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Study of Water Resources in Zimbabwe

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SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

Department for Natural Resources and the Environment

Publications on Water Resources

This series covers issues on water resources from a development cooperation perspective. Sida´s Department for Natural Resources and the Environment believes that the publications will be of interest to those involved in this field of work.

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Foreword

Sweden will during 1996 prepare a country strategy for development cooperation with Zimbabwe. The process involves discussion on which sectors should be given priority the next five-year period. This study was commissioned by Sida as an input to these discussions. The views presented in the report are those of the author and are not necessarily shared by Sida.

Water is becoming a more and more scarce resource in the country - a finite amount of fresh water shall satisfy the needs of the growing population, the production of food, industrial and energy production, cities and conservation of nature. The study addresses the future implications of water scarcity and the increased competition between different users of water as a potential source of conflict.

The study concludes that "Business as usual" will not address the growing water scarcity in Zimbabwe. In an "Adjusted scenario" the author discusses which measures are necessary to manage the limited water resource in the future.

Sida will give higher priority to water resources in future development cooperation. Sida has, among other things, decided to support sustainable use of water resources in a regional context in southern Africa.

We hope that the report will contribute to the discussions and the understanding of the complexity of water resources management in Zimbabwe.

Stockholm in March, 1996

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EXECUTIVE SUMMARY

Zimbabwe is presently experiencing the longest and most severe low-rainfall period of this century; the storage of water for the main towns is enough for another seven months on average. Just like in 1992, a drought management programme is underway to deal with the disastrous situation.

Droughts have always occurred in Zimbabwe and will continue to do so in the future; they are part of a general pattern of water scarcity, caused to some extent by unfavourable and fluctuating natural conditions and by an increasing population, but more importantly, by sub-optimal development and utilisation of available resources. Firstly, the **available water resources have still not been fully developed**; 4.7 cubic km, or 55% out of a total estimated annual potential surface water yield of 8.5 cubic km has been developed, and only a minor part of the potential groundwater resource is being utilised. There are also regional water resources in the rivers shared with neighbouring states, notably the Zambezi, of which it is assessed that Zimbabwe could utilise 2 cubic km. Secondly, there are **serious weaknesses in present water resources planning and management procedures**, leading to, among other things, an inefficient use of the developed resource. Thirdly, **there is a lack of understanding of** and institutional facility for dealing with water in its **broader environmental and cyclical context**; issues of catchment conservation, water harvesting and environmental impacts of and on water development do not receive sufficient attention.

Drought and water scarcity would be more efficiently counteracted through a **long-term programme of optimal resource development and improved water management,** than through crisis management and crash drought-fighting programmes as the need arises.

Surface water has been developed through a system of more that 8,000 dams. The irrigation sub-sector accounts for 80% of the developed surface water, and the urban, industrial and mining sub-sector for the remaining 20%. Commercial farmers use 84% of the irrigation water, in effect, two thirds of the developed surface water is used for large-scale commercial farming. Rural primary water supply is based on groundwater extraction through boreholes and wells.

The most important current area of conflict in the water sector is the matter of **equitable distribution of water**, notably between commercial and smallholder farmers. Tensions also exist between individual farmers in the same catchment, and between different types of users within and between sub-sectors. Conflicts are also emerging between communities and the Government, especially during the present drought.

Given the projected increase of population, and assuming the present per-capita development of water, it is shown in **a "worst-case" scenario**, that the internal surface **water resources would be sufficient only up to 2025**. If the assumed potential of international rivers is added, there would be enough water up to 2040. The effects of such a scenario on the economic and financial health of the country would be disastrous, and it is probable that the increased competition for water that would be the result, would create social unrest and political disturbance, nationally as well as regionally.

Such a scenario, however, does not take into account possible changes of the present sub-optimal water management patterns. By imparting a **holistic view on water resources**, by **improving** planning and management **institutions** and enhancing their capacity, by putting a **proper pricing** strategy in place, and by combining a careful further development of new resources with a **massive effort in conservation and recycling**, it is possible to arrive at **more positive scenarios**.

One such scenario is presented which serves as an example of what can be achieved with **fairly conservative and quite realistic improvements of recycling and water use efficiency**. In this scenario, the internal surface water **resources would be enough up to and even beyond 2050**.

There are currently several important initiatives underway in Zimbabwe, which are intending to address issues crucial to improved water management, the most significant being the preparation of a **Water Resources Management Strategy**.

The above scenarios have several implications at a policy level for the development cooperation between Sweden and Zimbabwe. The following areas are recommended to be brought up in the dialogue:

* **Water**, being probably the most important limiting factor for economic and natural resource development in the future, needs to be given the **prominence** it deserves **in the national planning process.**

* Droughts will continue to occur in the foreseeable future, and drought planning and management needs to be integrated into general **long-term routines for improved water resource development and planning** rather then being addressed through crisis management.

* There will be a need for massive investments in the water sector in the future; in order to avoid other directly productive sectors being disadvantaged, **alternative financing solutions,** including private, need to be found, and efforts in that direction supported.

* **Capacity building** in connection with foreseen institutional changes relating to decentralised catchment planning and management, and in connection with increased future attention to groundwater development and development of regional resources, **needs to be attempted in a coordinated fashion.**

1. INTRODUCTION

The objective of this study is to describe and analyse water resources issues in Zimbabwe with a view to include pertinent issues in a Swedish country strategy for Zimbabwe.

The study has required an examination of a very wide cross-section of sectoral information, in order to gain as comprehensive an overview as possible of the issues that could be of interest and concern to Sweden in its development cooperation with Zimbabwe. The methodology used for the study therefore included a desk study of relevant sector documents, and interviews with key sector institutions and individuals during a two-week field trip in Zimbabwe during July 1995. A draft report was presented in July 1995 and the present final version takes into account comments received - from Sida and others - on the draft report.

The report begins, in Chapter 2 below, with an outline of available water resources, and continues in Chapter 3 with a discussion on the implications of recent and recurring droughts. Chapter 4 presents the major water uses and users, and Chapter 5 identifies the conflicts that arise largely as a result of competing and growing demand under conditions of increasing water scarcity. The institutional, legal, policy and planning issues in the water sector, and the major sectoral developments, including the role of donors, have been summarized in Chapters 6 and 7. A more detailed description of these issues is presented in Appendices 3 and 4. Future water resources development scenarios and their societal implications are discussed in Chapter 8. Finally, Chapter 9 comments on some policy issues that arise from the scenarios, which may be of relevance to Sweden's future development cooperation with Zimbabwe.

2. WATER RESOURCES OF ZIMBABWE

A terrain and drainage map of Zimbabwe is shown in Figure 2.1. It is of particular interest from a water supply point of view that the major towns are located more or less on the water divide between the north-flowing and the south-flowing rivers.

The most important natural cause of water scarcity in Zimbabwe is the combination of a basic dry climate, and large temporal and spatial variations of rainfall. The mean annual **rainfall** is 650 mm, the main part of which occurs from November through March with the rest of the year being virtually dry. The variations of annual rainfall are also considerable, with variations of 400 - 600 mm from one year to another being common. Geographically, the annual rainfall varies between above 2 000 mm in the mountain areas in the east to less than 400 mm per year in an area covering one quarter of the country in the southwest.

The water balance of Zimbabwe is shown schematically in Figure 2.2. In a normal year, rainfall contributes a total of 253 cubic km of water to Zimbabwe. Of this amount, some 231 cubic km is lost as evaporation from the land surface and transpiration from vegetation. An estimated 20 cubic km forms runoff in the rivers, and constitutes the main source of water for irrigation, urban, industrial and mining uses. An estimated 3.7 cubic km infiltrates to form groundwater. A part of the groundwater which is not utilised, evaporated or lost as regional outflow, will eventually be discharged as surface flow in the rivers and thus be part of the surface water component. For the purpose of this study, this amount has been put at 1.7 cubic km.

With a population of 11.3 million, the total amount of water theoretically available per capita is thus around 1 900 cubic m annually. This can be compared to an average of 6 500 cubic m for Africa as a whole and a world average of 7 700.

However, the annual **run-off** has an even greater temporal variation than rainfall, extremes ranging from 4 mm to 300 mm. This large variation makes it necessary to construct storage reservoirs that can balance years of high run-off with years of low run-off. Due to evaporation from the water surfaces in the dams, and other losses, and due to lack of suitable control and storage sites and areas where water is difficult to utilise, the **surface water yield that could potentially be obtained** through an optimally designed system of dams and extraction points would, according to the Department of Water Resources (DWR), be **around 8.5 cubic km.** A more realistic figure of the annual per capita availability of surface water would therefore be 750 cubic m. This figure still does

not take into account the geographical variations of runoff and population, and extreme long-term variations of rainfall.

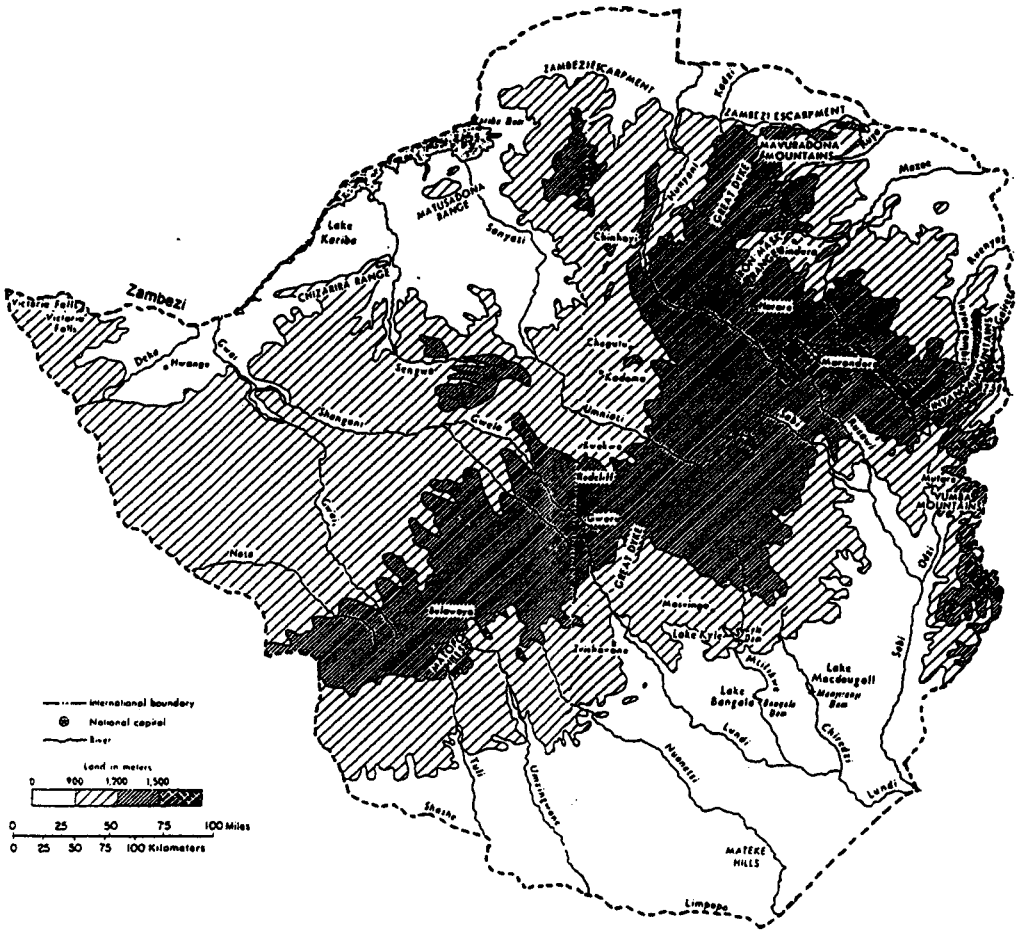

Figure 2.1 Terrain and drainage map of Zimbabwe (Nelson H D, 1982).

More than 8,000 dams of various sizes have been built to tap the surface water resources, and, including also the direct extraction from rivers, the **total developed surface water yield**, according to DWR, **is 4.7 cubic km.** This figure is based on issued water rights and is not equal to the actual use of water which will be less; conveyance losses will appear between the supply points and the users, and during normal years there will be an excess of water in the supply system, whereas during periods of low rainfall such as the present one, the actual yield of the system will be lower. In a normal year the actual utilisation is said to be 3.5 cubic km, whereas during recent years it has been as low as 2.8 cubic km. The figure of 4.7 cubic km does represent, however, the yield that has presently been committed in order to supply water at the different levels of risk applied. This means that, **theoretically, a potential surface yield of 3.8 cubic km remains for future development.** The realism of such a development will be discussed later in the report.

In addition to its internal water resources, Zimbabwe shares two major rivers with its neighbouring countries, the Zambezi on the border with Zambia, and the Limpopo on the border with South Africa. According to DWR the mean annual flow of the Zambezi as it enters the country is 37 cubic km, and the flow in the Limpopo is 2 cubic km. In the absence of accurate data, it may be a fairly realistic assessment that an annual yield of about half the mean annual flow could be developed; this is from purely technical point of view, considering storage requirements and expected losses. However, considering that this water will have to be shared with several other countries which have the right to participate in its development, the manifest interest of South Africa to participate in such a development, and the fact that a minimum amount of water will be needed for hydroelectric

production at plants already in existence, and other downstream uses including environmental, the amount available for Zimbabwe will be much more limited. For the purposes of the present discussion **it is assumed that Zimbabwe can extract 2.0 cubic km from common rivers.**

It should be pointed out that the word "internal" for Zimbabwe's water resources is somewhat vague since all runoff, if not dammed and used by Zimbabwe, would eventually end up somewhere else. For instance, a major part, or 11.5 cu km, of what has above been described as the internal surface water runoff, actually drains to the Zambezi. Several rivers originating in Zimbabwe are drained through Mozambique to the Indian Ocean, and it is obvious that Zimbabwe will not be able to use this water freely in the future without consultation.

The recharge and occurrence of **groundwater** is also highly variable, depending on varying local catchment conditions. The recharge estimate of 3.7 cubic km corresponds to a an average recharge of 1.5% of the rainfall, and is considered a conservative one. It is probable that groundwater recharge is higher, but there is presently no data to substantiate this.

Groundwater levels also vary substantially with rainfall. There has been a steady general decline of the levels during the present period of low rainfall. There are, however, indications of groundwater tables in certain parts of the country having been even lower during a period of low rainfall about 25 years ago, and then recovered (Morgan, 1995).

All groundwater recharge is not extractable; three quarters of the area of Zimbabwe is covered by hard rocks, and boreholes and wells constructed here will produce limited yields suitable only for primary supplies. There are some potentially high-yielding aquifers in sedimentary and alluvial deposits in the southeastern and western parts of the country, which would be suitable also for larger supplies including irrigation. Unfortunately, the location of these aquifers does not always correspond with population centres.

