be explored further.

10.0 ENVIRONMENT, GENDER ISSUES AND STAKEHOLDER INVOLVEMENT

Within the Water Policy, environment, gender issues and beneficiaries involvement are covered. In the IIESAWA programme for instance a gender policy has been adopted with the objective of creating gender awareness to all actors and beneficiaries within the programme and to deliberately encourage active participation of women in all programme activities especially in decision making, planning and implementation. The Water Policy calls for formulation of Village Water Committees, whose composition requires that over 50 percent must be women. Data on Village Water Committees and Water Fund is shown on Appendix IV.

Until May, 1995, out of 9,180 registered villages, 3726 have Water Committees and 2611 have Village Water funds amounting to over 146 million shillings.

As explained in chapter 6, that both urban water supplies and all major rural water schemes will in the immediate future be self-sustaining by fully involving stakeholders participation in cost-recovery measures.

Evidence shows that women play a key role at implementation levels with regard to the management of water and environmental resources. In many programmes these roles are insufficiently recognized. More effort is required to design programmes in such a way that women are more closely involved in planning and decision making. Similarly because of their roles at implementation levels, women should be given more opportunities in water affairs administration since they are likely to be more sensitive to the issue at hand.

When taking full account of water use needs particularly in relation to economic uses, time gains in the water service delivery increases the other economic activities. Therefore increasing involvement of women and community in general is of fundamental importance.

From the environment pollution point of view, municipal and industrial solid wastes and liquid wastes are the major causes of air pollution, water pollution and soil pollution in urban areas. In Dar es Salaam, Msimbazi river is the biggest river flowing through densely populated areas. The bulk of the water polluting industries in the city are also found in areas drained by

the Msimbazi river. Steinbach (1974) described it as de-oxygenated, foul smelling, turbid, contaminated and polluted with an overload of untreated domestic and industrial effluent.

Today (1995) the Msimbazi creak is even more heavily industrialized and settled with industries and residential houses built right in the flood plain thereby compounding the pollution problem with that of flood hazard.

Another live example of environmental degradation practices within Dar es Salaam is the solid waste disposal system where wastes are dumped within city premises and burnt openly and polluting the atmosphere heavily. More often, before the garbage is burnt, when it rains, surface runoff washes the dirt into the streets and unprotected open market places such as Kisutu, Tandale, and Tandika markets in Dar es Salaam.

Most of major water sources like for instance Lakes Victoria, Tanganyika and Nyasa and river systems like Pangani and Rufiji are increasingly threatened by both point and non-point pollution discharges. Some of these discharges are oxygen demanding substances, nutrients, heavy metals and pesticides. Associated with these problems are water-borne, water-washed, water-based and water related diseases, deteriorating water quality, fish killing and flourishing of water hyacinth like in the case of Lake Victoria.

It is highly recommended that the existing water quality and environmental pollution control programme and other similar initiatives be strengthened. Further more, the existing legislation on environmental pollution should be enforced rigorously.

In rural areas water pollution is primarily due to agricultural activities and a few scattered industries. In Tanga Region often times it is reported that Sisal plantations discharge effluent directly to rivers and streams without pre-treatment. In other parts of the country agricultural pesticides and fertilizers which contain harzadous chemicals are also a threat to lives particularly when these chemicals find their way to receiving water bodies.

CONCLUSIONS

(i) INSTITUTION ISSUES

In view of the existing fragmented roles and responsibilities of different institutions and actors, there is a need to institute a **coordination mechanism** and a **management information system** for the water and sanitation sector. Proposals to establish National Sector Coordination Committee (NSCC), ESA Coordination Unit (EAS-CU), Environmental Sanitation Committee and the like, could be considered. In this regard, a **Task Force** to look into harmonization of tasks and responsibilities with a view of adopting an **integrated approach** to water and sanitation programmes at all stages and levels is recommended. Furthermore, a support mechanism for **community based management** of water and sanitation facilities should be established.

(ii) FINANCIAL RESOURCES

Adequate funding levels are required to improve overall sectoral performance efficiency so as to meet the 2002 target.

Strategies of getting the required sector funding such as by promoting awareness of the general public to understand that provision of water and sanitation is very **expensive** and that present tariffs are insufficient to cover O/M cost let alone the urgently required rehabilitation and expansion cost. Therefore cost sharing and or cost recovery for sustainability of the schemes is crucial. Increasing the role of the Private Sector, Donor Communities and NGOs is necessary. At the sometime **proper financial management** should be put in place.

(iii) TECHNOLOGIES

The most efficient sustainable and affordable technology should be adopted. Thus the choice of technology will depend on availability, affordability and replicability of the scheme construction materials, equipment, chemicals and spare parts. The technology should also be socially, economically and technically acceptable.

Rainwater harvesting technology and Ventilated Improved Pit (VIP) latrine technologies should both be promoted for water supply and sanitation in rural and urban periphery areas.

(iv) MANPOWER

In general there is a need for human resources development programme for the Sector.

The crash professional training programmes of the 70's and 80's have shown good results during the water and sanitation decade. However the current Government retrenchment exercise

coupled with normal retirements and the decision to freeze employment will very soon lead to severe shortage of professionals in the Sector. The government will have to be called to reverse the decision.

It is recommended that fresh manpower strength situation should be carried out to determine the exact number of technical and general staff required for the Sector. Training programme should be developed to cater for systematic replacement of the retired technical staff. Further, use of private consultants, contractors, and retired sector personnel should be promoted.

With the emerging of the Private Sector, the Water Resources Institute should be geared at training sector oriented candidates for not only the Ministry but for the open market. Review of the Institute curriculum may be necessary.

(v) WATER AND SANITATION SERVICE LEVELS

From the water supply coverage table (Appendix III) it is evident that there is great disparity in the level of service from region to region and district to district. Causes of these disparities have not been well established in this study. However it is clear that even in some of the areas with donor implemented projects the coverage is still very low (Kagera, Kigoma, Iringa, Mbeya, Shinyanga, Tabora).

In general, for full water supply coverage, resources need to be targeted practically to all the regions.

On the other hand, figures for sanitation are encouraging showing almost full coverage in urban areas. But these figure are more or less for latrization only and it is highly doubted whether the reputed latrines are hygienic enough to warrant the credit of coverage.

It is recommended that a detailed study on sanitation situation in the country be undertaken to embrace sewerage, surface drainage, septic tanks, latrization and solid water problems.

(VI) WATER RESOURCES

For proper planning, designing, construction and O/M of water and sanitation schemes for sustainable social and economic development of Tanzania, there is **urgent need** to revamp the sections of the Ministry which are responsible for **hydrology, hydrogeology, water quality and Materials Testing** by providing adequate operational funds, equipment, tools, instruments, materials, and rehabilitate the existing networks and establish new stations where applicable.

To avoid conflicts amongst water users for different development activities such as agriculture, energy production, livestock development, industrial etc, the existing Basin Water Boards (Pangani and Rufiji) should be strengthened and formation of the remaining Boards should be expedited.

Furthermore, **integrated approach** to water supply and sanitation programmes should be adopted.