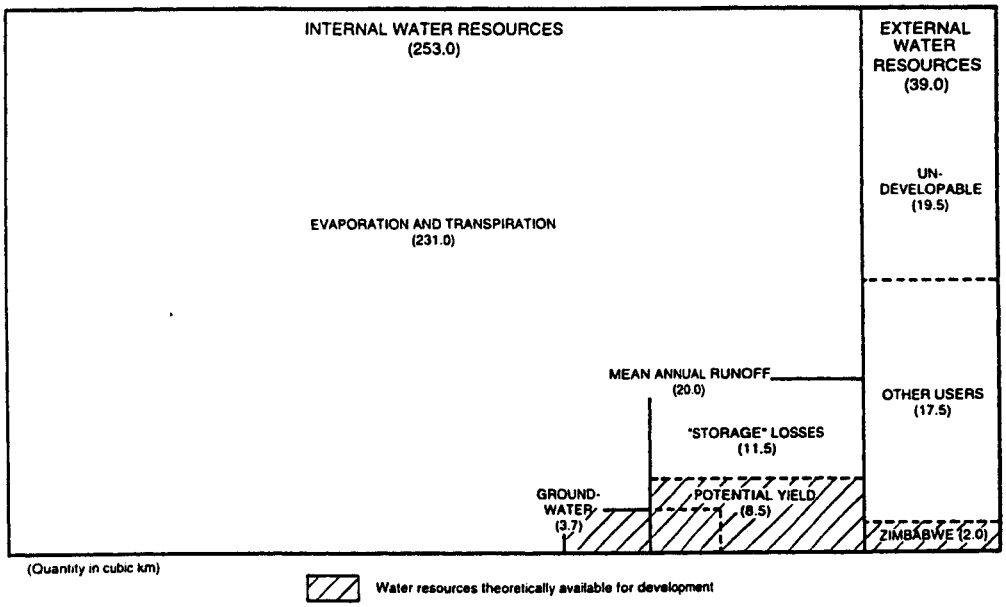

Figure 2.2 Water balance of Zimbabwe (including regional resources).

3. DROUGHT

3.1 Causes of drought

Zimbabwe was severely hit by drought in 1992 and rainfall has been below normal for the last seven years, which has resulted in extremely low levels of storage in certain areas. The present position (November 1995) is similar to that in 1992 and the country faces a difficult water supply situation during the following months.

It is appropriate to consider drought in relation to four basic conditions, namely (1) the basic dry climate condition that prevail in large parts of Zimbabwe, (2) the actual meteorological drought conditions brought about by extended periods of lower than normal rainfall, (3) aggravating effects of human activities such as physical degradation of catchment areas and sub-optimal water management, or the effect on the per capita availability of water caused by increased population, migration, and increased economic activity, and (4) certain economic and political conditions at national and regional levels.

Semi-arid conditions and naturally caused meteorological droughts are something that Zimbabwe will have to live with. Figure 3.1 shows a time series of rainfall anomalies over Zimbabwe. The rainfall pattern has a cyclic nature; periods of high rainfall alternate with periods of low rainfall.

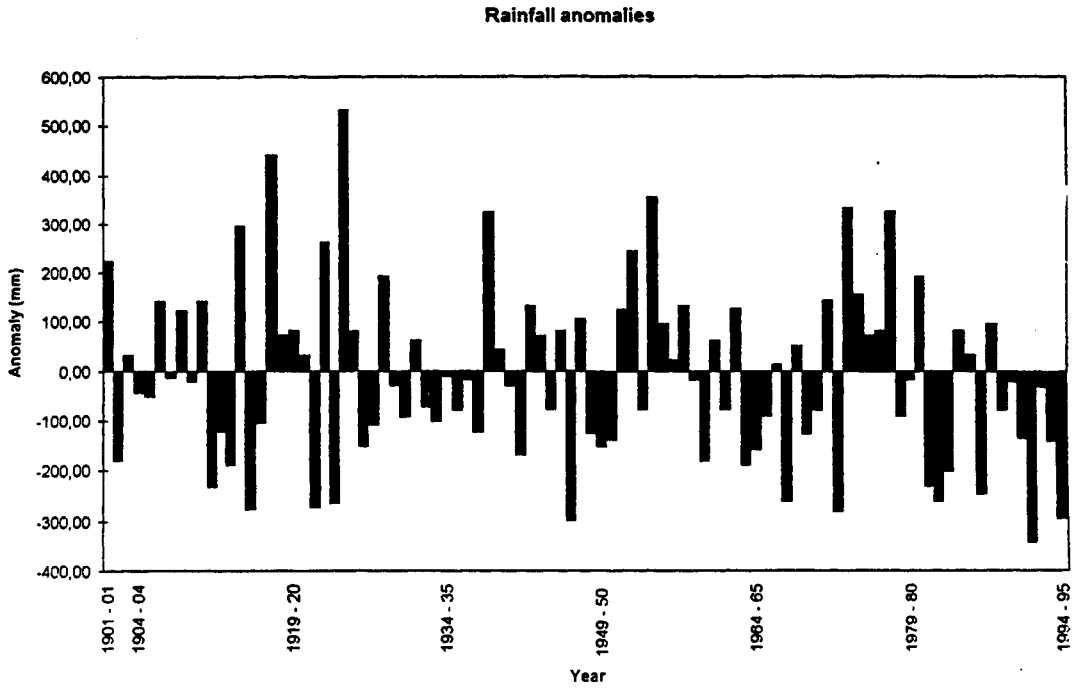

Figure 3.1 Time series of rainfall anomalies over Zimbabwe (adapted from Matarira, 1988).

Zimbabwe is presently in the longest and most severe low-rainfall period of the century, and it is often argued that this could be the result of global climatic change. However, model studies carried out in Zimbabwe have not shown any such correlation, and there is nothing to suggest that the present meteorological drought is caused by anything other than normal variability of rainfall.

It is more interesting and relevant to analyse the factors that aggravate the impact of meteorological drought, factors that are all influenced by human activities and which may, if not combated, turn the periodic natural droughts into a chronic condition of severe water scarcity. At the same time, changes relating to these factors may also result in improved water management in the future, as will be discussed in Chapter 8.

Land degradation and improper catchment management are important factors aggravating drought in Zimbabwe. The degradation of land results in decreased soil moisture and reduced infiltration to groundwater, and increases surface runoff, causing erosion and siltation of downstream dams. About 60% of the country is classified as eroded to some extent, with most of the severely eroded areas being in the communal lands which are also usually low-rainfall areas. Land degradation also results in drastically changed micro-climatic conditions which may start an irreversible local aridification process, which in turn will reduce moisture circulation and influence rainfall patterns.

The impact of droughts has been seriously aggravated by **poor water management practices**. Development of water has until now taken place in an uncoordinated way; it has been driven by

demand with little long-term or holistic planning. Specific factors that have contributed to poor water management practices have included insufficient monitoring and availability of planning data, insufficient funds for maintenance of primary supplies, lack of appropriate and sufficient conservation measures, old and inefficient distribution systems, deficiencies in pricing policies, and inefficient enforcement of the water law.

Of several **socio-economic variables** with a considerable impact on drought susceptibility, population growth is the most important. According to UN projections, the population will have increased by 73% by 2020, and by 136% by 2050; the impact on the per capita availability of water, especially in times of drought, is obvious. Furthermore, urbanisation, expanded irrigation and an increased industrial production increases demand and competition for the limited amounts of water available.

The drought in 1992, was aggravated by some **economic and political factors** at macro level. The then newly initiated Economic Structural Adjustment Programme (ESAP) put a strain on the country in general and on especially vulnerable groups in particular, a strain that further deepened the impact of the drought. In addition, Government food-stock and production policies had reduced the amount of food available in the country to unusually low levels, and cereals had to be imported. There was also at that time civil unrest in neighbouring Mozambique which created a refugee problem, and there were sanctions against South Africa, which resulted in difficulties in transport of commodities.

3.2 Effects of drought

The severe drought experienced in 1992 can serve as a good example of the effects of drought. More than 40 % of Zimbabwe's population was affected to the extent that they were forced to request and receive food rations from the Government. Women, children and elderly people, especially in the rural areas, were the most severely affected groups.

In economic terms, the drought resulted in a fall of GNP by 11-12% and an inflation rate reaching 48% at the height of the drought. The effects of this were most seriously felt by the more vulnerable groups. The drought resulted in loss of agricultural export and unprecedented food imports, with a net estimated impact on the balance of payments of 1.5 billion US$. The imported food was not enough, however, to provide full rations to all people; again it was the more vulnerable groups who suffered most, and the drought thus contributed to rural impoverishment. Production in the agricultural sector fell by 40% and more than 600 000 cattle were slaughtered or died due to starvation. Wildlife suffered from increased illegal poaching and lack of water in the National Parks.

Water supplies both to towns and in rural areas were seriously affected by the drought. Large cities like Bulawayo and Mutare were facing an acute risk of running out of water completely and were able to manage only by means of drastic rationing and emergency measures such as borehole drilling. In rural areas, 40% of the water supply points were dry or nun-functioning, and there was an increase of illnesses related to lack of water and malnutrition. Rural water supplies based on boreholes were less prone to drying up than shallow wells, and family wells often performed better than communal shallow wells. The industry and mining sectors suffered from lack of water supply and rationing of electricity, following a drastic fall of water levels in the Kariba Dam. This had serious repercussions on industrial production and unemployment rates. The effects of the drought were regional as well as national, affecting all countries in southern Africa. Attention was thus focused on the necessity of joint efforts to develop water resources in the common river basins.

In addition to the above mentioned effects, drought has serious negative effects on the physical environment as such. It leads to an even more intensive and destructive pressure on land, which will further aggravate land degradation caused by the drought itself, especially in ecologically fragile environments.

The present drought is expected to have similar effects on the economy and on water supplies as the one in 1992. Water reserves for most towns as on 30 October 1995 were enough for 7 months on average, although Mutare was left with water only for another 3 months.

3.3 Drought mitigation

In spite of the serious effects of the drought, it is a general consensus that the crisis measures taken by the Government to mitigate the effects of the drought in 1992 were on the whole successful, both in the agricultural sector and the water sector, although slower in the power sector.

With regard to water, there are several technical and legal instruments available for drought mitigation. For instance, if the volume of water available in the water supply dams falls below a certain level at a specific point in time, rationing is commenced. In the city of Bulawayo, the depletion of the water supply dams was serious in January 1991, and a rationing programme was introduced by which consumption above a certain level was levied with high fees. It was hoped that the rains during 1991/92 would improve the storage position, but when this did not happen and it was realised in January 1992 that the existing storage would be enough for just another 9 months, the rationing was revised drastically, and desperate measures were taken to bring the consumption down. The city and its surroundings was declared both a water shortage area and an underground water shortage area by the President. Such a declaration provides a legal instrument to redistribute water to where it is most needed. A drilling programme was started in a nearby aquifer and a 47 km pipeline constructed. The situation was saved by good rains before the programme had been finalised.

The 1992 drought was declared a National Disaster, and the National Action Committee for Rural Water Supply and Sanitation, with its National Coordination Unit, was tasked with coordinating the efforts of implementing agencies in the water sector to combat the drought. An emergency plan for procurement of essential raw materials and equipment, and for drilling and rehabilitation of boreholes and well-deepening for primary water supply was prepared. Although there were substantial delays in implementation, urgent requirements were satisfied, for example through use of water browsers. The bulk of the programme was aimed at recovery and mitigation, which was successfully achieved. The emergency plan also set targets for reduction of water consumption and losses in municipalities.

Later assessments of this work have been generally positive. The country managed to pull through the drought even if it was at high economic costs and suffering for people. One point of criticism is that although early warning was actually given, the preparedness of the authorities to respond was not sufficient.

The situation in Bulawayo today is similar although slightly better than in 1992. As on 30 October 1995, the supply in the city dams is enough for 7 months' supply assuming zero inflow. Heavy rationing is in place and is to be increased in order to make sure that a reserve is kept in case there is another season of poor rains. All groundwater sources are to be used at full extent.

Overall coordination of activities during the present drought is carried out by the Ministry of Labour, Public Service and Social Welfare. An Emergency Water Plan has been prepared, based on information from urban local authorities and concerned agencies. Some Government funds have been allocated for drilling activities among others, and the plan has been used for soliciting external funds.

While a great deal of emphasis is placed on the problem of drought as a natural disaster - with dramatic arguments being provided about disastrous rainfall patterns, climatic change and so on - drought should in fact be seen more as part of a pattern of ongoing water scarcity. **The best way to combat drought is through a long-term programme of optimal resource development and improved water management rather than through crisis management and crash drought-fighting programmes as the need arises.** In other words, drought planning and management should be integrated into general routines for water resource development planning and management. In addition, the need to integrate water resource planning and development with general environmental protection, and improvement of catchment areas can not be over-emphasized.

The problem of water scarcity in Zimbabwe is only to some extent a problem of a limited water resource; more important is that it is presently sub-optimally developed and managed. Developing the remaining internal potential water yield of 3.8 cubic km will be a matter of finding solutions that are feasible from technical, environmental, economic, financial, social and political

points of view. A possible but very difficult task, considering the massive investments needed. A balance will have to be found where an optimal level of development is combined with a maximally efficient management of the developed resource.

4. PRESENT USERS

4.1 Economic sector

Irrigation accounts for about 80%, or 3.8 cubic km, of the developed surface water, and the urban, industrial and mining (UIM) sub-sector for the remaining 20%, or 0.9 cubic km.

The development of **irrigation** started seriously in the early 1960's with the introduction of sugar cane irrigation. Following a need for self-sufficiency in wheat and the provision of credit facilities, a further expansion took place in the 1960's and 1970's. At present, due to high investment costs, there is only limited expansion other than for export crops such as tobacco and for horticultural crops. Sprinkler irrigation accounts for 75% of the irrigated area, the remaining being irrigated by surface methods.

The area presently developed for irrigation is 119 000 ha. With some areas cropped more than once in a year, the total area irrigated annually is about 150 000 ha. Commercial farms account for 84% of this area, parastatal schemes for 9% and smallholder farmers for 7%. In addition to officially developed irrigation land, there is an additional 20 000 ha of family garden and wetland ("dambo") cultivation, using water drawn by hand from pools and hand dug wells, or by drainage of upstream wetlands.

Most of the commercial farms use water developed by the farmers themselves, and even today new schemes are being implemented with private funding. The parastatal schemes were originally set up with the long-term goal of being taken over by communal farmers. This has failed and the schemes have become more of state farming ventures. Water for these schemes comes from large dams belonging to the Government.

There is growing emphasis on distribution of water to the **smallholder sector.** For instance, a decision has been taken to allocate an adequate percentage of the mean annual runoff for future use in communal lands, and 10% of all Government agreement water has in principle been offered for use by small scale farmers. There are, however, several limitations to the ability of smallholder farmers to develop irrigation, the most important being limited land tenure and a resulting inability to secure finance for investment. Other limitations are small-sized plots, lack of adequate extension and in some areas unsuitable land, be it for natural reasons or because of land degradation. Also, water supplies are often at substantial distances, causing high conveyance costs. Questions have thus been posed on the economic viability of the special allocation of water, but the advantages are seen to outweigh the limitations.

Development of **groundwater for irrigation** has been very limited. There is good scope for developing currently undeveloped high-yielding aquifers in certain areas for irrigation, pen-fattening and other income generating activities. It has been estimated that the total development of groundwater, for all uses, amounts to 0.15 cubic km.

It is assessed that the quantity of surface water developed for **industries and mining** amounts to about 0.4 cubic km. In addition, these two sub-sectors also utilise substantial amounts of groundwater. The major industrial users are the textile industry, dye houses, food manufacturers and leather and tanning industries.

Although electricity generation as such does not consume water, it relies on adequate flows and storage. There is no internal river in Zimbabwe suited for **hydropower** generation, and there is no hydro-power plant other than at the Kariba dam on the Zambezi river. The net evaporation losses from this reservoir are huge, some 7 cubic km per year. Due to low inflow into the Kariba dam during the last few years, the power plant is able to supply only 15% of Zimbabwe's electricity needs compared to 20% as originally intended. The current level of water in the reservoir is presently (November, 1995) only 1.3 metres above the minimum level required for power generation, a level which would drop to zero in less than half a year assuming no inflow. No formal energy conservation

measures have been taken, but there have been public appeals for voluntary conservation. There are plans to start importing energy from South Africa in January 1996. The energy sector also uses water for cooling of coal-driven plants, however, the extent of this use is not known.