(VII) SANITATION

Sanitation problems which include surface water drainage, sewerage disposal, septic tanks, latrines and solid waste disposal in urban areas throughout the country are posing serious pollution and unhygienic conditions. Deterioration of these sanitation systems are basically caused by poor urban planning, and inadequate O/M due to meager financial allocations. In addition, fragmentation of authority over sanitation issues in general, have also made monitoring and coordination of activities very difficult.

it is recommended, therefore, that the following measures should be taken:

- Institutional framework be streamlined for handling sanitation activities as recommended in (i) above.
- Law related to sanitation must be enforced.
- All existing sewerage system should be rehabilitated.
- Industries should have pre-treatment plants
- Urban councils should have waste collection containers, structures and receptacles at all places where wastes are dumped.
- Pit/cesspit emptying, cleaning and unblocking equipment should be provided.

For rural areas efforts should be made to extend the use of Ventilated Improved Pit (VIP) latrine. In this respect, public awareness of the importance of sanitation should be given priority. Use of media for sensitization is desirable.

(VIII) ENVIRONMENT AND GENDER ISSUES

It has been established that development is contingent upon stakeholder involvement. In this regard active participation of women at all levels in water resources and sanitation programmes including decision making and implementation should be institutionalised. This is very vital for schemes sustainability.

On the question of environmental protection, EIA prior to embarking on any project implementation is recommended.

Furthermore, enforcement of existing legislation on environment including the Water Utilization Act is very essential.

(IX) THE PRIVATE SECTOR

The current economic and political atmosphere gives room for active participation of the Private Sector in water and sanitation activities. Processing and manufacturing industries must be encouraged to invest in the manufacturing of water and sanitation industry inputs. Such inputs may include spareparts for pumping units, pipes and fittings, water treatment chemicals, shallow wells pumps etc.

It is further recommended that the Private Sector be allowed and encouraged to invest in the construction, operation and maintenance of water and sanitation schemes.

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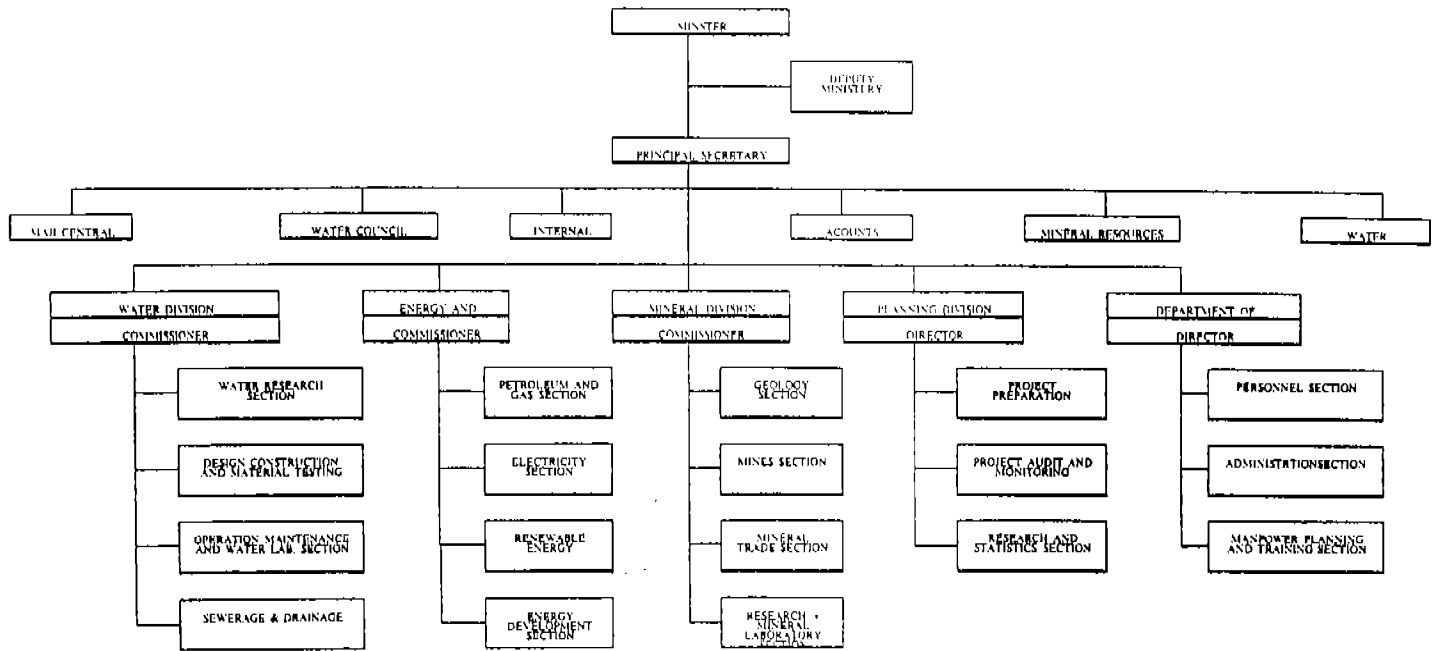
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APPENDIX I

ORGANIZATION OF THE MINISTRY OF WATER, ENERGY AND MINERALS



THE TANZANIA TEMPORARY STANDARDS OF PHYSICAL AND CHEMICAL QUALITY OF PORTABLE WATER COMPARED WITH STANDARDS OF OTHER COUNTRIES AND THE WORLD HEALTH ORGANISATION

No.	Water classification and substances	STANDARDS OF WATER QUALITY OF DIFFERENT COUNTRIES								
		Units	International (a)		European (b)	American (c)	Swedish (d)	French (e)	Bulgarian (f)	Tanzania (g)
			Acceptable	Allowable						
1.	Water causing toxic effects									
1.1	Lead, pq	mg/l	n.m.	0.05	1.10	0.05	0.02/0.05	n.m.	0.10	0.10
1.2	Arsenic, As	mg/l	n.m.	0.05	0.05	0.05	0.01/0.05	n.m.	0.05	0.05
1.3	Selenium, Se	mg/l	n.m.	0.01	0.01	0.01	0.01/0.05	n.m.	0.05	0.05
1.4	Chromium (b+).Px	mg/l	n.m.	0.05	0.05	0.05	0.02	n.m.	0.05	0.5
1.5	Cyanide, CN	mg/l	n.m.	0.02	0.05	0.01	0.01/0.20	n.m.	0.01	0.20
1.6	Cadmium, Cd	mg/l	n.m.	0.01	0.01	0.01	0.01	n.m.	0.05	0.05
1.7	Barium, Ba	mg/l	n.m.	1.00	1.00	1.00	n.m.	n.m.	1.00	1.00
1.8	Mercury, Hg	mg/l	n.m.	n.m.	n.m.	n.m.	0.001/0.005	n.m.	n.m.	n.m.
1.9	Silver, Ag	mg/l	n.m.	n.m.	n.m.	0.05	n.m.	n.m.	n.m.	n.m.
2	Water affecting human health									
2.1	Fluoride, F	mg/l	n.m.	1.5	0.7-1.7	0.8-1.7	1.5	n.m.	0.7-1.0	8.0
2.2	Nitrate No ³	mg/l	n.m.	30.0	50/100	45	30	44	30	(100)
3	Water for general domestic use									
3.1	water being organon-septic									
3.1.1	Clour	mgPt/l	5	50	n.m.	15	10	n.m.	15	50*
3.1.2	Turbidity	mgSiO ₂ /l	5	25	n.m.	3	weak	n.m.	30(y)	30*
3.1.3	Taste	l	n.o.	n.o.	n.m.	nil	weak	n.m.	nil	n.o.*
3.1.4	Odour	-	n.o.	n.o.	n.m.	3(x)	n.m.	n.m.	2bs(y)	n.o.*

3.2	Water of salinity and hardness									
3.2.1	PH	-	7.0-8.5	6.5-9.2	n.m.	n.m.	6.0-8.0	n.m.	6.5-8.5	6.5-9.2*
3.2.2	Total filtrable residue	mg/l	500	1500	n.m.	n.m.	200	2000	n.m.	2000*
3.2.3	Total hardness	MgCaCO ₃ /l	n.m.	n.m.	500	n.m.	n.m.	300	450	600*
3.2.4	Calcium, Ca	l	75	200	n.m.	n.m.	n.m.	n.m.	150	n.m.
3.2.5	Magnesium, Mg	mg/l	50	150	125	n.m.	n.m.	125	50	n.m.
3.2.6	Magnesium-Sodium Sulphate.	mg/l	500	1000	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
3.2.7	Sulphate, SO ₄ ²⁻	mg/l	200	400	250	250	25/250	250	250	600*
3.2.8	Chloride, Cl	mg/l	200	600	600	250	25/250	250	250	800*
3.3	Water with non toxic metals									
3.3.1	Iron, Fe	mg/l	0.3	1.0	1.0	0.3	0.2	0.2	0.2	1.0*
3.3.2	Manganese, Mn	mg/l	0.1	0.5	0.05	0.05	0.05	0.1	0.1	0.5*
3.3.3	Copper, Cu	mg/l	1.0	1.5	0.05/3.00	1.0	0.05/1.0	0.2	0.2	3.0*
3.3.4	Zinc, Zn	mg/l	5.0	15.0	5.0	5.0	0.3/5.0	3	3	15.0*
3.4	Water with organic pollution of natural origin.									
3.4.1	BOD 5	mgO ₂ /l	n.m.	6	n.m.	n.m.	2	n.m.	2.6	6.0
3.4.2	PV (Oxygen abs. KMnO ₄)	mgO ₂ /l	n.m.	10	n.m.	n.m.	20	n.m.	nil	20
3.4.3	Ammonium, NH ₄ ⁺	mg/l	n.m.	0.5	0.05	n.m.	0.1	n.m.	n.m.	n.m.
3.4.4	Total Nitrogen, exclusive nitrate	mg/l	n.m.	0.1	n.m.	n.m.	n.m.	n.m.	n.m.	1.0
3.5	Water with organic pollution introduced artificially									
3.5.1	Surfactant ABS	mg/l	0.5	1.0	n.m.	n.m.	n.m.	n.m.	n.m.	2.0
3.5.2	Organic matter as carbon in chloroform extract	mg/l	0.2	0.5	0.5	0.2	nil	n.m.	1.0	0.5
3.5.3	Phenolic substance as phenol	mg/l	0.001	0.002	0.001	0.001	n.m.	n.m.	0.001	0.002

Source: Ministry of Water, Energy and Minerals, Dar es Salaam.

APPENDIX III

URBAN AND RURAL WATER SUPPLY COVERAGE (DECEMBER, 1994)

N A.	REGION	TOTAL	REGION COVERAGE		RURAL POPULAT ION	RURAL COVERAGE		URBAN POPULA TION '000	URBAN COVERAGE	
			SERVED	%		TOTAL	%		TOTAL	%
1	2	3	4	5	6	7	8	9	10	11
1.	Arusha	1,762.0	658,235	37.4	1,510.2	487,455	32.3	251.7	170,780	67.8
2.	Pwani	756.5	329,336	43.5	662.0	265,308	39.0	74.4	64,028	86.0
3.	D'Salaam	1,844.0	1,500,000	81.3	228.4	131,000	57.3	1,615.5	1,369,000	84.7
4.	Dodoma	1,427.1	913,510	64.0	1,169.4	733,200	62.70	290.0	180,310	62.2
5.	Iringa	1,383.8	666,521	48.2	1,105.9	560,816	47.3	197.9	106,105	53.6
6.	Kagera	1,554.8	441,636	28.4	1,400.0	392,000	28.0	154.8	49,636	32.1
7.	Kigoma	1,029.0	426,028	41.4	902.8	357,118	39.6	146.9	68,910	47.0
8.	K'Njaro	1,407.0	758,806	58.6	1,243.5	696,890	56.0	163.4	61,916	47.1
9.	Lindi	742.0	409,763	58.2	624.2	309,021	49.5	117.7	100,742	85.5
10	Mara	1,161.7	622,800	53.6	1,012.3	543,241	54.0	158.7	79,567	50.1
11.	Mbeya	1,708.0	848,098	48.7	1,463.7	683,654	46.7	244.2	164,444	67.3
12.	Morogoro	1,572.0	754,000	48.0	1,331.7	600,000	45.1	240.2	155,000	64.5
13.	Mtwara	984.6	833,800	84.7	661.9	722,602	83.8	122.7	111,198	90.6
14.	Mwanza	2,209.0	1,245,436	56.4	1,785.2	891,303	49.9	423.8	354,133	83.6
15.	Rukwa	982.0	484,700	54.3	744.7	434,000	58.6	147.2	50,700	34.4
16.	Ruvuma	824.1	442,960	53.8	694.8	372,154	28.7	129.2	70,809	54.8
17.	Shinyanga	2,060.6	518,595	28.2	1,958.1	562,000	41.2	219.7	136,000	61.9
18.	Singida	920.0	393,617	42.8	833.3	343,109	32.1	86.6	50,508	58.3
19.	Tabora	1,200.0	417,000	34.8	956.4	307,000	59.7	243.5	110,000	45.0
20.	Tanga	1,425.2	909,93	63.8	1,198.8	715,831	46.3	226.3	194,091	85.7
	TOTAL	27,061.7	13,671,571	50.52	21,698.	10,046,313		5,363,400	3,668,566	68.5

Source: Ministry of Water, Energy and Minerals

APPENDIX IV

WATER DEMAND AND SUPPLY IN URBAN AREAS AS AT 30/6/92
(CUBIC METERS/DAY)

S/No	TOWN	WATER DEMAND	WATER SUPPLIED	INSTALLED CAPACITY	%
	(1)	(2)	(3)	(4)	(5)
	ARUSHA REGION	83,000	30,000	46,360	79
1	Arusha Municipal	420	330	N.R	79
2	Usa River	455	149	N.R	33
3	Monduli	1,518	1,156	2,326	76
4	Babati	789	320	1,621	41
5	Mbulu	660	135	585	20
6	Karatu	45	N.R	N.R	-
7	Kateshi	299	197	N.R	66
8	Mto wa Mbu	138	50	N.R	36
9	Namanga	90	90	N.R	100
10	Oldeani	100	57	N.R	57
11	Tengeru	133	57	N.R	43
12	Makuyuni	42,647	32,541	50,892	76
Total Arusha Region					
	DAR ES SALAAM	409,500	191,000	273,000	47
1	Dar es Salaam				
	DODOMA REGION	47,670	33,140	34,867	70
1	Dodoma Capital	2,310	2,640	3,264	114
2	Kondoa	1,880	219	2,927	12
3	Kongwa	4,010	1,864	2,512	46
4	Mpwapwa	55,870	36,863	43,570	66
Total Dodoma Region					
	IRINGA REGION				
1	Iringa Municipal	20,000	9,700	11,000	49
2	Mafinga	2,500	800	800	32
3	Njombe	3,152	2,200	2,300	70
4	Ludewa	289	175	327	61
5	Makete	310	248	345	80
Total Iringa Region		26,252	13,123	14,772	50

APPENDIX IV CON'TD.