"Passive" users of water include the **tourism industry** which is dependent on flow of water in the rivers and water for wild life. **Fishery** is an important industry in lake Kariba with annual catches of 30 000 tonnes, valued at 55 million US$.

4.2 Social sector

It is assessed that about 0.5 cubic km is developed for **urban water supply.** This water is supplied from surface dams with some minor complementary quantities from groundwater, such as the Nyamandhlovu Aquifer close to Bulawayo. The water is mostly provided at the source by DWR, and the local authorities are responsible for its abstraction, purification and distribution.

The **rural primary supplies** are based on groundwater, traditionally from ponds, springs and open shallow wells, but more recently through deep wells and boreholes constructed under the National Rural Water Supply and Sanitation Programme (NRWSSP). These are usually communal water supply points, but there is also a separate programme to supply rural domestic water through family wells; these can be more efficiently maintained and do not dry up as easily during dry periods.

The officially stated coverage of primary water supplies is 60% for rural areas. Some 29 000 wells and boreholes have been developed under NRWSSP and the goal of the programme is to reach an estimated 60,000 to achieve full coverage. It is assessed that the present extraction of groundwater for primary supplies is less than 50 million cubic metres per year. From a national water resource point of view, therefore, there should be no difficulty in achieving full coverage through groundwater extraction. However, the occurrence of groundwater is geographically highly variable and there are some pockets where groundwater in sufficient quantity is not available. A major problem in this programme is presently the lack of funds for maintenance; about 30% of the supply points are presently out of action, some because of drying up but most because of lack of maintenance.

There are also private companies engaged in drilling wells for domestic supplies. The extent of their operations is not known, but it is estimated that there are between 50 and 100 private drilling rigs in operation in the country. There is presently no legal control of the development of groundwater under normal conditions, this aspect is expected to be dealt with in a future revision of the Water Act.

The Zambezi river is used for urban water supply for some 100 000 people, but there is so far **no major water extraction project in any of the international rivers**. As will be described later on in this report, however, there are several planned projects at various levels of conceptualisation.

The development of surface water in relation to total potential is shown in Figure 4.1.

4.3 Pollution and water quality

Siltation of dams, caused partly by degradation of catchment areas due to improper land use, is an important water pollution problem in Zimbabwe today. Data on the actual siltation rates are not available, but according to DWR, smaller dams are expected to lose half their storage capacity within 20 years. The siltation rates for the very large dams is estimated to be about 10% in 80 years.

Other known sources of water pollution include mines, which contribute to siltation of dams and acidification of water, and pollution by heavy metals in the formal sector, and mercury pollution through illegal use of mercury by up to 200 000 small-scale gold panners. An iron and steel plant has been polluting the Kwe Kwe river for a long time, with negative effects on aquatic life and siltation. Pollution from textiles and ginning industry has occurred in several rivers, and there are also instances of pollution from waste oil from petroleum industry.

Use of fertilizers in agriculture in combination with the extensive erosion of mismanaged land, promotes growth of aquatic weeds such as water hyacinth in reservoirs, and chemicals and

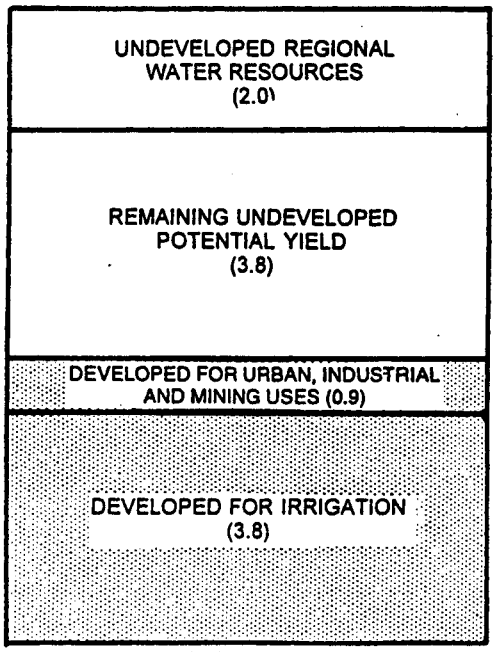

Figure 4.1 Development of surface water by main sub-sectors.

pesticides used in agriculture pollute surface and groundwater. Untreated sewage effluent from industries and major towns has created problems in some rivers and in Kariba Lake, and there has been instances of dumping of industrial refuse.

There is concern about possible influence of industrial pollution on the production of fish in Kariba lake.

The quality of groundwater is usually not a factor limiting its use for primary supplies, although there are some geographical pockets with high mineral or fluoride contents for which piped supplies may be developed as an alternative to wells or boreholes. Generally, however, surface dams are not considered suitable for primary supplies due to the contamination risks. There are instances of bacteriological contamination of unprotected wells, especially when located close to sanitation sites.

5. CONFLICTS

5.1 Conflicts in the water sector

Considering the wide range of actors in the water sector, in terms of water planning, development and management agencies and water users and polluters, given the historical evolution of water distribution in Zimbabwe and the dynamics between the many sector stakeholders, and given that water is a finite and generally scarce resource, it is in no way surprising that various conflicts exist in this sector.

The most important conflicts arising out of scarcity, use and distribution of water resources are:

* **Between the mostly white commercial farmers, and the smallholder and emerging black commercial farming sector.** Conflicts between these sectors concerning access to and use of water, emanate - as with land - from historical imbalances. In this context, one of the key issues is that most public water is developed or allocated for use in large-scale commercial irrigation. In

addition, the majority of permanent water rights are attached to land that falls within commercial farming areas, the ownership of which has been skewed historically in favour of a minority of white farmers.

* **Between individual commercial farmers within a given river basin**, where earlier right-holders may be challenged by more recent right-holders, or upstream users by downstream users, especially at times when flow levels are low. Where River Boards exist, these help to manage and control use within the legal parameters defined by individual water rights. However, in their absence, there is little evidence of self-management by right holders, and the chances of resolving conflicts between users at an early stage is more remote.

* **Between different types of agricultural use.** There is a persistent tension in the ongoing debate concerning use of limited water resources either for national food security purposes or for generating export earnings. At a more local level, there are conflicting policies between those that encourage cash crop production and those concerned with household food security. This latter issue is likely to have gender specific consequences, since women and men have different interests and concerns regarding these matters.

* **Between agricultural users and UIM users.** This issue mainly arises under conditions of acute water scarcity. The common principle is that under such conditions, UIM users are favoured, with domestic use having automatic priority, followed by mining, then industry. Agriculture usually follows last. These types of decisions are often perceived by different users to be too simplified, based on insufficient information and inadequate consultation with relevant stakeholders. Such conflicts typically arise over surface water sources. However, occasionally a groundwater source has been involved in such disputes, as occurred with the construction of the pipeline from Nyamandhlovu Aquifer, based within a commercial farming area, to Bulawayo city to provide for emergency water needs arising out of the 1992 drought.

* **Between communities and Government.** There are present indications of urban consumers coming out against their council for raising prices during the present drought; with the current general move towards stricter economic pricing of water, such conflicts are bound to be more common and more serious. Conflicts between communities and Government also commonly arise in relation to relocation due to dam construction, or in the development of irrigation schemes. A graphic example of the latter occurred recently in Guruve district, where villagers in two communal lands were reported to be resisting the construction of a Z$250 million German-funded irrigation scheme, and had threatened "to beat up anyone who visits their area in connection with the project" (The Herald, 1 July 1995).

In addition, **less pronounced and less dramatic conflicts** cover a number of areas, such as:

* Between local authorities and water polluters, where the local authorities face conflicts in trying to control negative practices. These include various industries in urban areas, or small-scale gold panners in rural areas causing environmental damage both to the riparian environment and to the water itself.

* Between men and women, where women's access to water resources for irrigation - as with other key resources in agriculture, such as land and credit - is severely limited. The future increase in water availability for the smallholder sector may well exacerbate this conflict unless fairer gender practices in resource allocation at national and local levels are implemented.

* Between and within certain Government ministries, particularly where coordination is either inadequate or non-existent. In a sector with so many different players, the division of responsibility for certain aspects of water resources development or management may be unclear or over-lapping, causing tension and conflict between agencies. This was true for some years with regard to borehole drilling, but has since been amicably resolved between DWR and the District Development Fund (DDF). Alternatively, competition for financial and human resources or even for status, may arise between sector agencies. Such conflicts are sometimes exacerbated by donors providing support to one agency without relating this to the responsibilities of others, so reinforcing institutional competition rather than cooperation. Donor competition may well be a related problem in this regard.

* Between differing policy approaches. Unclear or absent policies and strategies in key areas of sector development may allow for uneconomic, contradictory or even conflicting approaches to be adopted by unguided implementors. For example, before the adoption of family wells by the RWS sector as a valid technology choice for primary water supply development, there had been tension surrounding the issue and an under-utilisation of this low-cost yet sustainable option.

Serious conflicts between Zimbabwe and neighbouring riparian states along shared water courses have not yet developed. Concerns in the region have arisen over quantity allocation, poor water quality and environmental degradation. This has been exacerbated through the absence of adequate regional agreements or appropriate river basin institutions that could effectively manage the shared resource. One recent example is the concern expressed by Mozambique concerning Zimbabwe's proposed Pungwe Project. Looming in the future, however, may be more serious conflicts over multiple abstraction requirements from the Zambezi River. The recent signing of the Protocol on Shared Watercourse Systems in the SADC Region is one significant step towards avoiding future conflict in this area.

5.2 Factors likely to increase or reduce conflicts

An obvious long-term concern revolves around the threat of increasing water scarcity, and therefore the potential for increased competition and conflict over its distribution and use. While scarcity will be affected to some extent by changes in natural conditions, it is the changing demographic and economic patterns that are likely to contribute most to future scarcity and conflicts.

In the more immediate term, conflicts are exacerbated to a large extent by such factors as the lack of public information and education about water issues, lack of adequate consultation with stakeholders, unclear and/or contradictory national development and sectoral policies which have a bearing on water resources development and management, and insufficient financial or human resources with which to adequately develop, maintain, conserve and manage available water resources.

Correspondingly, some of the **measures likely to pre-empt or reduce potential and existing conflicts include:**

* improved **communication** and dialogue between users, with an emphasis on areas of common interest in water resource management;

* **increasing the available water resources** through conservation and recycling measures and generally more efficient water use;

* developing **clear policies and unambiguous legislation** on water allocation and reallocation, based on principles of 'equitable' distribution; and

* ensuring **greater transparency in decision-making** with regard to prioritisation of water resources development and allocation, as well as narrowing the gaps between political criteria and technical, economic or environmental criteria in decision-making.

5.3 Conflict management and dispute resolution

Despite the possibilities for reducing or preventing conflicts, the reality is that water-related conflicts do exist and will continue to arise, and appropriate and effective mechanisms are needed to manage and resolve such problems. These may include the following:

* **An appropriate institution (or institutions) at national level**, with sufficient capacity and authority to undertake sector policy making, planning, coordination and management;

* **Mandatory river or catchment management bodies** at local level, representing all stakeholders (not only water right-holders), with adequate capacity and information to plan, monitor and manage local water resources development and use, and empowered with sufficient authority to enforce decisions;

* **An enhanced Administrative (Water) Court** with sufficient capacity to speed up its decisions and increase the possibility for decentralised hearings, and with wider representation amongst its adjudicators;

* **Regional river basin commissions** which are harmonised with national priorities and laws, supported by appropriate legal and institutional measures to address dispute resolution, and with sufficient authority, capacity and resources to ensure implementation of joint decisions.

6. INSTITUTIONAL, LEGAL, POLICY AND PLANNING FRAMEWORK

The key agencies concerned with water resources development, distribution, management and sustainability, and their institutional capacity are described in detail in Appendix 3, which contains also a detailed description of the legal, policy and planning framework in place in Zimbabwe. A summarized account is provided in the following.

The **institutional framework** for the sector is characterised by the large number of actors involved in different aspects of water resources development and management. Within the public sector, the Department of Water Resources (DWR) is most critical in terms of its role in administering the Water Act, in developing key sector policies, and in planning and developing large scale water supplies. The District Development Fund (DDF) is the main implementation agency with respect to development and operation and maintenance of primary rural water supplies. The Department of Agricultural, Technical and Extension Services (AGRITEX) plays a complementary role to DWR in its responsibilities for both large scale and smallholder irrigation development. In addition to these, there are numerous other public sector agencies linked with related aspects such as environment, local government, health, hydro-power and national economic planning. The activities of private sector organisations, other than private drilling and engineering companies, are mostly in terms of representation of various stakeholders' interests. Other agencies - both public and private - are engaged in research and training.

While there are examples of active coordination bodies within particular sub-sectors - the most successful of these being the National Action Committee for Rural Water Supply and Sanitation - overall sector coordination is weak, especially with regard to policy development and strategic planning, which reduces the effectiveness of investments. This is expected to improve with a current initiative to develop a **Water Resources Management Strategy (WRMS)** which will cover aspects such as equitable allocation, pricing, demand management, quantification of resources and demands, management guidelines, investment strategies, capacity building and legislation.

In terms of the **legal framework** for the sector, the Water Act is the single most important piece of legislation, guiding water resources planning, development, distribution, pollution control, dispute resolution and management. Despite being fairly comprehensive, the Act has nonetheless been under review for some time, with proposals revolving around such issues as the current rights allocation and water distribution system, the need to revive outline water development plans, making river boards - or rather an expanded catchment management body - mandatory, strengthening the monitoring and control of groundwater resources under normal conditions, and strengthening enforcement mechanisms for both pollution and misuse of water. The Administrative (Water) Court, which plays such a key role in allocation of rights and dispute resolution, is considered to be insufficiently resourced and too centralised to carry out its responsibilities effectively. There are a number of other Acts that have a bearing on water resources, however there is need for greater harmonisation between all relevant legislation, both at national and regional levels.

Parallel to the debates within the legal sphere are several **policy developments and challenges** which have begun to cluster around a few key areas. One of the main issues concerns equitable distribution, and in particular the need for increased water resources to be made available to the smallholder farming sector. Emphasis is being placed on developing a river basin approach to water resources planning and management, which corresponds with growing commitments to decentralisation and enhanced stakeholder participation. The strengthening of Rural District Councils also falls in line with overall decentralisation policy and general moves towards democratisation, whilst creating possibilities for improved sustainability of the water resources and associated infrastructure. Community-based management and growing gender awareness in the rural water supply sub-sector are especially relevant to sustainability and democratisation. In addition to the above, important links are beginning to be made between access to and use of land and water.

The present Government policy with regard to **pricing of water** is to recover the historical capital costs, and the present costs for operation and maintenance. It is also intended that rural and low-income urban households should get water at a subsidised price. Most water is supplied at a blend price, which averages out all costs and all sales of water within each of the different sub-sectors. There are severe deficiencies in the present pricing system and the manner in which it is being applied. The application of blend prices, although justifiable from equity point of view, inhibits the development of water-saving technologies and a more efficient use of water. The intended subsidy effects are skewed by deficiencies in the actual application of the pricing policy, resulting in costs being far from recovered; if such implicit subsidies are considered from a macro-economic perspective it seems that high-income urban families are more subsidised than rural and low-income urban households. The implicit subsidies to the irrigation sector are enormous, both to commercial and formal small-scale irrigation farmers.

Planning responsibilities in the sector are spread amongst many agencies, making it difficult to ensure a strategic and holistic approach. So far, national development planning has not provided the necessary framework for coordinated, cross-sectoral planning, other than in particular sub-sectors such as rural water supplies. However, there is growing evidence of a move in this direction. A macro-level perspective is much needed with regard to both urban and rural development projections and growth strategies, in order to guide resource planning and ensure a balance with current and future demand requirements. Achieving this perspective is largely dependent on more and better planning information, an area which in itself needs strengthening. There is also a need to recognise water scarcity and occasional periods of acute shortage as an ongoing pattern, and therefore to include drought preparedness measures as part of routine planning and management of water resources.