S/N/O.	(1)	(2)	(3)	(4)	(5)
	Kagera Region				
1	Bukoba Urban	9,000	6,200	10,500	69
2	Biharamulo	815	500	690	72
3	Mtoto	1,050	640	685	81
4	Mnara	558	250	300	45
5	Kayunga (Karaga)	1,544	700	800	44
Total Kagera Region		13,007	8,090	12,975	64
	Kilimanjaro Region				
1	Moshi Urban	27,000	15,040	19,040	56
2	Ilai	875	153	153	17
3	Longo	665	120	120	48
4	Mwanza	1,100	225	363	20
5	Sime	1,600	100	546	19
Total Kilimanjaro Region		31,240	16,038	20,722	51
	Mara Region				
1	Muramba	11,010	7,680	8,000	70
2	Dunda	1,900	720	1,200	19
3	Mugumu	1,670	360	600	22
4	Tarime	2,530	900	1,500	36
Total Mara Region		17,110	9,660	11,300	51
	Mbeja Region				
1	Mbeja Municipal	30,000	20,000	21,000	67
2	Vwawa	2,840	1,000	2,300	35
3	Chunya	1,820	800	2,300	44
4	Kyela	2,270	2,000	2,700	88
5	Tukuyu	1,800	1,600	3,500	89
6	Itumba	825	400	720	48
Total Mbeja Region		39,555	25,800	31,420	65
	Mtwara Region				
1	Mtwara Urban	8,500	6,600	-	42
2	Newala	2,500	2,400	-	96
3	Mnazi	2,00	1,500	-	75
Total Mtwara Region		13,000	7,500	-	58

S/NO.	(1)	(2)	(3)	(4)	(5)
	MWANZA REGION				
1	Mwanza Municipal	48,245	37,800	50,400	78
2	Nansio	1,150	633	1,092	55
3	Magu	2,041	1,400	1,728	69
4	Ngudu	1,367	750	980	55
5	Geita	2,330	1,296	1,530	56
6	Songoroma	2,918	1,165	5,760	47
Total Mwanza Region		58,051	43,244	61,490	74
	COAST REGION				
1	Kibaha	779	720	1,080	92
2	Kisarawe	790	630	1,800	80
3	Kilindoni	560	380	720	68
4	Utete	675	450	1,080	67
5	Bagamoyo	1,605	1,372	NUWA MAINS	85
Total Coast Region		4,409	3,552	4,680	81
	RUVUMA REGION				
1	Songea Town	7,126	4,300	4,300	60
2	Mbinga	1,556	778	778	50
3	Tunduru	2,388	555	555	23
Total Ruvuma Region					
	RUKWA REGION				
1	Sumbawanga	3,500	2,800	3,390	80
2	Mpanda	2,500	1,000	1,000	40
3	Nkasi	770	270	270	35
Total Rukwa Region		6,770	4,070	4,660	60
	SHINYANGA REGION				
1	Shinyanga	11,609	8,895	12,273	77
2	Kahama	1,670	750	1,200	46
3	Maswa	1,987	640	12,859	32
4	Bariadi	1,222	645	808	53
5	Mwanhuzi	325	65	120	20
Total Shinyanga Region		16,751	10,995	27,260	66

S/NO.	(1)	(2)	(3)	(4)	(5)
	SINGIDA REGION				
1	Manyoni	985	518	-	53
2	Kiomboi	1,356	457	-	34
3	Singida Town	6,700	2,950	3,000	44
		9,041	3,923	3,000	43
	TABORA REGION				
1	Tabora Municipal	21,237	8,300	11,469	39
2	Nzega	1,165	700	888	60
3	Igunga	742	400	432	54
4	Urambo	952	189	717	20
5	Nanga	247	64	991	26
6	Sikonge	696	135	70	19
7	Choma	828	135	138	16
8	Nkinga	401	135	141	34
9	Ndala	674	64	177	9
10	Bukene	425	45	113	11
11	Useke	325	95	87	29
12	Kaliua	530	117	194	22
	Total Tabora Region	28,222	10,379	15,417	37
	TANGA REGION				
1	Tanga Municipal	40,217	24,400	26,000	61
2	Pangani	1,939	1,374	1,061	71
3	Muheza	3,859	1,728	1,920	45
4	Korogwe	5,675	1,469	1,685	26
5	Lushoto	2,350	604	1,385	26
6	Lushoto	2,761	950	1,621	34
	Total Tanga Region	56,792	30,525	33,672	54
	KIGOMA REGION				
1	Kigoma Urban	18,600	12,000	12,800	65
2	Kasulu	1,878	864	950	46
3	Kibondo	617	150	325	24
	Total Kigoma Region	21,095	13,014	14,075	62

S/NO	(1)	(2)	(3)	(4)	(5)
	LINDI REGION				
1	Lindi Urban	3,500	1,500	2,500	43
2	Kilwa Kivinje	1,000	350	600	35
3	Kilwa Masoko	2,400	850	2,000	35
4	Liwale	1,300	255	500	20
5	Nachingwea	3,500	1,452	2,000	41
	Total Lindi Region	11,700	4,407	7,600	38
	MOROGORO REGION				
1	Morogoro Muncipal	30,000	19,000	20,000	63
2	Kilosa	3,000	1,710	1,950	57
3	Ifakara	3,500	1,670	1,900	48
4	Mahenge	2,000	1,300	1,300	65
	Total Morogoro	38,500	23,680	25,150	62
	GRAND TOTAL	912,581	494,269	661,288	54

Source: Ministry of Water, Energy and Minerals.

APPENDIX V

DATA ON VILLAGE WATER COMMITTEES (VWC_B) AND WATER FUNDS (VWF_B)

REGION	REGISTERED VILLAGES	VILLAGE WITH WATER COMMITTEES		NO. OF VILLAGE WATER FUNDS		TOTAL AMOUNT TSHS.
		TOTAL	%	TOTAL	%	
1. Tanga	548	270	49	270	49	6,117,698.00
2. Shinyanga	815	160	19	172	13	4,555,408.00
3. Mtwara	541	217	40	102	19	478,152.00
4. Mwanza	673	253	37	217	32	11,981,046.00
5. Morogoro	393	94	24	73	18	37,981,046.00
6. Singida	328	249	76	219	67	11,003,767.00
7. Iringa	619	155	25	102	16	3,235,526.35
8. Tabora	450	146	32	127	28	6,055,005.00
9. Dodoma	398	163	41	163	41	22,622,911.00
10. Kigoma	220	97	44	97	44	5,930,089.00
11. Morogoro	491	104	21	104	21	281,9926.50
12. Zanzibar	510	75	14	18	7	21,458,794.00
13. Lindi	367	26	61	141	38	4,574,780.00
14. Pwani	531	111	21	111	21	4,090,615.00
15. Mtwara	126	188	57	187	57	1,515,610.00
16. Mbeya	632	593	94	185	29	21,841,747.00
17. Kilimanjaro	440	110	25	131	43	8,662,122.50
18. Mara	398	124	31	93	23	4,258,476.00
19. Dar es Salaam	408	166	40	74	18	3,903,842.45
20. Dar es Salaam Villages	52	5	10	5	10	210,000.00
TOTAL	9,380	3,726	40	2,611	28	146,186,140.20