7. MAJOR DEVELOPMENT ACTIVITIES IN THE WATER SECTOR

A detailed description is given in Appendix 4, of major water-related programmes and projects in Zimbabwe, the investment patterns in the water sector and the role played by donors. A summarized account is provided in the following.

Primary water supplies are mostly implemented through an integrated national programme, coordinated both horizontally and vertically. The programme has expanded fairly rapidly over the past five years, and it is estimated that by 2005 over 80% of rural districts will have either completed or be implementing integrated water supply and sanitation projects. The sub-sector has been at the forefront of decentralisation, and is now complementing this approach with an increasing focus on community management and gender awareness.

DWR has an ongoing national programme for construction of **dams and conveyance works** for large scale water supplies to service urban, industrial and mining needs and irrigation requirements of commercial and parastatal agriculture, and smallholder irrigation. DWR has long-term water resources development plans based on fairly linear projections of future demands. The scale of projects ranges from medium sized dams in communal lands to large national dams and conveyance works. The larger projects are often confronted with complex economic, social and environmental challenges, as is the case in two current projects, namely the Pungwe Project to supply water to Mutare from the Pungwe River, and the Zambezi Pipeline Pre-Feasibility Study, which faces the sensitive issues associated with pumping water from the Zambezi River.

Of primary importance with regard to **water resources management and institutional development**, is the forthcoming development of a comprehensive Water Resources Management Strategy, which is expected to address a wide range of institutional, policy and planning issues of general concern to the sector. Other current projects include the promotion of catchment management pilot projects in several river basins, the Save Basin rehabilitation project, a programme of institutional restructuring of DWR including a proposed move towards establishing the Zimbabwe National Water Authority (ZINWA), and various institutional development activities within the National Rural Water Supply and Sanitation Programme such as introduction of quality assurance methods. In addition, the national programme for capacity building of Rural District Councils has important implications for the water sector as a whole.

Sector **research and development** activities include ongoing work on appropriate rural water supply technology, most recently on family wells and the 'User Friendly Bush Pump', as well as on collector wells. There has been some research on groundwater resources, mostly on alluvial and sedimentary aquifers, whereas research on irrigation technology has been limited. Areas especially needing further attention include water conservation and improvement of water use efficiency; water capture and conservation options such as rain-water harvesting and sub-surface dams; irrigation technology; and groundwater monitoring, development and management.

A recent comprehensive study of water resources in Southern Africa, sponsored by USAID, provides an **overview of national and regional projects** in the sector. The report identifies thirty projects of particular significance for future development in the region, in at least half of which Zimbabwe is expected to be a key participant, including three of the first five priority projects. These are concerned with regional groundwater development studies, capacity building of river basin commissions, and ongoing implementation of the Zambezi River Action Plan. The recent signing of the SADC Protocol on Shared Watercourse Systems is expected to stimulate and enhance cooperation on water resource development and management in the region.

Donors are providing substantial support to the water sector, in the range of US$ 325 million for current projects. The proportion of donor to Government funding, however, varies between and within different sub-sectors. Overall, the main support for the sector emanates from a combination of two development banks - the African Development Bank and the World Bank - and nine bilateral Governments, of which Germany, Italy, Norway and Sweden provide some of the largest contributions. Financing by the different donors is generally concentrated in certain areas of interest. It is of prime importance for the Government to ensure coordinated policies and strategies for sector development in order to guide donors in their support.

8. SCENARIOS FOR FUTURE WATER DEVELOPMENT

8.1 Projected scenario

As has been described earlier, the amount of water potentially available for development internally in Zimbabwe is 8.5 cu km. Assuming that it would be possible to develop all this water, and **given the present consumption patterns and expected changes of population, when will Zimbabwe hit the ceiling as regards its water resources?**

Projections made by the UN indicate that Zimbabwe's population will reach 19.6 million by 2025 and 26.7 million by 2050. Using that as a basis, Figure 8.1 gives a generalised picture of what will happen if the per capita water development for each user category is kept at the present level, and assuming a degree of urbanisation of 50% by 2050. **The potentially available internal water yield of 8.5 cu km will be sufficient up to 2025**, after that it will be necessary to find new sources of water. Assuming that Zimbabwe can utilize only 2.0 cubic km of water from shared rivers, **the absolute limit as regards water resources physically available to Zimbabwe would be reached by 2040.**

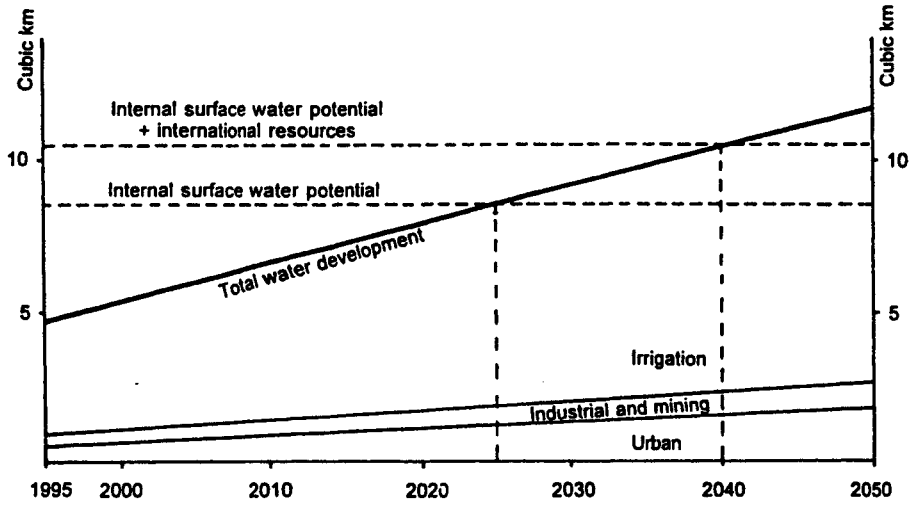

Figure 8.1. Projection of water development in Zimbabwe up to 2050 (based on present levels of per capita water development and UN population projections).

The above scenario would have **the following possible effects**:

EFFECTS ON ZIMBABWE:

- ★ Decreased economic viability of water supply projects
- ★ Substantially decreased economic viability of water-dependent activities, such as irrigation and industries
- ★ Decreased agricultural and industrial productivity
- ★ Massive drainage of capital for construction, operation and maintenance of water supply schemes, from other productive sectors of society
- ★ Permanent water scarcity, and drastically increased competition for water among sectors and sub-sectors, resulting in increased conflict, social unrest and political disturbance
- ★ Increased pollution and other negative environmental effects

EFFECTS ON THE REGION:

- ★ Acute risk of international conflict

This scenario should be seen as a **"worst case"** scenario, which it will most probably be possible to avoid, as discussed below.

8.2 Influencing factors

Obviously, the generalized picture shown in Figure 8.1 fails to take several important factors into account, factors which have a substantial impact on the present level and patterns of water development and will have so even more in the future. It is the **most important conclusion of the present study that water scarcity in Zimbabwe,** today and in the future, is only partly caused by limited natural water resources and increased population. More importantly, it **is caused by sub-optimal utilisation of the available resources.**

A discussion centered around some important factors is provided in the following in order to illustrate how the picture shown in Figure 8.1 can change, and what possible action, if taken now, will help to achieve a more sustainable supply and use of water in the next few decades. It should be noted that the **awareness of these issues, and the necessity to address them, is widespread**

among key agencies and actors in the water seetor in Zimbabwe. Many of the issues discussed below are being or will be addressed by a number of important initiatives already underway, notably the Water Resources Management Strategy.

Water resources

The figure of potential internal **surface water yield** of 8.5 cu km, has been calculated by DWR taking into consideration the necessary hydrological, technical and topographical aspects of dam design and construction. With the reservation of a possible impact of the presently very low rainfall, it thus constitutes an adequate assessment of the amount of water that can technically be developed. The quantity of water assumed to be available from shared river courses, 2.0 cubic km, is a much coarser estimate, but still considered fairly realistic. The development of water up to these limits, however, will depend on financial, economic, environmental and institutional conditions far more difficult to assess. We will return to such considerations below.

The long period of **dramatically low rainfall** which Zimbabwe is presently in, causes concern for the future renewal of water. As stated earlier, there is nothing to suggest that the low rainfall is caused by anything other than natural climatic fluctuations. Should this be incorrect, however, the very basis for calculation of potential yields of rivers and dams will be highly inaccurate.

Water has not been viewed holistically in the past, neither in national development planning nor in sectoral plans. There is a **lack of understanding of water in its broader environmental and cyclical context.** In this regard, a number of issues need to be adequately addressed, such as catchment conservation, effective water harvesting through appropriate land use patterns, links between surface water and groundwater both in terms of hydrological relationships, utilisation and pollution, and the overall impact on the environment of inappropriate water use and management. Water resources should be **understood as a 'chain of systems'**, with use or abuse of water in one area or part of the cycle affecting water elsewhere.

If and when the internal water resources of Zimbabwe are no longer sufficient to meet demands, it will be necessary to turn to **common rivers, notably the Zambezi.** It seems that the cost of developing Zambezi is prohibitive at present, but that may change in the future, as the value of water increases and suitable technical solutions unfold. As already mentioned, even the seemingly enormous quantity of water flowing in the Zambezi becomes quite limited if one considers the claims and interests of other users, and it is clear that the Zambezi river water alone will not provide the long-term solution to Zimbabwe's water problems. The serious economic, financial, environmental and technical difficulties connected to extraction of water from the Zambezi will need to be overcome, and cooperation with other riparian states achieved. The SADC Protocol will, when ratified, mean obvious benefits for Zimbabwe in terms of information exchange and actual joint planning for development of Zambezi water, but it will also mean increased demands for accountability and transparency with the other riparian states whilst placing restrictions on intended future uses.

Geographical imbalances

The **geographical imbalances in water availability and water demand** have not been taken into account in Figure 8.1. Certain parts of Zimbabwe are better endowed with water resources than others, unfortunately these areas are not always where the population concentration is highest or where expansion of irrigation is feasible.

Such geographical imbalances will mean that the available water resources will become insufficient earlier in certain parts of the country, and either **transferring water or controlling the migration of people** will be necessary. Transfer of water for significant distances is problematic from technical and environmental points of view and rapidly becomes economically unrealistic with increased conveyance distance, especially so in the case of irrigation water. Controlling migration of people may be even more difficult.

A plan for the expansion of the urban water supply dam systems up to 2020, which is directly linked to specific water demands and water resources actually available, has been prepared by DWR (Horizon 2020). This is based on an assumed annual urban population growth of 5%, and a net

consumption growth of 5% assuming that any future increase of per capita demand can be offset by conservation measures. The plan specifies when and from where water needs to be extracted for each urban centre in order to meet the increased demand. According to the plan, the total yield of all urban water supply dams will increase from the present 0.5 cu km to 1.2 cu km by 2020. In most cases, storage sites can be found reasonably close to the urban centres, but for Bulawayo it is assessed that extraction from Zambezi will be necessary by 2013. It is indicated in the plan that Harare will have to take up extraction of water from Zambezi by 2023.

Instead of transferring water to population centres, **can people be moved or unwanted migration of people be stopped?** To the extent that migration is part of the industrialization process, hindering it is neither possible nor desired. But, migration caused by adverse living conditions in the rural areas, should and could be stopped; provision of safe water in rural areas is one possible way. It is possible also, that such areas where large and presently unexploited groundwater resources are available could be made into rural focal points of economic development, and such areas could attract people that would otherwise live in the cities.

Estimations of the possible area that could be developed for **irrigation** if only land quality is considered, vary from 400 000 to 700 000 ha. The area that can actually be developed, however, is drastically limited by the availability and distribution of water. A plan for construction of dams for possible major irrigation development up to 2020 has been indicated by DWR (Horizon 2020). According to this, an additional 88 000 ha could be put under irrigation during that period using a yield of 1.4 cubic km of water from 14 specified dam sites. None of these projects has Zambezi as a source. In fact, apart from an area of 15 000 ha northeast of Lake Kariba, there is very little land suitable for irrigation close to Zambezi. This means that any other irrigation project based on water from Zambezi will suffer from prohibitively high conveyance costs. In effect, expansion of irrigation based on surface water will, a few decades from now, most probably have to depend more on the ability to utilize already available water more efficiently, than on the development of new sources.

The potential of using groundwater for further development of irrigation is high, as presently only about 0.15 cubic km or 4% of the total groundwater recharge of 3.7 cubic km has been developed for all uses. A recent estimate indicates that 80 000 ha could be developed for irrigation by groundwater; that would mean a quantity of 1.2 - 1.6 cubic km (Nyoni, 1995). It should be noted, however, that large extraction of groundwater will reduce the downstream surface water flow correspondingly.

Sharing of resources

The development of water in Zimbabwe was traditionally oriented towards four different categories: irrigation, urban, industrial and mining. After independence, however, increased efforts were put into rural primary water supply. When discussing future development of water resources, it may be of interest to consider **any future shift of priority** between the user categories, and any changes of priority within the user groups.

It should be kept in mind that about 80% of the water is used for **irrigation**, and this is expected to be the case for the next few decades. Thus, changes of consumption levels in the other sectors will have a relatively small impact as far as total water resources are concerned. As indicated above, however, further development of water for irrigation will probably have to be achieved mainly out of Zimbabwe's internal water balance; once that has been utilized fully, further development will be mostly for the UIM sub-sector, for which it may be economically more feasible to extract water from the major shared rivers.

The high priority put on **primary rural water supply** is expected to continue until nominal full coverage of safe water supply is achieved, which, at present levels of development, can be expected to happen around 2005 - 2010. After that, there will still be a substantial need for rehabilitation. The development of a fully covering primary water supply is, although it concerns a majority of Zimbabwe's people, only marginally related to limited water resources at a macro scale, since the quantities extracted are limited and since sufficient quantities of groundwater is generally available. The programme will compete, however, with other types of water development in the country in terms of finance and institutional capacity.

The impact of improved and more accessible primary supplies will be **especially positive for women** in terms of time and energy savings, improved family health and so on. Primary supplies are also used to some extent for livestock watering, thus improving the economy of rural families.

It is expected that matters relating to **equitable distribution of the limited water resources,** such as the policy of changing the water rights in favour of smallholder farmers, will receive even greater attention in the future. The actual physical development of smallholder irrigation, however, has taken place at a pace of less than 3 % per year since 1978 and this is not expected to change dramatically unless the economics of small-scale irrigation is drastically improved. There will probably be major changes, however, related to administrative aspects of water resources planning, with a substantially increased involvement of small-scale farmers in planning and decision-making.

One possible **impact of increased smallholder irrigation** could be **on women,** both positively and negatively. Where women constitute a large percentage of smallholder farmers, they could benefit from increased access to irrigation water, but where they are not in control of irrigated farming land, irrigation schemes often mean loss of their own small plots and additional work demands on irrigated plots, adding to already high domestic burdens.

The **need for prioritisation and allocation** of water between and within user categories **will increase** in the future as the available resources become more limited. The ability of the Government at highest level, and by other democratic and management institutions at catchment and local levels, to carry out this in a transparent and equitable manner will be a factor crucial for the possibilities of avoiding conflict.

Consumption levels and water use efficiency

What can be expected to happen with regard to **per-capita consumption** in Zimbabwe during the next few decades? The per-capita domestic consumption figure used by DWR for urban supplies in Horizon 2020 is 220 litres/head/day. The degree of urbanization has risen steadily in Zimbabwe, from 7% in 1950 to 32% in 1995, with a present urban growth rate of 4.4%. Urbanisation will continue, although probably at a somewhat slower pace for the next few decades, and this means that an increasingly larger percentage of Zimbabwe's population will be urban citizen's with higher per-capita consumption demands than the national average. According to data from Bulawayo, however, there is no indication of a historical increase in the per capita UIM consumption as such.

There is substantial scope for increasing **water use efficiency** in Zimbabwe, both in urban water supply and irrigation. It can be achieved through a combination of more efficient technical supply and user systems management, and changes in pricing policy and legislation.

Considerable savings are expected to be made by **improving the technical quality and efficiency** of existing - and often very old - town supply systems, and by improving the systems for monitoring and control of water use.

Purification and **recycling of wastewater** in urban areas and by industry has an extremely good water-saving potential. About half of the water used in urban supplies is discharged as sewage. If this could be recycled, the apparent yield of the water supply dams would be doubled. This is being successfully done for major urban supplies in South Africa and to some extent in Harare. All large centres in Zimbabwe have been requested to investigate the cost of recycling waste water, and if this turns out to be cheaper than the water from the next planned dam, they will be expected to recycle 20% of their water before a new dam is constructed. There is a clear interest amongst urban local authorities to undertake recycling measures, unfortunately coupled with a lack of capacity and resources to do so.

Similarly, and from a water resource point of view even more relevant, there is tremendous scope for improving the **efficiency of water use in irrigation.** Old-fashioned technology is used to a large extent, and water duties of up to 15 000 cum per hectare seem common; this can be compared to water duties in Israel of around 5 000 cum per hectare. Obviously, Zimbabwe is not in a position to copy such efficiency, but keeping in mind that irrigation accounts for about 80% of the developed water, any average per-hectare saving will result in a direct and substantial reduction of the total

water requirements. Further water savings may also occur as a result of possible future re-orientation towards less water requiring crops.

The issue of water savings in irrigated agriculture has a bearing on the problem of **salinisation**; a more moderate use of water can decrease the risk of salinisation and still maintain the same, or even higher, production.

Pricing policy is an important tool to control the development and use of water. All consumers of UIM and irrigation water are today charged an average price irrespective of whether they are using water from an old or new scheme. If this were not done, it would seriously restrict the financial viability of new schemes and discourage development of smaller urban centres and expansion of irrigation. On the other hand, it may result in new projects being taken up which are not feasible from strictly economic points of view, and it inhibits the development of water saving technologies and a more efficient use of water. It is expected that a forthcoming new pricing policy will reduce subsidies and achieve a more market-oriented pricing.

Similarly, the present **revision of the water law** is expected to bring about better monitoring and control of water use, and regulations regarding the development of groundwater.

Planning and research

Planning of water development in Zimbabwe has until now been mostly demand-driven; water sources have been identified and developed for specific towns or irrigation purposes as the needs have developed. As already mentioned, water has not been seen as a part of a wider environmental system that can sustain its quality and quantity, and there has been little holistic, long-term planning, involving coordination with other sectors.

In the present situation, when it is foreseen that the available water resources will soon be more fully developed, a more holistic planning will be necessary. **Facilities for integrated catchment and river basin planning and management** are expected to be provided, possibly along the lines that are presently being tried in the Save catchment. Such facilities would make it possible to consider land management and environmental issues alongside with pure water development, and at the same time it could be expected to provide a forum for full stake-holder participation and thus enable a more sustained use and management of water. In particular, the representation of communal and resettlement farmers, and especially women smallholder farmers, in the appropriate bodies may be achieved. Democratic catchment boards could probably also deal more efficiently with drought management, than the present rather ad-hoc setup.

The decentralisation and democratisation of water resources planning and management is crucial also to the possibility of **increasing public and user awareness** of water issues such as use efficiency, conservation, economic value, and legislation, in order to maximise efficient use of limited water resources and reduce potential for conflict.

Future planning can be substantially improved by addressing the presently insufficient **coordination at national level amongst the many players** within the broader water sector, in terms of making appropriate institutional, policy, legislative, planning and financing linkages between all the key components of water resources development, use and management.

Adequate planning information for sustainable water resources development, both with respect to a water resources data base and to projections for future use in various sectors and sub-sectors needs to be made available. Information emanating from research and development activities, which are under-developed in the sector, will also be necessary inputs for improved planning. **Research and development** activities therefore need to be substantially increased. Technology development is particularly needed on water conservation and improvement of water use efficiency in urban supplies and irrigation.

One specific planning point with a direct bearing on water resources utilisation that may be re-evaluated in the future, is the **risk factors** presently applied. The water supply dams are presently most commonly designed with a risk factor of 4% for UIM and 10% for irrigation water. This means that the dams will be able to supply a set amount of water in 96 and 90 years out of 100,

respectively. By adjusting the risk factors upwards, the storage reservoirs can be made smaller, reducing both evaporation losses and costs, and thereby optimizing the utilization of the available run-off. However, the possible application of this measure will depend on consumers being motivated to accept more frequent and more severe rationing; in the present drought situation probably unrealistic in the case of urban supplies, but possible for irrigation water.

In a technical context, improved planning will be able to **reduce losses caused by improper project designs**, such as unnecessary conveyance losses in long canals or unnecessary expensive dam designs, and thus save on both water and costs.

Institutional capacity and sustainability

One can discuss any number of proposals on how Zimbabwe could use its water resources more efficiently, but eventually the question arises as to who is going to do it. It is clear that the **institutional capacity** is limited at present, and for any attempt to improve water management to be successful it **needs to be strengthened**. If sustainable solutions are to be achieved, future involvement in the sector by donors is required to have a clear orientation toward building capacity in the country, rather than employing European consultants to provide turn-key solutions. It is expected that the capacity building process will benefit substantially from the knowledge of water conservation, inter-basin water transfer etc., available in South Africa.

Capacity building will be particularly important in connection with the expected institutional changes relating to decentralisation, for instance the Rural District Councils, local-level operation and maintenance of primary water supplies, and the proposed catchment management agencies. It will also be important in connection with the necessary improvements of water use efficiency.

Institutional weaknesses, and information, policy and legislative **gaps related to groundwater management** are expected to be resolved in connection with the present strategy work. Recent initiatives taken to institute groundwater level monitoring on a routine basis will be extremely valuable, but need to be correlated with information from other sources, comprehensively analysed and fed into overall water resources planning and management.

The institutional and legal frameworks and capacity for **water quality and pollution monitoring and control** are insufficiently developed. However, quality and pollution control activities should not be seen in isolation from overall catchment protection and water resources management.

Imperative to the possibility of using Zambezi and other shared water courses as future major sources is that the work that has been started on defining and **establishing relevant institutions for regional cooperation** among the riparian states is continued. In this connection, institutional capacity will have to be developed both for the regional institutions and internally in Zimbabwe.

Economy and finance

Economic and financial constraints are probably the most important limitations for a full development of the available water resources in Zimbabwe. The rate of cost increases for operation and maintenance of existing water supply schemes is far above the present inflation rate. In addition, economics of future schemes will be negatively influenced by longer conveyance distances and topographically less optimal dam sites. As a result partly of higher costs, it will be increasingly difficult to arrange funding for construction, operation and maintenance of new schemes. At the same time there will be increased funding needs for operation and maintenance of existing schemes.

While the options for reducing costs are more limited, although not non-existent, the financing situation can be improved by a more **appropriate pricing policy**, and by making sure that water revenues are channeled back to the sector. Current attempts to decentralise water resources management, such as within the rural water supply and sanitation programme, will make it possible to achieve a more user-oriented and therefore probably more efficient maintenance service, and a system for financing maintenance through tariffs. The current water management strategy work is addressing this issue.

The **scale of the problem**, however, **is enormous**. The capital expenditure for a total development of the presently undeveloped potential yield can be estimated at a minimum of 73.6 billion Z$, and it would cost 5.2 billion Z$ annually to operate the system (see Appendix 3). This can be compared to an actual capital expenditure for 1994/95 of 112 million Z$ and operation costs of 96 million Z$. It is obvious that with the present system of funding, the Government would not be able to take care of more than a small portion of future water development investments.

There are two conclusions to be drawn from the above. Firstly, future increases of water demand can be met only to a certain degree from developing new sources, and that **alternative solutions such as recycling and conservation** will be increasingly important in the future, provided they do indeed prove to be more cost-efficient. Secondly, **new ways of funding and managing large water supply schemes** will have to be found, in which private investment can be combined with overall Government interests and obligations. Such obligations should include supply of water to poor people at affordable cost.

8.3 Adjusted scenario

An attempt has been made in Figure 8.2 to show the possible impact on the future water resources development scenario that would result if some of the steps discussed above were taken. The Figure is not intended to show a true picture of the future, but to serve as an illustration of what can actually be achieved with fairly conservative and quite realistic changes. It is based on UN population projections and the following specific assumptions:

- 50% recycling of UIM sewage water achieved by 2050,
- 25% decrease of per-hectare use of water for irrigation by 2050, and
- 10% savings on use in all sub-sectors by improvement of conveyance and supply systems.

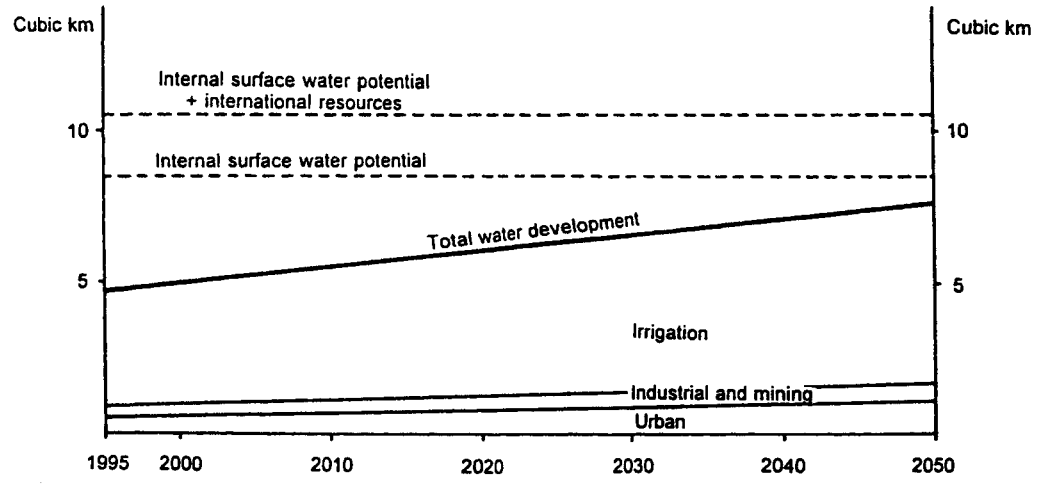

Figure 8.2 Adjusted scenario for water resources development in Zimbabwe up to 2050 (assumptions given in the text).

With this new scenario, the internal water resources of Zimbabwe will be sustained beyond 2050. For the scenario to materialise, it will probably be necessary that most of the administrative, planning, legal and political measures indicated earlier in this Chapter be taken. **Present indications are that key institutions and actors in the sector are indeed moving in these directions.** However, since the sector is extremely complex, any prediction will suffer from a high degree of uncertainty. Added to this, financial and institutional resource constraints can frustrate the best of intentions.

Even with drastic reductions of consumption levels and with improved water management being achieved, **it will not be possible to avoid water scarcity**, especially during dry years. The negative effects of such scarcity, such as inequities in supply and payment, health risks, and unemployment will prevail.

The effects that would result from the "worst-case-scenario" shown in Figure 8.1 are dramatic. **The new adjusted scenario** is more positive in that respect; although it still puts a lot of pressure on the financing and institutional capacity of the country, it **would mean that water-dependent activities could continue** and develop further, **and the risk for national and regional conflicts would be much more limited.**

In **summary**, the most important measures needed to be taken today, in order to achieve the more positive scenario are to:

* impart a **holistic view** of water resources as part of a broader environmental and cyclical context,

* **improve** planning and management **institutions** (decentralisation, democratisation, catchmentalisation and integration),

* **enhance institutional capacity**,

* combine a **careful further development of new resources** with a **massive effort in conservation and recycling**, and

* put a **new pricing and revenue strategy** in place, which makes it possible to cope with the high investments needed, and which puts pressure on users to increase conservation.

9. IMPLICATIONS ON SWEDISH DEVELOPMENT COOPERATION WITH ZIMBABWE

9.1 Overview of principles

Under the principal goal of improving living conditions for poor people, Swedish development cooperation has five specific goals of promoting

* growth of resources,
* economic and social equity,
* economic and political independence,
* development of democracy, and
* the sustainable use of natural resources and care for the environment.

With regard to the water sector, two principles have been adopted jointly by the Nordic countries; that water resources should be managed at the lowest appropriate level, and that water should be regarded as an economic good. Of special interest for development cooperation in the water sector is the current preparation by Sida of a strategy for promoting the consideration of gender issues in development cooperation.

9.2 Present cooperation

The main goal for Swedish development cooperation with Zimbabwe is to contribute to sustainable economic and social development and strengthening of democracy and human rights. The main orientation of the Sida support has been towards supporting growth and equity. ESAP is supported directly by financing of imports, and through institutional support to public administrative development. Poor and vulnerable groups are supported through projects in the education, health, public administration and transport sectors.

There is only one Sida supported programme that relates directly with the water sector, that is the health sector support programme, which contains a rural water and sanitation component. Funds

are channeled directly through the Ministry of Health and Child Welfare to the Rural District Councils, an arrangement which is also intended to support the decentralisation process currently underway in Zimbabwe. Funds are also provided for research and development, and NGO activities in rural water supply and sanitation. Of interest to the present study is also that Sida supports the preparation of an agriculture strategy.

SwedeCorp has supported courses for business managers and promotion of joint ventures, and more recently, an environmental programme, "Clean, green and profitable", aimed at improving environmental management in six selected industries. A programme relating to industrial pollution is also being prepared. BITS has provided support in the aviation and power generation sectors. In relation to water, BITS has funded a transfer-of-technology project aimed at introducing a Swedish method for water flow modeling in Zimbabwe. BITS also funded the pre-feasibility study for the supply of water to Bulawayo/Matabeleland, and has committed to providing part credits for the Pungwe-Mutare water conveyance project. SAREC supported research cooperation programmes have concentrated on utilization and management of natural resources, and have included a programme on groundwater resources development.

9.3 Water resources issues in a development cooperation context

Many of the issues discussed in Chapter 8 have a direct link to existing development cooperation between Sweden and Zimbabwe. In addition to the obvious links to programmes and projects directly concerned with water supply and water resources management - such as the Water and Sanitation component of the Health Sector Programme, the pre-feasibility study on water supplies for Bulawayo and the pipeline construction project for Mutare - links can be made to other current areas of bilateral cooperation. These include the support to the Public Administration Sector and to ESAP. There are also direct links to currently Sida-supported regional activities and other future regional initiatives, such as ZACPLAN and other river basin cooperation programmes. Many of the issues also have direct links to the fulfillment of Sida's general goals for its development cooperation with Zimbabwe, and to goals and strategies for Sida's development cooperation in general. Finally, some of the issues are of special interest for development cooperation considering specific knowledge and resources available in Sweden.