Source: Ministry of Water, Energy and Minerals

APPENDIX VI

THE CONDITION OF WATER SUPPLY SCHEMES

No.	REGION	TOTAL DIESEL SCHEMES	OPER. DIESEL SCHEMES	TOTAL ELECTR.	OPER. ELECTR.	TOTAL GRAVITY SCHEMES	OPERAT. ACTIVITY	TOTAL WASHBOUN WELLS	OPER. S/WELLS	OTHER TECHNOLOGIES			
											+	M/Band OO	**
1	ARUSHA	27	1	1	3	105	101	94	70				4 (4)
2	DAR ES SALAAM	9	2	3	2	-	-	N.R.	N.R.	N.R.			
3	DODOMA	238	133	12	8	16	14	58	78		4 (1)		
4	IRINGA	43	24	3	2	67	67	27	27				
5	KAGERA	43	28	2	3	25	21	367	254		1 (1)		
6	KIGOMA	40	3	1	1	63	52	24	24		2 (1)		
7	KILIMANJARO	10	3	4	4	75	75	106	60			2 (2)	
8	LINDI	74	20	N.R.	19	0	5	1793	960				
9	MARA	34	11	2	12	5	5	274	99				
10	MREYA	38	18	4	5	28	25	101	264		5 (5)	NIL	
11	MOROGORO	10	13	17	17	64	63	1192	781	28 (18)			
12	MWANZA	39	13	8	7	0	1	934	701	395 (18)	1 (1)	8 (8)	
13	MWANZA	14	83	3	3	NIL	NIL	1148	1038	1 (1)		NIL	
14	COAST	58	10	10	1	N.R.	N.R.	303	219				
15	RUVUMA	26	10	1	1	24	24	30	29		8 (8)		
16	SHINYANGA	59	22	16	10	1	1	1657	546	1 (0)			1 (2)
17	SINDIGA	72	25	15	15	0	2	436	306				18 (5)
18	TARUBA	67	27	4	4	1	1	696	203				1 (1)
19	USUKUMA	21	9	21	13	62	62	429	333		1 (1)		1 (1)
20		38	11	N.R.	N.R.	42	N.R.	157	N.R.		3 (3)		
TOTAL		835	477	112	133	634	573	8736	6108	426 (179)	21 (20)	7 (7)	78 (5)

+ = Mixed (SW+BH)

* = Mixed (SW + BH)

** = Windmill

ANNUAL ALLOCATION, EXPENDITURE AND REVENUE COLLECTION IN URBAN AREAS

S/N	REGION	FINANCIAL YEAR 1990/91 X 1000			FINANCIAL YEAR 1991/92 X1000		
		ALLOCATION	EXPENDITURE	REVENUE	ALLOCATION	EXPENDITURE	REVENUE
1	LINDI	45,237.6	46,125.4	6,069.0	50,393.1	71,931.1	5,366.8
2	RUKWA	25,660.0	15,601.7	7,511.3	(Amount is for 1990/91 and 1991/92)	(Amount is for 1990/91 and 1991/92)	(Amount for 1990/91 and 1991/92)
3	TABORA	260,932.1	129,236.6	22,059.7	(Amount is for 1990/91 and 1991/1992)	(Amount is for 1990/91 and 1991/1992)	(Amount is for 1990/91 and 1991/1992)
4	SINGIDA	36,250.0	36,249.0	2,851.4	42,591.7	42,662.5	
5	MWANZA	182,050.3	182,050.4	73,352.6	262,199.0	262,198.0	3,200.3
6	MTHARA	364,527.0	N.R.	6,627.2	633,917.8*	N.R.	87,018.0
7	KIGOMA	46,837.0	47,137.0	18,452.6	58,424.7	58,733.9	4,408.5
8	IRINGA	N.R.	N.R.	N.R.	38,110.1	72,164.5	20,743.5
9	DODOMA	132,526.0	125,139.4	20,719.5	(Amount is for 1990/91 and 1991/1992)	(Amount is for 1990/91 and 1991/92)	11,050.6
10	MOROOGORO	140,000.0	N.R.	65,232.0	(Amount is for 1990/91 and 1991/1992)	(Amount is for 1990/91 and 1991/92)	(Amount is for 1990/91 and 1991/92)
11	RUVUMA	N.R.	N.R.	1,052.3	N.R.	N.R.	2,837.4
12	TANGA	99,024.3	101,188.4	74,659.9	86.5	98,425.6	60,838.4

13	COAST	77.4	80.5	4.0	18,737.9	87.2	5.1
14	MBEYA	27,806.5	29,874.4	18,544.7	6,059.7	49,113.1	20,105.0
15	KILIMANJARO	4,222.3	N.R.	2,971.7	N.R.	N.R.	3,594.7
16	KAGERA	N.R.	50,600.0	7,780.0	112,680.0	70,000.00	11,287.0
17	MARA	119,884.0	119,864.0	20,445.3	160,806.8	112,680.0	16,208.0
18	ARUSHA	100,667.2	110,543.2	108,551.3	125,000.0	182,730.8	116,266.4
19	D'SALAAM	264,600.0	264,600.0	689,625.0	84,900.0	125,000.0	994,993.0
20	SHINYANGA	71,503.1	56,143.4	5,742.8		69,880.1	4,133.2
		1,921,967.6	1,314,573.8	1,152,338.0	1,063,427.0	1,344,413.9	1,385,449.6

Funds from central Government: FINNIDA and UNICEF, CDF, RDF and self help for rural and urban water supply

APPENDIX VIII

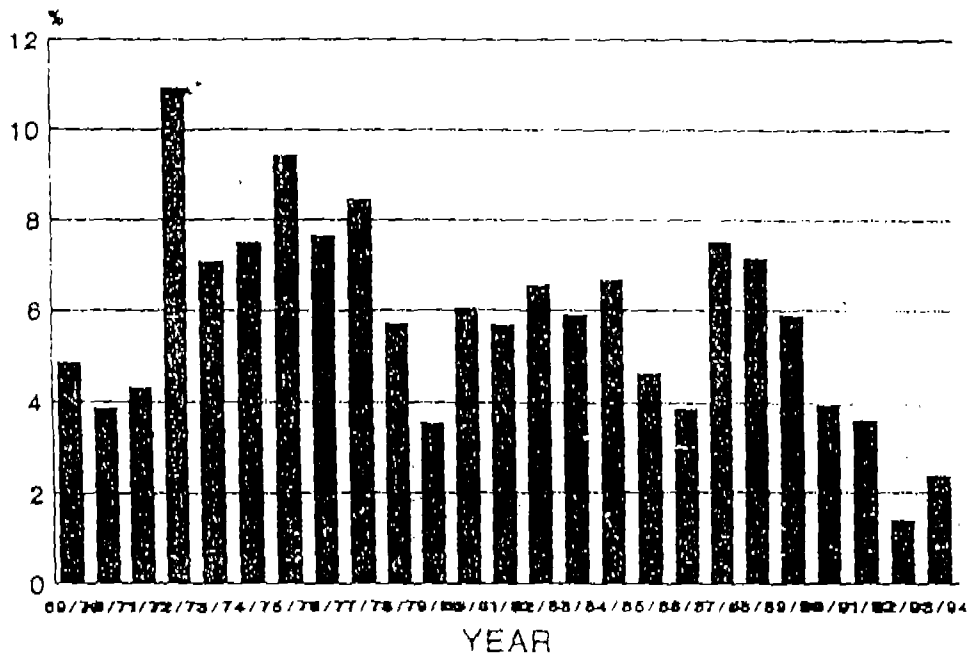
FINANCIAL REQUIREMENTS FOR IMPLEMENTING
THE YEAR 2002 TARGET