Some pertinent links in this respect are:

* **between** the current moves in Zimbabwe towards decentralisation of water resources planning and management with related issues of public participation, gender, democratic governance, sustainability and capacity building, **and Sida's** support to the Public Administration Sector, the general goals of strengthening democracy and promoting social development, the strategy of promoting water resources planning and management at the lowest appropriate levels, and the forthcoming strategy on gender issues;

* **between** needs, opportunities and initiatives to develop a strategy for water resources planning and management based on economic and environmental sustainability, and optimal water utilisation, **and Sida's** support to ESAP, and the general goals of environmental sustainability and economic development;

* **between** current moves to achieve a more equitable distribution of water resources by means of legislative review and change, and improved representation of smallholder farmers in relevant bodies, **and general Swedish** development cooperation goals of strengthening democracy and promoting social development;

* **between** current plans for extraction of water from the Zambezi and Pungwe Rivers, **and Sida's** interest in supporting regional initiatives for cooperation on shared water resources;

* **between** the central role of water resources in agricultural production in Zimbabwe, **and Sida's** support to the development of an agricultural policy and strategy;

* **between** needs for and potential benefits of improved conservation and recycling of water in the Urban, Industrial and Mining (UIM) sub-sectors, **and Swedish** technical know-how on municipal and industrial water treatment and recycling; and

* **between** expressed needs for a more intensive development of Zimbabwe's groundwater resources, **and Swedish** technical know-how on groundwater resources assessment, development, monitoring and protection, especially in hard rock terrain.

9.4 Policy level recommendations

Chapter 8 outlined the important issues and probable future developments with relation to present and future scarcity of water resources in Zimbabwe, and the expected effects thereof. It also described the measures that need to be taken in order to avoid the "disaster" scenario that would result from continued present levels of development and management combined with projected population increases. With reference to the general links between some of these issues and the present development cooperation between Sweden and Zimbabwe indicated in the previous Section, there are a few specific issues of high priority that should be raised at a policy level within the framework of development cooperation between Sweden and Zimbabwe.

It is highly unlikely that a scenario where the available water resources are "depleted" will appear in Zimbabwe. What is likely to happen, however, is that water scarcity will persist due to increasing marginal costs of water development, and that this scarcity will continue to be pronounced during dry periods. On the other hand, it is also expected that serious and substantial efforts to improve efficiency in water development and management will be made by the Government and other actors in the future.

The future water sector scenario in Zimbabwe will have implications on the development cooperation in at least four ways. **Firstly**, the **scarcity of water resources** itself will be a **limiting factor** for most types of development activities. **Secondly, droughts will continue to appear in the future**, with **obvious negative effects** on economic development and the welfare of people. **Thirdly, the economic limitations and financial requirements** relating to development and management in the sector **will adversely affect** development in **other sectors. Fourthly,** expected efforts to improve planning and management of water in Zimbabwe will involve **administrative and organisational changes** which will have implications on other development activities, and which **will need attention and support.**

In the near future, as an increasingly large part of the available water resources is being developed, water may become, in many parts of the country, the single-most important factor to consider in development work. **Water** therefore needs **to be given** the **prominence** it deserves **in the national planning process**, and the necessary instruments and data for such planning need to be developed and generated. This issue should be stressed in the dialogue.

Droughts are not new to Zimbabwe, they have always occurred and they will continue to occur in the future. Unfortunately, efforts so far in combating the recurrent droughts have been surprisingly ad-hoc and short-term in nature. It is one of the conclusions of the present study, that the best way to combat drought is to reduce drought susceptibility through long-term programmes of improved ongoing water management rather than through crisis management and crash drought-fighting programmes. The need for **drought planning and management** to be **integrated into general long-term routines** for improved water resource development planning and management should be stressed in the dialogue.

It is obvious, that whatever measures taken in order to bring down consumption and improve management, there will be a need for **massive investments** in the water sector in the future. The water sector will thus compete with other, more directly productive sectors in the allocation of funds, thus creating constraints for development in these sectors. The **necessity of finding alternative financing solutions**, including private funding, and reductions and re-orientation of Government subsidies, should be stressed in the dialogue, and efforts in that direction supported.

The need to view water resources in a wider environmental and cyclical context, and a need to improve water resources planning and management in general, is expected to lead to the establishment of decentralised and democratic catchment planning and management bodies for integrated planning. This will involve substantial institutional changes which will have direct implications on the present public administration system, including that of the existing administrative set-up for primary water supply. Organisational support and capacity building in this context will be tremendously important for the new institutions to become sustainable. Capacity building will also be necessary in connection with an expected future increased emphasis on groundwater development, and development of regional water resources. The need for a **coordinated approach to** these **organisational changes and capacity building activities** should be stressed, and efforts in that direction supported.

APPENDICES

APPENDIX 1

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APPENDIX 2

LIST OF ABBREVIATIONS

AGRITEX	Department of Agricultural, Technical and Extension Services
CFU	Commercial Farmers Union
CZI	Confederation of Zimbabwe Industries
DWR	Department of Water Resources
ENDA	Environment and Development Activities
ESAP	Economic Structural Adjustment Programme
IUCN	The World Conservation Union
IWSD	Institute of Water and Sanitation Development
MAID	Ministry of Agriculture Irrigation Development Committee
MZWT	Matabeleland Zambezi Water Trust
MHCW	Ministry of Health and Child Welfare
MLGRUD	Ministry of Local Government, Rural and Urban Development
MLWR	Ministry of Lands and Water Resources
NAC	National Action Committee for Rural Water Supplies & Sanitation
NCU	National Coordination Unit for Rural Water Supplies & Sanitation
NEPC	National Economic Planning Commission
NRWSSP	National Rural Water Supplies & Sanitation Programme
RDC	Rural District Council
UIM	Urban, Industrial and Mining
WRMS	Water Resources Management Strategy
ZACPLAN	Zambezi River System Action Plan
ZACPRO	Project under ZACPLAN
ZERO	Zimbabwe Energy and Environment Research Organisation
ZFU	Zimbabwe Farmers Union

APPENDIX 3

DETAILS OF INSTITUTIONAL, LEGAL, POLICY AND PLANNING FRAMEWORK

1. Institutional framework

This Appendix presents an outline of some of the key agencies concerned with water resources development, distribution, management and sustainability, divided between public sector agencies, private sector agencies including non-governmental organisations, cross-sectoral coordinating bodies, and training and research institutions.

1.1 Key public sector agencies

There are numerous Government ministries and departments playing key roles in a sector that covers the development and management of different types of water resources for a variety of uses. Overall, the **Department of Water Resources (DWR)** in the now Ministry of Lands and Water Resources (MLWR) is often considered to be the single most important of these. DWR has several primary responsibilities which include the following: the development and administration of legislation, policies and strategies concerning water planning, development, control and management; development and coordination of plans for effective water utilisation and management; the design and construction of dams, treatment works and distribution systems; provision of raw water from Government dams; siting and drilling of boreholes; collecting and analysing hydrological and hydrogeological data; and control of water pollution.

In recent years there has been a process of rethinking the institutional form of the DWR, and a proposed **Zimbabwe National Water Authority (ZINWA)** - which will combine the existing DWR with the Regional Water Authority - has been accepted in principle by Cabinet. While details are still being worked out, many of the current functions of DWR will be incorporated into the new structure. However, the intention, according to the Minister, is for ZINWA "to emulate private sector working methods where appropriate while strengthening Government's ability to develop the water resources and provide fair access to water to all sections of the society".

A recent ministry reshuffle has separated agriculture from lands and water resources. One of the key agencies linked to water for agriculture is the **Department of Agricultural, Technical and Extension Services (AGRITEX),** which plays a central role in the irrigation sub-sector. Amongst other things, AGRITEX has the mandate for planning, design, construction, operation and maintenance and monitoring and evaluation of all smallholder irrigation schemes; chairs the MAID Committee which allocates irrigation water from Government dams to commercial agricultural consumers; advises the Administrative (Water) Court with regard to applications for water rights; and administers the donor-funded Irrigation Support Fund. Closely linked to its role in irrigation, AGRITEX plays an important role in monitoring and advising on appropriate land use.

Other public sector agencies that are significant for the water sector include the following:

* **District Development Fund (DDF)**, which is responsible in communal lands and resettlement areas for construction of small dams and some small piped schemes, borehole drilling, sinking of deep wells, construction of civil works, and operation and maintenance of all primary rural water supplies;

* **Ministry of Local Government, Rural and Urban Development (MLGRUD),** which through its various departments is active in coordinating the rural water supply and sanitation sub-sector, coordinating the development of urban infrastructure, supporting the relevant urban and rural local authorities in their responsibilities for local development and service provision including provision of water supplies, and developing appropriate local and regional development plans that take into account current and future water demands;

* **Ministry of Environment and Tourism (MET),** which is responsible for all matters related to natural resources, excluding minerals, and in particular for administering relevant legislation and developing and implementing policy on environmental monitoring and protection. To enhance

capacity in this regard, MET has established an Environmental Planning and Monitoring Unit in the Department of Natural Resources;

* **Ministry of Health and Child Welfare (MHCW)**, which has responsibility in the areas of safe drinking water and sanitation facilities, environmental health and hygiene education related to the use of water, and monitoring of water quality with respect to public health;

* The **Administrative or 'Water' Court**, which is concerned with granting, cancellation or reallocation of water rights for the use of public water, and which also plays a key role in dispute resolution with respect to abstraction, appropriation, control, diversion or use of public water. It also has an allocation function in periods of water shortage;

* **National Economic Planning Commission (NEPC)**, which is responsible for ensuring proper coordination of national development priorities and plans and for allocation of public sector investment funds;

* The **Regional Water Authority (RWA)** which is responsible for development, conservation and management of water resources in the Save River Basin. However, almost all the water it manages is already committed by long-term agreements to established users;

* The **Zimbabwe Electricity Supply Authority (ZESA)**, which is responsible for the development and provision of power from various sources, including hydropower.

1.2 Private sector agencies

All of the major sub-sectors linked to the water sector, such as agriculture, industry and mining, have at least one or more private sector agencies representing either the overall interests of the sub-sector or particular groups of interest within it, and all of whom address water issues in one way or another. Within the agricultural sub-sector for example, the **Commercial Farmers Union (CFU)** and the **Zimbabwe Farmers Union (ZFU)** represent respectively the mainly white large scale commercial farmers, and the smallholder and emerging black commercial farmers. In addition, the commercial farming community has associations representing more specialised interests, such as the **Zimbabwe Cereals Producers Association.**

In industry, the **Confederation of Zimbabwe Industries (CZI)** is active in the water sector, and through its infrastructure and environment committees is dealing with such issues as water level monitoring, pollution, conservation and water use efficiency. The **Chamber of Mines** represent mining interests in Zimbabwe. Their activities related to the water sector have been less demonstrative than some of the other sub-sectors, possibly due to their privileged status with regards to water allocations under periods of water scarcity. However, they have taken the initiative to develop environmental management guidelines for the mining and exploration which have particular relevance for water quality in areas close to mining operations.

Somewhat different from the above agencies is an organisation such as the **Matabeleland Zambezi Water Trust**, which represents a wide range of stakeholders in the Bulawayo area, collectively committed to seeing the construction of a pipeline from the Zambezi River to Bulawayo and Matabeleland in general.

The private sector category is also inclusive of **NGOs**, amongst which are those either supporting or implementing primary water supply activities, such as **Plan International, Christian Care, Save the Children Fund (UK)** to name a few, and those concerned with environmental research and natural resources management, such as **ZERO, IUCN** and **ENDA**.

1.3 Coordinating bodies

In addition to the individual agencies active in the sector, there are several public sector bodies that have been established specifically for the purpose of inter-agency or inter-sectoral coordination, and which play a particularly critical role where joint policy-making, planning and decision-making is

required. Falling under this category are such bodies as the **National Action Committee for Rural Water Supply and Sanitation (NAC)**, the **Water Resources Management Strategy (WRMS) Steering Committee**, the **Ministry of Agriculture Irrigation Development (MAID) Committee**, the Government-sponsored **Irrigation Liaison Committee**, the **Water Quality Control Advisory Committee**, and so on. The NAC is one of the few of these committees that has a permanent secretariat, and this has partly been necessary because of the need for operational support from the secretariat for the sub-sector. Besides these more permanent or ongoing bodies, there are also always a number of ad-hoc coordination committees or working groups set up to fulfill a more short-term objective, such as an inter-ministerial steering committee established to oversee the Zambezi Pipeline Pre-Feasibility Study.

In the regional context, **SADC-ELMS** in Lesotho acts as a regional coordination body on water-related issues. Though few have yet been established, regional river basin commissions will provide coordination between key players within a particular river basin. The Zambezi River Authority is one relevant example within Zimbabwe's borders, and the Limpopo Commission has recently been revived. The Pungwe/Save Basin Commission has been agreed upon in principle but has not yet been implemented.

1.4 Training and research institutions

The sector benefits from a number of training and research institutions. Some undertake both components such as the **Institute for Water and Sanitation Development (IWSD)**, which provides training to middle and senior level managers in the water sector in such topics as water planning and management, water conservation, water quality control, participatory methods, and so on. IWSD also undertakes scientific and institutional research within the sector. The **University of Zimbabwe** is an important source of manpower development and research, especially in technical areas, through the faculties or departments of Engineering, Geology, Agriculture and Geography amongst others, whilst the new **National University of Science and Technology** will further expand capacity in technical fields. Research is also carried out by Government research institutions such as **Blair Research Laboratory** which focuses mostly on biological and health aspects of water quality, or the Ministry of Agriculture's **Department of Research and Specialist Services**. More 'hands on' technology research and development for the rural water supply and sanitation sector is undertaken by **Dr Peter Morgan** and his colleagues at the **Mvuramanzi Trust**.

2. Institutional capacity

One of the strengths of DWR is the quality of its Provincial Water Engineers, who have substantial experience. However, there is quite a big gap between these officers and the next level, where junior engineers are employed. The department suffers from being **unable to retain professional staff** due to inadequate salary levels and conditions of service. Some of the work on institutional restructuring being undertaken in DWR with GTZ support, is intended to address this. DWR has also experienced little expansion of capacity in the Planning Branch since independence, despite growing demands and **pressures to expand role and scope of planning**. On the other hand, the department is gradually **beginning to develop its pollution monitoring and control capacity** through a small unit of 4 people at head office and an officer attached to each of the provinces. It is important however, that linkages are made between this unit and other agencies monitoring water quality and pollution, both in the public and private sectors.

In terms of **technical capacity** in the sector, a notable expansion of public sector drilling capacity has taken place in the past few years, primarily resulting from the large number of drilling rigs imported into Zimbabwe during the 1992 drought. At present, DDF has approximately 39 drilling rigs while DWR has 71 rigs, of which approximately 80% are functioning. Private sector capacity is estimated to be in the range of 50 - 100 rigs which at present are believed to be under-utilised. In the meantime, DDF is focusing on enhancing its professional and its decentralised capacity, through hiring and training of 9 new hydrogeologists, two of whom are women. At present, it is easier for DDF to retain its professional staff, most of whom are not subject to civil service regulations and conditions of service.

Capacity exists in various institutions to provide **agricultural extension services** to farmers, but these services need to be better coordinated, and feedback to the research process should be strengthened. There is also a need to provide technical training to Agricultural Extension Workers in AGRITEX on irrigation and water management techniques. Their experience and training to date has been geared more towards rainfed agriculture.

One of the areas of greatest concern is the **lack of adequate policy formulation and strategic planning capacity** throughout the sector, a problem echoed in the public sector as a whole and demonstrated to dramatic effect during the 1992 drought which revealed inadequate drought preparedness. While there are now attempts to enhance drought planning and management capacity in the sector, the problem is a much wider one which needs a more comprehensive capacity building approach.

An associated problem is in the area of **information management.** Reliable updated data is essential for sound planning, however in some areas this is unsatisfactory, for example in groundwater monitoring. On the other hand, the dam database in DWR is comprehensive and kept currently updated, and seems to be widely used. In addition, DDF has improved its information management considerably in recent years.