ACTIVITY	AMOUNT REQUIRED TSHS. BN/-
Capacity Building	196
New Investment:	
(a) Water Supply	195
(b) Sanitation	54
Sub Total	249
GRAND TOTAL	445

GOVERNMENT DEVELOPMENT BUDGET ALLOCATION
 (IN '000' TSHS) 1969/70 -1993/94)

YEAR	WATER SECTOR	ALL SECTORS	PERCENTAGE ALLOCATED TO WATER SECTOR
1969/70	33,050	676,357	4.89
1970/71	36,835	930,653	3.87
1971/72	41,050	952,214	4.32
1972/73	128,450	1,175,477	10.93
1973/74	105,275	1,484,113	7.09
1974/75	165,252	2,199,274	7.52
1975/76	245,116	2,559,000	9.46
1976/77	286,320	3,742,334	7.65
1977/78	328,002	3,859,931	8.50
1978/79	317,725	5,518,332	5.73
1979/80	454,909	12,690,156	3.58
1980/81	427,219	7,040,733	6.07
1981/82	377,948	6,222,333	5.92
1982/83	316,716	4,816,203	6.56
1983/84	344,783	5,830,011	5.91
1984/85	489,508	6,560,400	6.70
1985/86	317,856	6,828,000	4.66
1986/87	616,596	15,859,273	3.89
1987/88	1,300,881	17,254,933	7.54
1988/89	2,033,820	29,400,000	7.16
1989/90	1,340,354	22,696,100	5.92
1990/91	1,325,008	33,350,000	3.97
1991/92	727,957	19,887,233	3.66
1992/93	650,703	46,245,843	1.42
1993/94	3,272,485	135,923,500	2.42
TOTAL	15,683,853	393,185,357	AVG. 3.99

GOVERNMENT DEVELOPMENT BUDGET ALLOCATION
TO WATER SECTOR 1969/70 - 1993/94



HUMAN RESOURCES REQUIREMENT

OCCUPATIONAL CATEGORY	STAFF STRENGTH 1989	PROJECTIONS 2002
Civil Engineers	149	200
Mechanical Engineers	26	176
Electrical Engineers	19	119
Public Health Engineers	1	10
Hydrologists	12	32
Surveyors	43	50
Research Officers/Chemists	50	100
Planners/Economists	2	5
Sociologists	13	60
Accountants/Accounts Clerks	5	20
Manpower Officers	1	10
Technicians	13	100
Craftsmen/Operators	10	20
Supporting Staff	2,840	3,840
	6,000*	24,000
	3,000*	2,500

* Estimated

Environmental Classification of Water-Related Infections

Category	Infection	Pathogenic agent
(1) faecal-oral	Diarrheas and dysenterias	
(Water-borne-washed)	Amoebic dysentery	P
	Balantidiasis	P
	Campylobacter enteritis	B
	Cholera	B
	E. coli diarrhoea	B
	Giardiasis	P
	Rotavirus diarrhoea	V
	Salmonellosis	B
	Shigellosis (bacillary dysentery)	B
	Yersiniosis	B
	Enteric fevers	B
	Typhoid	B
	Paratyphoid	B
	Poliomyelitis	V
	Hepatitis A	V
	Leptospirosis	S
	Ascariasis	H
	Trichuriasis	H
(2) Water-washed:	Infectious skin diseases	M
(a) skin and eye infections	Infectious eye diseases	M
(b) Other	Louse-borne typhus	R
	Louse-borne relapsing fever	S

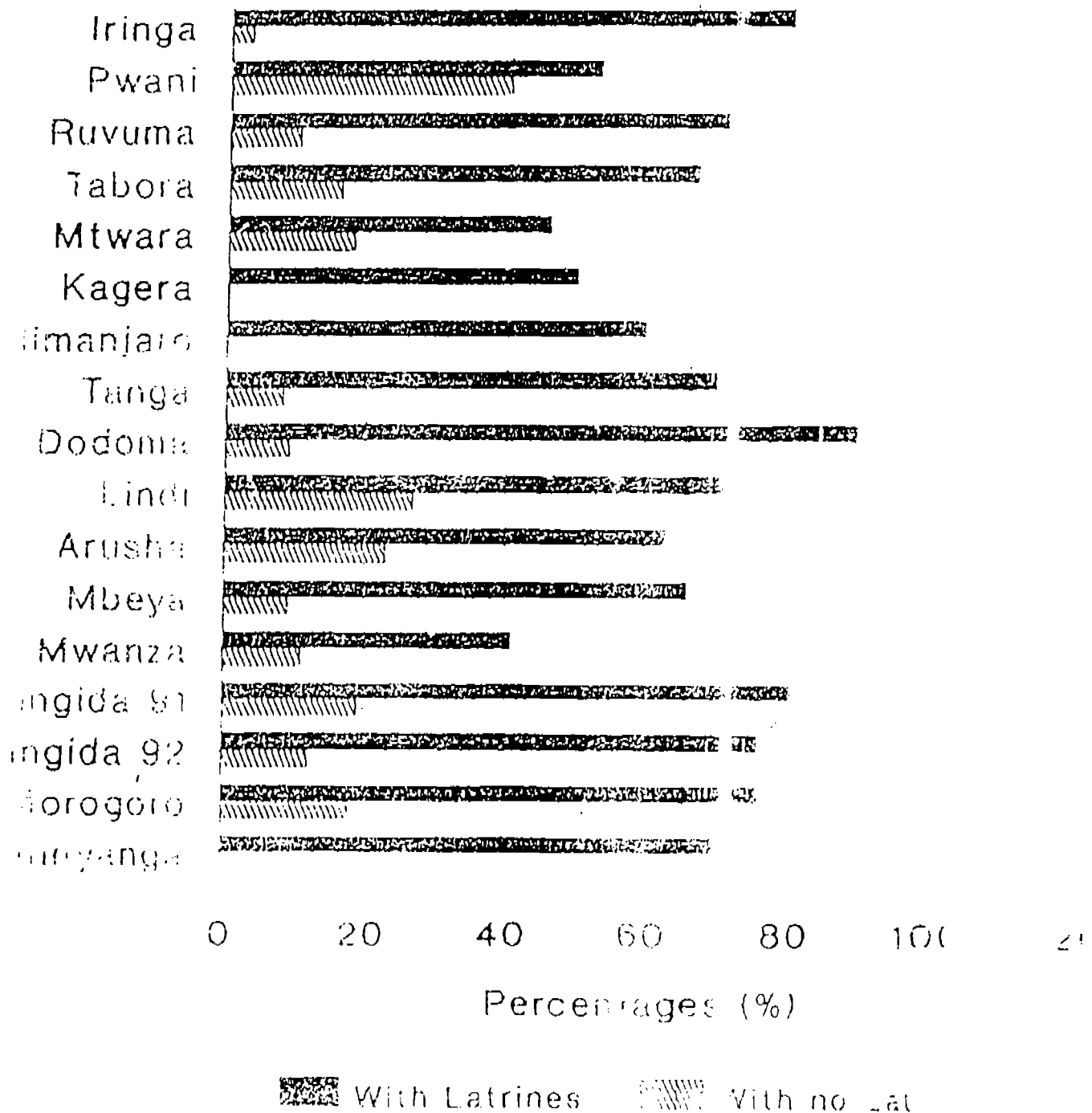
(3) Water-Born:	Schistosomiasis	M
(a) penetrating skin		
(b) ingested	Guinea worm	H
	Clonorchiasis	H
	Diphyllobothriasis	H
	Fasciolopsiasis	H
	Paragonimiasis	H
	Other	H
(4) water-related insect vector:	Sleeping sickness	P
(a) biting near water		
(b) breeding in water	Filariasis	H
	Malaria	P
	River blindness	H
	Mosquito-borne viruses	V
	Yellow fever	V
	Dengue	V
Other	V	

B = Bacterium P = Protozoan S = Spirochaete M = Miscellaneous
H = Helminth R = Rickettsia V = Virus

Source: (Ref. 18, P. 20)

Latrines Coverage, By Region TANZANIA, 1992

Regions



APPENDIX XIV

LATRINE COVERAGE 1992 (TANZANIA MAINLAND)

NO	Region	Number of Household inspected	Number of acceptable latrines	Number of unacceptable latrines	Number of House without latrines	New latrines	Coverage
1	ARUSHA	133,465	89,249	21,398	20,700	2,118	67
2	D'SALAM	82,665	61,033	1,910	1,686	-	74
3	DODOMA	239,082	184,224	-	54,858	-	77
4	IRINGA	181,853	122,187	51,782	5,238	-	67
5	KAGERA	141,497	90,253	43,951	7,253	-	64
6	KIGOMA	NO	REPORT	-	-	-	-
7	K'NJARO	2785		440	-	372	71
8	LINDI	NO	DATA	-	-	-	-
9	MARA	NO	NO DATA	-	-	-	-
10	MBEYA	NO REPORT	177,259	-	-	-	-
11	MOROGORO	208,405	149,202	-	-	-	33
12	MTWARA	80,802	182,400	-	31,281	19,090	83
13	MWANZA	233,080	13,785	110,153	100,996	-	78
14	PWANI	78,618	69,072	28,028	23,903	5,831	18
15	RUKWA	987,220	52,526	19,520	8,281	9,070	70
16	KUVUMA	74,579	45,699	16,535	5,518	-	70
17	SHINYANGA	260,435		140,470	-	7,688	18
18	SINGIDA	NO DATA	114,97	-	-	-	-
19	TABORA	175,255	60,639	26,055	11,333	29,895	66
20	TANGA	89,125	1,412,325	15,304	12,545	432	68
TOTAL		2,079,866		475,584	283,592	74,496	974

Source: Ministry of Health

REGION	DIPHTHERIA	DYSENTERY	TYPHOID	SCHISTO SOMIASIS	EYE DISEASE	ERL DISEASE	MALARIA	WORM INFECTION	AMOEBIASIS	MAL NUTRITION	RAKES	CELEBRAL SPINAL MENINGITIS
ASHANTI	3332	2995	756	3284	37511	92711	414828	27560				449
BRAMA	4462	2732	2	1884		16032	245262				8	294
BOOMA	8022				63129	43748	667762	287736				
EFENGA	111010	1016	229	966		34020	366664	38713				1378
WATERA	88724						70533	48348				
WIDEMA								76499				343
WONKAD	64744	27725	3811	24888	18276	87618						
WINTI	383286	253237	5072	4030							1461	
WAKA												
WBEVA	112291	7217	271	11332	66169	60104						228
WEDZEGE	19380	1444	182	12242	61486	406881	846210	11242				
WIDARA	93858	1034	20	14466	66158	41669	322775	22466				32
WONKAD	88985	20766	31	12349			1162137	6660				
WONKAD	87719	12	3	4253	41281	39064	291164	17463			3	67
WONKAD	68264	115	2783	2785	6927	3859	262122	2154			6	230
WONKAD	14760	2748	141	5422	38073	8856	755920	292				
WONKAD	15219	246282	182	22242	33880	36412	616345			1207		
WONKAD	48419	21662		840			54576				700	
WONKAD	44419	64	1024	21264		35112					673	
WONKAD	18219	4782		151			373266					
	28497	86124	22	23567			689613				2827	
TOTAL	1,913,866	1,178,248	13,785	241,129	427,899	1,055,331	13,144,326	595,073		3,207	5,654	14,8

Source: Ministry of Health

APPENDIX XVI

Percent distribution of population by Region and type of toilet both in rural and urban areas

REGION	1	2	3	4	5	TOTAL %
ARUSHA	2.7	1.08	68.06	28.19	0.29	100.0
COAST	0.82	0.58	80.06	18.52	0.06	100.0
D' SALAM	13.16	4.77	79.94	2.03	0.09	100.0
DODOMA	2.07	0.37	81.06	16.19	0.31	100.0
IRINGA	0.69	0.40	97.44	1.43	0.03	100.0
KAGERA	0.88	0.36	88.72	9.98	0.07	100.0
KIGOMA	0.61	0.65	95.32	3.41	0.01	100.0
K'NJARO	4.87	3.41	88.11	3.57	0.04	100.0
LINDI	0.81	0.46	81.35	17.37	0.01	100.0
MARA	0.93	0.77	80.34	17.95	0.02	100.0
MBEYA	1.63	0.73	94.06	3.47	0.04	100.0
MOROGORO	2.83	1.22	88.23	7.04	0.67	100.0
MTWARA	1.20	0.72	87.06	11.01	0.01	100.0
MWANZA	1.74	1.08	87.43	9.70	0.05	100.0
RUKWA	0.66	0.57	92.64	6.13	0.00	100.0
RUVUMA	1.09	0.60	95.97	2.29	0.04	100.0
SHINYANGA	1.41	0.57	85.70	12.25	0.07	100.0
SINGIDA	1.03	0.38	81.08	17.50	0.01	100.0
TABORA	1.41	0.50	76.27	21.82	0.00	100.0
TANGA	2.70	1.20	82.24	13.71	0.15	100.0
MAINLAND	2.44	1.05	85.38	11.02	0.11	100.0

KEY:

- 1: Flush toilet inside the house
 2: Flush toilet outside the house
 3: Pit/others
 4: None
 5: Not stated

Source: Ministry of health

APPENDIX XVII
 Percent distribution of population by Region and type of toilet facilities.