In the present climate of increasing decentralisation, a policy decision has been taken by the NAC to **decentralise planning and management responsibility** for district integrated rural water supply and sanitation projects to the Rural District Councils (RDCs). Together with the growing number of activities for which it is becoming responsible, the RDCs are facing serious challenges to their capacity, and support for capacity building is needed from all possible sources, although in a coordinated fashion.

In addition to questions of institutional capacity amongst sector agencies, there is also the question of **capacity of communities to initiate and manage development** in their own areas. To a large extent this has been undermined during the past fifteen years of independence, through creation of dependence both on Government and on donors. As financial resources diminish, there is a move towards various forms of cost-sharing and community-based management approaches. Decentralisation in general may begin to stimulate more democratic participation in local development, but in the water sector in particular, local catchment management mechanisms and stakeholder participation provide the possibility basis for more self-reliant and sustainable development of resources.

Finally, problems have been identified with regard to the **performance and capacity of existing River Basin Commissions in the region.** The recent USAID-sponsored report on regional water resources argued that this was due largely to the lack of financial and technical resources, lack of commitment by member states and insufficient transfer of technology from external support agencies. The report notes in fairly strong terms that "the lack of development of water resources in the region can be directly attributed to the inability of the River Basin Commissions to perform as needed".

3. Legal framework

The Water Act, which is administered by the Ministry of Lands and Water Resources, is the primary legislation governing the use, control, planning and management of water in Zimbabwe. The main Act is in twelve parts, addressing various aspects of water development planning, establishment and judicial scope of the Water Court, identification of public water rights and individual owners' rights, control of public surface and groundwater under conditions of acute scarcity, water pollution control mechanisms, dam safety, and regulatory powers. Whereas the Act is generally seen as very comprehensive, there are various aspects that have long needed revision. A Water Act Review Committee was established several years ago, with fairly wide stakeholder representation, and although the Committee's recommendations have not yet been formally adopted as amendments to the legislation, several of the issues raised during the review process have either become policy or remain very active matters for debate and consideration within the sector.

Some of the key aspects of the Water Act that have received attention in recent years include the following:

The righting of public water: With regard to formal rights granted for specified storage or abstraction of water from public streams, this may be provisional, temporary or final, depending on various criteria. Once final it is thereafter attached to the land, irrespective of future change of ownership. One of the key principles of water rights is that of precedence based on the chronological order of applications to the Water Court. By contrast, 'agreement' water is Government stored water surplus to requirements, which is sold to agricultural users on the basis of temporary agreements with individuals, there being no permanent agreements attached to land. Both these are additional to riparian rights for primary use. The issue of chronological rights has been of particular concern to emerging commercial farmers and the smallholder farmers who feel disadvantaged by history. A strong lobby has begun to emerge to consider redistribution of water on a more equitable basis. This has not yet been addressed in the legislation, but to date policy decisions have been made by Government to reserve an adequate percentage of Mean Annual Run-off for future use in communal lands, as well as to reserve 10% of stored agreement water for use by smallholder farmers. Despite these positive changes in principle, in practice the lack of investment resources and capacity within the smallholder sub-sector have made it extremely difficult for farmers to utilise this water.

Outline Water Development Plans: The Act provides for the preparation of these plans for the eight defined river systems. They should be prepared on a catchment basis in consultation with the relevant authorities, and are expected to provide an inventory of the existing resources in the catchment area, to identify appropriate allocations for different uses, taking into account any relevant regional development plans, and to specify potential dam sites and yields for future use. Such outline plans, although prepared in draft form, have never been implemented, however there is a strong push from many quarters to reintroduce them, since they create the possibility for more efficient and equitable distribution of water resources. In addition, they would provide an essential tool for effective catchment management.

Water Management Boards: The Act provides the basis for establishing river boards for the purpose of regulating and supervising the operation of rights to the use of public water. However, the current thinking in the sector is that these should be broadened quite substantially to take on a more developmental and natural resource management role on a catchment or river basin basis. In addition, it is widely argued that river or catchment management boards should be made mandatory.

Control of underground water: The Act is weak in defining measures to monitor and control abstraction of groundwater, other than to empower the Minister to limit or reallocate groundwater use under conditions of acute scarcity. This is achieved through declarations of underground water control or shortage areas. There is a strong consensus surrounding the need to strengthen groundwater monitoring and control under normal conditions.

Water pollution control: The Act provides measures for MLWR to monitor, test, control and prevent pollution of water mainly with respect to discharges into water courses. It is commonly agreed however, that the punishments for contravening pollution control regulations are in no way sufficient to deter the polluters, and this aspect of the Act therefore needs to be strengthened. Other forms of water quality control are addressed by other legislation, such as the Natural Resources Act with regard to natural causes of pollution such as siltation, and the Public Health Act in terms of monitoring and control of treated water.

In addition to the Water Act, **several other Acts have a bearing on the water sector**, such as the Natural Resources Act, which gives broad 'watchdog' powers to the Natural Resources Board but no power to control water development or water pollution activities; and the Rural District Councils Act, which empowers RDCs - at least in principle - to provide and maintain water supplies for domestic, irrigation, industrial and mining purposes. An Environmental Management Act is not yet in place, but is being planned for the future by the Ministry of Environment and Tourism, which in the meantime monitors the environmental consequences of development activities through its EIA policy.

Regional legislation is still fairly under-developed with regard to water, however, the "Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC) Region",

signed by nine SADC nations on 28th August 1995, will provide the basis for further developments in this field. The Protocol has still not been ratified by Zimbabwe and there is no indication as to when this will happen. It is hoped that a number of current initiatives will evolve more fully over time, including several proposed river basin commissions. However, it has been clearly identified by the USAID regional water resources report that there is a pressing need to develop a model river basin commission agreement for the region, to train lawyers in the region in international water law, and to find ways of harmonising national laws with regional agreements.

4. Policy framework

The above discussion of sector-related legislation provides some indication of the framework which underlies policy in the sector. In addition, this Chapter briefly highlights some of the current policy developments and concerns.

* The scarcity of water as an ongoing and intensifying reality has raised many policy questions in the water sector. These focus on such issues as **water allocation priorities and mechanisms, water pricing, water conservation, drought preparedness and catchment planning and management**. It is accepted that there are many such policy gaps in the sector, and great hopes have been placed on the Water Resources Management Strategy as a channel for closing these gaps.

* In the **irrigation** sub-sector, policy shifts are underway in the direction of **more equitable distribution of water** in general, and **increased emphasis on smallholder irrigation** in particular. This is already having an impact on water resources allocation policy in DWR, with the decision to reserve a percentage of water rights and stored water for smallholder farming. An irrigation policy and strategy is presently being developed by the Ministry of Agriculture, with FAO support, which is said to emphasise - in addition to the above issues - a river basin approach to irrigation planning and development, a user pays and self-management approach to irrigation development, and the proposed development of a Master Irrigation Plan. Unfortunately, the draft policy and strategy document was not made available to the study team.

* In the **rural water supply** sub-sector, **policy development has been fairly well developed**, focusing mostly on **operational policy decisions** such as service coverage levels, technology options and standardisation, operation and maintenance of facilities, financing methods, decentralised planning and management, community-based management and mainstreaming gender concerns. What has assisted effective policy development and implementation has been the existence of a well-functioning coordination mechanism, the National Action Committee. The NAC is often cited as an example of successful inter-agency collaboration.

* It has been noted in several quarters that there are **critical linkages between land and water**, both in terms of their interaction and effects on each other as related natural resources, but moreso in terms of the historical and current parallels in the distribution of these resources. However there has so far been little coordination in the development of land and water policy, despite the institutional positioning of Government responsibility for land and water within a single ministry.

5. Pricing framework and development costs

The present Government pricing policy is to recover the historical capital costs, and the present costs for operation and maintenance. It also intends to subsidise the price paid for water by rural and low-income urban households.

The pricing of water from Government dams is done differently for different uses. There are presently three categories of water in this respect:

* purified water for domestic purposes,
* raw water for urban, industrial and mining (UIM) purposes, and
* raw water for agriculture.

Purified water for domestic purposes supplied at rural service centers, growth points and small towns is sold at a rate that recovers the operation and maintenance costs plus an administrative fee of 12.5%. The capital cost for the system is thus not included in the price. The total cost for all water supply stations is divided by the total quantity of water supplied, to arrive at a blend price. This price is adjusted for the benefit of poor people, by selling the first 10 cubic meters at a concessional rate.

Primary water supply in rural areas is mostly from boreholes which are drilled, equipped and maintained by the Government. This water is supplied free of cost.

The cost for raw **UIM water** is calculated by discounting capital costs over a 40 year period and adding the operation and maintenance costs. This amount, for all UIM supplies, is divided by the total quantity of water sold to arrive at a blend price. The same methodology is applied for **irrigation water.**

The reasons for averaging out the costs and sales for the respective sub-sectors are several. Without the blend pricing, new and small local authorities would have to pay very high rates for their new supplies whereas larger authorities would pay very little for their old dams. With regard to irrigation, the economic viability of new schemes would be much more limited if the farmers would have to pay the cost of developing a new scheme. The blend price for irrigation water is at present around 5 cent/cubic m, whereas the long run marginal cost for developing new sources is around 20 cents/cubic m (1993). The UIM blend price is presently around 8 cents/cubic m.

There are **severe deficiencies** in the present pricing system and the manner in which it is being applied.

The application of blend prices may result in new projects being taken up which are not feasible from strictly economic points of view, and it **inhibits the development of water-saving technologies and a more efficient use of water.**

The **intended subsidies are skewed by deficiencies in the actual application of the pricing policy.** The blend prices calculated by DWR are implemented only with very long delays; for instance the blend price that should presently be applied for UIM and irrigation water according to calculations is three times higher than what is actually charged. Added to this implicit subsidy, charges are made for water delivered and not water released, thus the users do not pay for actual transmission losses. It has been estimated that the total annual subsidies amount to 75 million Z$ for the agriculture sector and 52 million Z$ for the UIM sector (Robinson, 1995). This can be compared to annual subsidies in the primary water supply sector of 70 million Z$. On a per capita basis, this works out to 12 Z$ in the rural areas, 10 Z$ for low-income urban families and 35 Z$ for high-income urban families. This means that these **actual subsidies in the water sector are reverse to what is intended.**

The implicit **subsidy to commercial irrigation farmers** amounts to about 1 000 Z$ per hectare for water from Government dams. Farmers using righted water are also subsidised by favourable Government loans and tax deductions. Another example of subsidy in the irrigation sector is that of the Government programme for **formal small-scale irrigation**, where a number of 16 000 households receive an annual subsidy of 4 250 Z$.

The present pricing policy is being reviewed by a Pricing Options and Implications Study which is presently being conducted under the WRMS programme.

The **capital needs for future investment** in the water sector **are tremendous**. The total investments for the urban water supply development foreseen in Horizon 2020 has been estimated at 15.5 billion Z$ and the annual operation costs at 1.1 billion Z$ (Robinson, 1995). This is for a yield of about 0.8 cubic km. The remaining 3.0 cubic km of potential internal yield will be much more expensive to develop and operate. However, even if the same unit cost is used, the capital expenditure for a total development of the presently remaining potential yield would be 73.6 billion Z$ and it would cost 5.2 billion Z$ per year to operate the system. This should be compared to a capital expenditure for 1994/95 of 112 million Z$ and operation costs of 96 million Z$.

6. Planning framework

Planning in relation to the water sector occurs within a particular national planning context, in addition to the legislative and policy frameworks described above. In this regard, some of the key issues are presented below.

* In a national development context, water has been viewed primarily in terms of its facilitation of various sectoral developments, whether in the agricultural, industrial, mining or rural development sectors. Little attention has been given in national development plans to the **origins, renewability, management or sustainability of these water resources**, nor to the implications of increasing demands on limited or diminishing supplies. Equally important at the national level is a **clear division of responsibility for planning** different aspects of water development, in terms of types of water resources, types of users, levels of use and conservation, and so on.

* In general, there is a **lack of macro-planning** in relation to both urban development and rural growth, that would otherwise provide the necessary guidance to the water sector for its future development plans. NEPC is meant to be focusing on this level, but so far there has been little information forthcoming to guide national water development priorities. These conditions make it difficult to define **realistic projections of future requirements** relative to the available water resources. Such an exercise would need comprehensive data and data analysis of a number of complex demographic, economic and social factors and likely scenarios. In practical terms, this also means **stronger linkages between DWR and the Department of Physical Planning** in MLGRUD on this issue, and possibly also with the Central Statistical Office. Complementary to this is the need to consider **gender implications** both from a macro and micro level planning perspective, with regard to targeting, decision-making, management, sustainability and so on. This requires asking the question: 'who gains and who loses in the water cycle?'

* As has been frequently noted in this report, Zimbabwe is faced with recurring drought conditions and increasing water scarcity. However, planning is not addressing this trend adequately. There is a need to **include drought preparedness and mitigation strategies as part of routine sector and sub-sector planning**. NEPC is soon to receive capacity building support for drought preparedness/planning, but this should be broadened to cover sectoral capacity in drought planning and management. A current initiative on disaster planning and management supported by WHO provides an appropriate framework for developing national and sectoral policies and strategies for drought preparedness.

* Repeatedly, emphasis has been placed on the need for **planning and management on a river basin or catchment basis**. Institutional arrangements, including appropriate planning mechanisms at the local level, need to be developed to ensure effective stakeholder participation in planning and management. One of the key issues at this level is the need for agreed definitions of equitable water distribution, and agreed criteria for changing priorities over time, related to a range of factors such as health, social, environmental and economic. Catchment planning, using the Outline Water Development Plan framework, needs to be a continuous process, based on regularly updated information.

* Finally, linked to planning is the issue of sector financing. The question of **alternative financing options** for the sector requires extensive discussion, which is not possible in this report. However, one key issue that would need to be addressed is the role of and balance between public sector funds, donor funds, private sector finance, and community contributions in sustainable water resources development and management.

APPENDIX 4

DETAILS OF MAJOR DEVELOPMENT ACTIVITIES IN THE WATER SECTOR

1. Major water-related programmes and projects

The major water-related programmes and projects in Zimbabwe are divided below into four main categories: primary rural water supplies; dam development and pipelines; water resources management and institutional development; and research and development.

1.1 Primary rural water supplies

The majority of activities related to the development of primary water supplies in rural areas, are coordinated through the inter-ministerial National Rural Water Supply and Sanitation Programme (NRWSSP). District integrated projects, developed through a decentralised planning system, provide the main channel for fulfilling the objective of providing rural people with safe drinking water at reasonable walking distances, together with improved sanitation facilities. Community participation is stressed at all stages of the projects, in addition to which there is a growing gender awareness in the programme, particularly in planning, monitoring, mobilisation, recruitment and training. One of the NRWSSP's major shifts in the past few years has been to test a fully decentralised project management approach, whereby project funds are now being channeled directly to Rural District Councils to administer. This is in line with the overall trend towards decentralisation, which the rural water supply and sanitation sector has been consistently promoting. However, the changes are complex and there is a clear need for capacity building of RDCs and Government personnel at all levels during this period of transition.

At present there are integrated projects underway in 29 districts. Within the next five to seven years, close to 80% of Zimbabwe's 57 districts will either have completed or be implementing integrated water and sanitation projects. In addition, there are a number of districts where more ad-hoc water activities are implemented with support from individual donors and NGOs, as well as through the Public Sector Investment Programme (PSIP) which provides funds annually to DDF and DWR for borehole drilling. Coverage in rural areas - which is host to approximately 7.7 million Zimbabweans - is now said to be in the range of 29 000 water points. However, distribution is uneven and it is estimated that up to 40% of the population has yet to be adequately serviced.