REGION	1	2	3	4	5	TOTAL %
ARUSHA	0.61	0.45	67.04	31.6	0.28	100.0
COAST	0.39	0.43	78.43	20.73	0.02	100.0
D'SALAAM	0.02	1.29	83.58	11.97	0.14	100.0
DODOMA	0.38	0.23	81.56	17.56	0.27	100.0
IRINGA	0.56	0.30	97.62	1.49	0.03	100.0
KAGERA	0.37	0.15	89.13	10.29	0.07	100.0
KIGOMA	0.25	0.46	95.65	3.62	0.01	100.0
K'NJARO	3.25	2.40	90.55	3.77	0.04	100.0
LINDI	0.29	0.33	80.53	18.86	0.00	100.0
MARA	0.47	0.33	79.78	19.41	0.01	100.0
MBEYA	0.83	0.57	94.64	3.91	0.04	100.0
MOROGORO	0.45	1.81	89.49	8.43	0.82	100.0
MTHARA	0.55	0.39	87.15	11.90	0.01	100.0
MWANZA	0.42	0.18	88.86	10.48	0.05	100.0
RUKWA	0.22	0.39	92.75	6.63	0.00	100.0
RUVUMA	0.78	0.50	96.22	2.47	0.04	100.0
SHINYANGA	0.73	0.17	86.20	12.83	0.07	100.0
SINGIDA	0.65	0.19	80.49	18.66	0.01	100.0
TABORA	0.35	0.13	74.16	25.36	0.00	100.0
TANGA	0.44	0.44	83.17	15.79	0.15	100.0
MAINLAND	0.56	0.39	86.18	12.75	0.11	100.0

SOURCE: 1: Flush toilet inside the house
 2: Flush toilet outside the house
 3: Pit/others
 4: None
 5: Not stated

APPENDIX XVIII

Percent distribution of population by Region and type of toilet in urban areas

REGION	1	2	3	4	5	TOTAL %
ARUSHA	15.93	5.97	75.92	1.85	0.33	100.0
COAST	3.36	1.45	89.48	5.75	0.29	100.0
DAR ES SALAAM	14.34	5.67	79.51	0.87	0.09	100.0
DODOMA	16.45	1.60	76.78	4.56	0.61	100.0
IRINGA	1.89	1.38	95.80	0.89	0.04	100.0
KAGERA	10.06	4.10	81.39	4.41	0.04	100.0
KIGOMA	3.26	2.07	92.85	1.81	0.10	100.0
KILIMANJARO	23.61	15.06	60.04	1.22	0.07	100.0
LINDI	3.76	1.20	86.07	8.91	0.06	100.0
MARA	4.84	4.53	85.08	5.50	0.04	100.0
MBEYA	5.30	1.79	91.41	1.46	0.05	100.0
MOROGORO	11.30	2.70	83.74	2.09	0.16	100.0
MTWARA	5.09	2.70	86.56	5.66	0.00	100.0
MWANZA	7.74	5.16	80.88	6.16	0.05	100.0
RUKWA	3.36	1.67	91.94	3.03	0.00	100.0
RUVUMA	3.30	1.37	94.20	1.04	0.09	100.0
SHINYANGA	11.20	6.36	78.54	3.86	0.03	100.0
SINGIDA	5.16	2.43	87.46	1.95	0.00	100.0
TABORA	7.64	2.71	88.63	1.02	0.00	100.0
TANGA	13.36	4.81	77.86	3.84	0.13	100.0
MAINLAND	10.68	3.94	81.87	3.41	0.10	100.0

SOURCE: Population Census 1988

KEY:

- 1: Flush toilet inside the house
- 2: Flush toilet outside the house
- 3: Pit/Other
- 4: Not stated

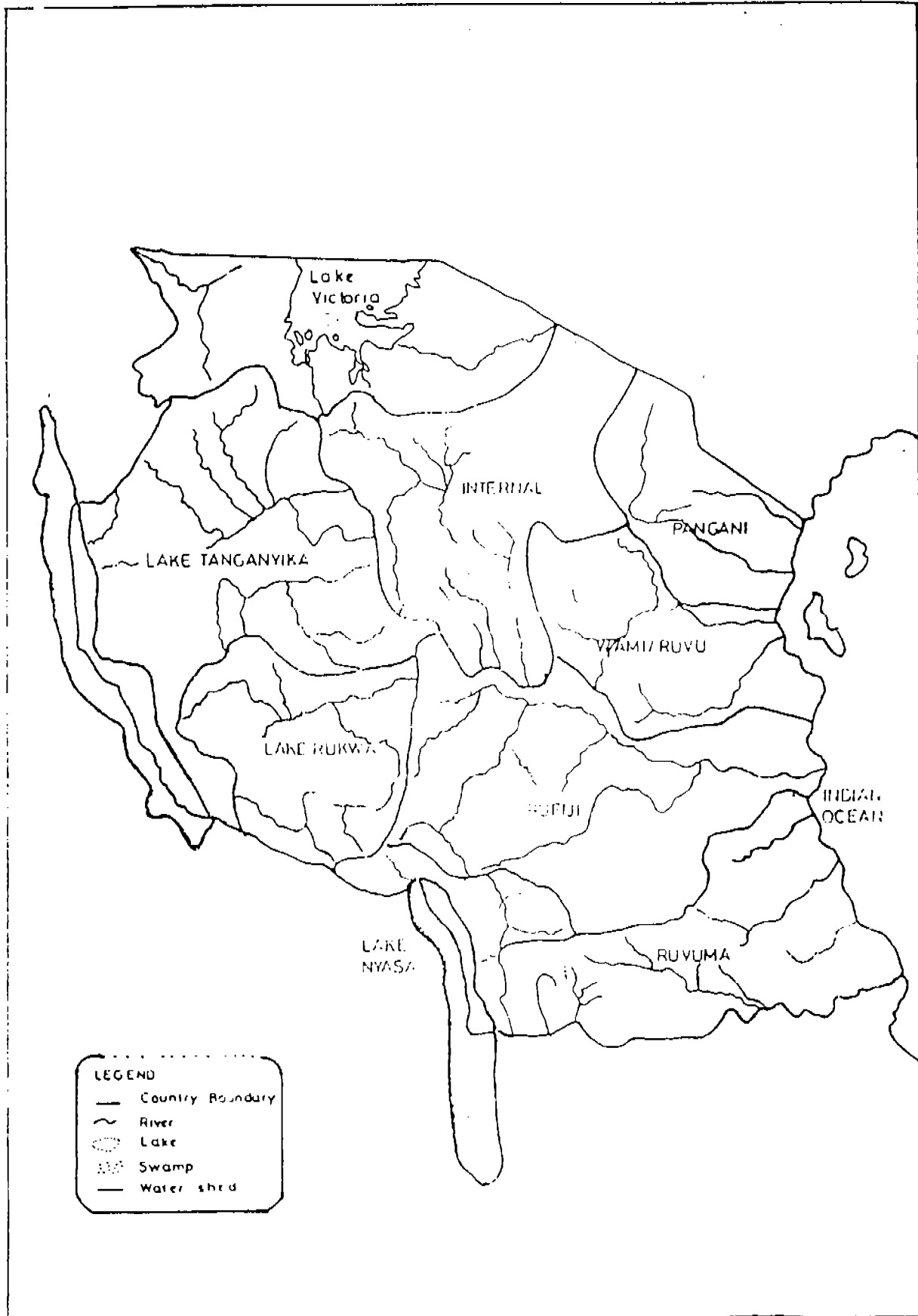
APPENDIX XIX

House with sanitation facilities

Sanitation facility	Mainland			Island		
	Total	D'Salaam	Other Urban	Rural	Zanzibar	total
Own flush toilet	0.9	2.6	3.2	0.2	1.1	0.9
shared flush toilet	0.4	0.8	1.5	0.1	0.2	0.4
Traditional pit latrine	84.2	92.1	88.8	82.4	41.3	82.8
Improved pit latrine	1.3	1.9	3.4	0.7	1.3	1.3
No facility, bush	12.3	1.8	2.2	15.7	56.2	13.7
Missing/ Don't know	0.9	0.8	0.9	0.9	0.0	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Tanzania Demographic and Health Survey 1991/1992
Bureau of Statistics, Planning Commission.

Major Drainage Basins of Tanzania



Mean Annual Rainfall