Some of the issues coming under closer scrutiny in the NRWSSP include questions of sustainability, both of the appropriate institutions, the facilities provided and the water resource itself, the adoption of appropriate technology options such as piped supplies and family wells, and a stronger focus on community-based and gender aware approaches to primary water supply development and management.

1.2 Dams and pipelines

The DWR has an ongoing national programme for construction of water conservation works and large scale water resources such as large dams, pipelines and other conveyance works, to service UIM requirements as well as for major irrigation development in commercial and parastatal agriculture. In addition, the department develops small and medium sized dams to support smallholder irrigation in communal and resettlement areas, while DDF is responsible for developing small dams mainly for livestock watering and some localised small-scale irrigation. DWR dam development assumes future requirements based on fairly linear demographic projections, rather than on strategic multi-dimensional planning.

Two major national projects currently under development are the proposed Pungwe-Mutare conveyance project to supply water to Mutare city from the Pungwe River, and the Zambezi Pipeline Pre-Feasibility Study.

With regard to the Pungwe project, this received Cabinet approval in 1993 when Mutare had faced severe water shortages related to the 1992 drought. The estimated Z$600 million project has been at the centre of some controversy from the outset. Opposing views have been presented concerning the financial viability of the scheme both in the present and the future, the availability of a potentially less expensive and more readily available source from the nearby Osborne Dam, the possibility of reduced water for downstream users both within Zimbabwe and across the border in Mozambique, as well as potential environmental damage in different parts of the Pungwe Basin. Mozambique has expressed its concern to the Government of Zimbabwe, and subsequently there has been a decision to establish a Joint Commission on shared waters. Whilst Zimbabwe acknowledges the Pungwe as a key water supply source for Beira, Mozambique has accepted the abstraction of the proposed 690 lps by Mutare for urban consumption. However, any other future use of piped water, especially for irrigation, will need to be discussed and negotiated. An introductory EIA has already been carried out which has not identified any major or insurmountable environmental problems, following which the project was put to international tender. Up to nine international companies have made bids, part of which include sourcing finance from their countries of origin. Nordic interest in the project, with BITS in a lead role, has been expressed in the region of Z$300 million, mostly in loan form. A more detailed EIA is due to be undertaken in tandem with construction, but not necessarily before.

The Pre-Feasibility Study for the Zambezi Pipeline, jointly funded by BITS and the Matabeleland Zambezi Water Trust (MZWT), is perhaps even more complex and sensitive. The project, being managed by an inter-ministerial steering committee chaired by MLGRUD, is intended to explore the feasibility of the pipeline as a source of supply, amongst others, for Bulawayo City and its hinterland, the two Matabeleland Provinces. The MZWT, representing the people of Bulawayo, is committed to the pipeline option, and although most people accept that the Zambezi will have to be tapped in the long run, a number of critical views have been expressed regarding for example the overall costs of development just for the Bulawayo/Matabeleland users, which would place the price of Zambezi water at an exorbitant Z$7-10 per cubic metre. It is argued in some quarters that costs may only be feasible in the long run if the Zambezi source is developed either on the basis of a gravity-fed channel through the central parts of the country and split into two pipelines - one for Bulawayo and one for Harare - or if it includes end-users beyond Zimbabwe's national boundaries. A gravity-fed channel, however, would also require high pumping lifts. Indications of adequate groundwater supplies from Kalahari sands aquifers in the region, in combination with existing and proposed dams, provide the basis for proposing one kind of medium-term solution to Bulawayo's water woes. Bulawayo would probably accept a phased approach that starts with conjunctive use of surface and groundwater, and eventually links to the Zambezi.

1.3 Water resources management and institutional development

There are several initiatives and programmes underway that are addressing the critical issue of water resources management in Zimbabwe, as well as overall capacity and development of sector institutions. A selection of these activities is presented below:

* A **Water Resources Management Strategy (WRMS)** is to be developed. Guidelines were formulated in 1993, which outlined the 'essential characteristics' of the strategy as the following: the equitable allocation of water; a pricing strategy; demand management and efficient use of water; quantification of the total water resources; quantification of current and forecast demands; guidelines for the sharing of international sources; the establishment of comprehensive resource management guidelines; planned responses to water scarcity; a methodology for the selection of investment priorities; guidelines for water quality management; definition of institutional form and responsibilities; a programme for capacity building; and drawing up of enabling legislation. A WRMS inter-ministerial steering committee was established some time ago, with three sub-committees dealing with UIM water, agricultural water and rural water supplies respectively. Progress has initially been slow, however the coordinator for the WRMS Secretariat has now been appointed, and the Water Pricing Options and Implications Study is well under way.

* **Catchment management** is receiving increased attention, and a number of pilot projects in local catchment management are to be funded, for example in the Mupfure Catchment with Dutch funding, and in the Mazowe Catchment with German funding. In addition, there are positive attempts already underway to coordinate and cross-fertilise experiences. Groundwork has already been done

on aquifer management in the Nyamandhlovu Aquifer area, however this has not yet been followed up at the local level.

* The **Save Catchment Rehabilitation Project**, which covers an extremely large catchment area, plans to bring under a coordinated umbrella the activities of a variety of independent natural resource management projects being implemented by agencies as diverse as the Forestry Commission, ARDA, various NGOs and Rural District Councils. IUCN is active in the Save area as a 'neutral' facilitator of dialogue and integrated planning.

* In the area of **institutional development**, relevant activities range from the GTZ-sponsored institutional restructuring project within DWR, to training programmes of the Institute of Water and Sanitation Development on various aspects of water sector planning, management and implementation, to the national programme for capacity building of Rural District Councils, whose responsibility for local water resources development and management, and natural resources management in general, is on the increase.

1.4 Research and development

The rural water supply sector has successfully developed appropriate technologies for primary supplies over the past few decades. For much of this time this was carried out through the work of the Blair Research Laboratory. Current research there includes studies on environmentally friendly Blair latrines, technology improvements in family well construction, development and promotion of rainwater catchment systems for low rainfall areas, development of acceptable technologies for domestic purification, and effluent infiltration from pit latrines into soil and groundwater.

Dr Peter Morgan and the Mvuramanzi Trust have been undertaking research and development on family wells and the 'User Friendly Bush Pump'. Besides this, in recent years there has been limited promotion of new research into technology options particularly for water capture and conservation, such as rainwater harvesting or sub-surface dams in river beds.

Research on health impact studies relating to water supply, biological processes for wastewater treatment, and freshwater augmentation through e.g. rainwater harvesting is being carried out by IWSD.

There is today no comprehensive country-wide data available on groundwater resources. However, there are a few minor groundwater monitoring activities taking place, some being the routine work of agencies such as DWR, DDF and the Geology Department at the University of Zimbabwe, whilst other more specific studies are conducted either as academic research or as consultancies. At present, a detailed hydrogeological study is being undertaken in one part of the high-yielding Nyamandhlovu aquifer as part of a wider EIA of the Nyamandhlovu-Bulawayo Pipeline, co-funded by Bulawayo City Council, the Government and DANIDA. Studies are also performed in the Lomagundi aquifer by the German Geological Survey, and hydrogeological studies are included as part of the Zambezi Pipeline Pre-Feasibility Study. Groundwater research carried out by the Geology Department at the University of Zimbabwe include studies on groundwater collector wells for garden development and aquifer testing in the south-east of the country, storage potential of sand river aquifers and methods of extraction from alluvial aquifers, geophysical investigation methods and plant water use in dambo lands, and remote sensing technology for measuring evaporation losses.

Research and development in the irrigation sector is under-developed, although given adequate resources, there are a number of research institutions well-suited to carrying out relevant research (see Appendix 3). Areas identified by actors in the sector as requiring future study include irrigation design, appropriate technology for informal irrigation, technology options and improvements in water use efficiency, water recycling, socio-economic aspects of irrigation including gender impacts, farmer participation, and water user associations.

Other research gaps specified by research agencies include groundwater recharge and pollution, monitoring of groundwater levels and chemistry, general groundwater management, water quality and water pollution, wastewater treatment in small urban centres, and operational research on policy-related issues, including catchment management and sustainability issues.

During the course of the present study, the following areas of research have been identified as particularly important:

* water conservation and improvement of water use efficiency,
* water capture and conservation options such as rain-water harvesting and sub-surface dams,
* irrigation technology, and
* groundwater monitoring, development and management.

2. Investment patterns in the water sector

Investments in the water sector are divided between the various sub-sectors as well as between different agencies with responsibilities for aspects of sector development and management. In the discussion below, only a selection of some of the major areas of investment are presented to provide an indication of patterns and the order of magnitude of sector financing.

2.1 Rural Water Supplies

Since 1987, both Government and donor financing of this sub-sector has been directed primarily through the National Rural Water Supply and Sanitation Programme (NRWSSP). Over the period 1987-1992, an estimated Z$130 million (at 1990 prices) was committed from donors (86%) and NGO sources (14%) for district integrated projects as well as for a number of institutional development projects through the various implementing agencies at head office. Over the same period, Government invested around Z$38 million, approximating 26% of total investment. However, in general, between 1986-1989 Government allocations for capital development in the sub-sector were declining, and it appears that this trend has persisted to some extent in the present in terms of the real value of public sector investments in rural water supply. This has been especially true with regard to DDF's operations and maintenance allocations which stagnated around Z$5 - Z$6 million from 1990 onwards despite the correspondingly high rise in the number of water points requiring maintenance. By contrast, over the past five years annual capital investments in the NRWSSP for the district integrated projects alone - mainly from donor sources - have increased from Z$16 million in 1990/91 to Z$70 million in 1993/94. Direct Government funding for integrated projects over this period averaged between Z$1.4 million and Z$2.8 million per year, revealing a rapid drop in the percentage of public sector funds relative to donor investment from 8.75% in 1990/91 to 4% in 1993/94.

A Five Year Plan was developed for the NRWSSP in 1990 which estimated an annual minimum investment requirement of Z$25 million (at 1990 prices) for ten years to achieve basic sector targets. There has been no review of this plan or updating of target projections and future financial requirements since then. Despite this, the NRWSSP continues to expand and for the time being seems able to mobilise sufficient resources for its capital development activities. However, of growing concern is the cost of long-term sustainability, an issue which has been debated within the NAC for many years. Proposals were made to Cabinet many years back on various cost sharing options, but there has been no formal response and hence no policy developed on the matter. In the meantime, the NAC - through DDF's lead -has begun to address the sustainability issue through development of community-based management approaches, especially in the area of operation and maintenance. In addition, it is assumed that the strengthening of Rural District Councils and their increased role in local development, will contribute towards more sustainable management of water supplies.

2.2 Large scale water resources development: dams, irrigation and piped schemes

The Department of Water Resources (DWR) is the main agency involved in large-scale water resources development. Figures available for DWR's capital expenditure in the areas of conservation works, construction of water supplies and investigations since 1980, and recurrent expenditures over the same period, reveal the following:

Table 1: DWR capital and recurrent expenditures 1980/81 - 1994/95
(Amounts given in Z$ millions)

Financial Year	Capital Exp. Govt.	Donor	Recurrent expenditure	Recurrent as % of capital
1980/81	5.70	N/A	8.61	151
1985/86	32.96	10.01	24.01	56
1990/91**	111.58	57.78	44.45	26
1994/95	112.17	107.05	95.88	44

Data source: Department of Water Resources
*** The anomaly in 1990/91 of a sharp increase in capital expenditure may be explained in terms of special supplementary allocations made to address the drought crisis. (Supplementary PSIP 'drought' allocations in 1992/93 for example, were calculated at Z$81.65 million and Z$48.24 million for DWR and DDF respectively, for activities in both rural and urban areas.)*

What Table 1 shows is that there has been a steady increase in the nominal funds available to DWR for capital development from Government sources over the past fifteen years - from close to Z$6 million in 1980/81 to around Z$33 million in 1985/85, Z$111 million in 1990/91 and Z$112 million in 1994/95 - although the increase is marginal in real terms. Donor funding has risen too, from Z$10 million in 1985/86 to an estimated Z$107 million in 1994/95. At the same time, there has been a marked and worrying decrease in recurrent expenditure relative to capital investment, from an overwhelming 151% in 1980/81 to 44% in 1994/95. However, there is no absolute certainty in sustaining even current levels of capital finance for water resources development. Most recently, DWR has been informed that no funds would be available for construction of any new works in the forthcoming financial year, and even ongoing works may have to be suspended.

Unfortunately, disaggregated data were not readily available during the study for an assessment of relative levels of investment in large scale water supplies for commercial farming and UIM purposes as compared with investments in small and medium size dams serving mainly the smallholder farmers in communal lands and resettlement areas. Such comparisons would be of particular interest at this point in time given the relative shift towards water resources development for this sub-sector. It should be noted, however, that whereas there has been some private dam development by commercial farmers, local authorities and the mining sector, Government has, up to the present day, funded all dam construction and in-field irrigation for schemes in communal lands.

However, DWR data available for one representative province (Masvingo), provided an indication of investment requirements for the development of proposed small and medium dams for smallholder irrigation for the period 1993/94 to the year 2000. Estimated dam construction costs (at mid-1992 prices) ranged from Z$0.5 million to Z$25 million, with most costing between Z$5 - Z$6 million. Average costs per hectare (ha) were around Z$120 000, with a range from Z$37 500 to Z$ 533 300 per ha. Added to this would be an average operation and maintenance cost of Z$597 per ha for dams and between Z$978 and Z$1 356 per ha for different forms of irrigation, plus combined pumping and maintenance costs of between Z$ 1 580 and Z$2 556 per ha.

3. Regional projects

The recently completed study, "Southern Africa Regional Water Sector Assessment", sponsored by USAID, provides a detailed and comprehensive overview of national and regional water resources projects, and identifies 30 proposed regional projects in order of priority. Of these, Zimbabwe was identified as a relevant participant in at least 16 projects, including three of the first five 'priority' projects, these being: Regional Groundwater Development Studies, Capacity Building/Institutional Support to International River Basin Commissions, and Zambezi River Basin Integrated Water Resources Management Plan: ZACPRO 6, Phase III. In addition to these, future projects of significance to Zimbabwe could include: Establishment of a River Basin Commission for the Pungwe and Save Rivers, Development of a Hydrologic Model for Upper and Middle Limpopo River, Preparation of a Model River Basin Agreement with Dispute Resolution Provisions, Technical Assistance to Harmonise National Water Laws with Basin Agreements and the SADC Protocol on Shared Watercourse Systems, Water Quality Standards and Monitoring Project, and Zambezi Southern Transfer Reconnaissance Study.

While ZACPRO 6 is the only regional project amongst these that is currently being implemented by Zimbabwe together with its Zambezi Basin partners, all the above-mentioned projects have direct relevance to the development and management of Zimbabwe's national water resources or of its regionally shared water. For example, establishing a commission for the Pungwe and Save Rivers is more than timely, given Zimbabwe's intention to harness the Pungwe waters for supply to Mutare, and given the current catchment rehabilitation and management initiatives underway in the Save Basin. An agreement has recently been made between Zimbabwe and Mozambique to establish a Joint Commission on Shared Waters, the signing of which is expected to take place soon.

Also, as Zimbabwe is party to a revival of the Limpopo Basin Permanent Technical Commission, and strengthening relations with states within the Zambezi Basin, there is a pressing need to enhance institutional and legislative capacity in the areas of river basin management and dispute resolution. Equally so, there is a need to increase knowledge of existing and potential water resources locally and within the region as a whole, and to strengthen information management as a basis for efficient basin management.

The Protocol on Shared Watercourse Systems establishes several principles which the parties agree to adhere to. Amongst others, these principles imply an agreement to:

* respect and abide by the principles of community of interests in equitable use of shared watercourse systems;

* maintain a proper balance between people's needs and the need for conservation and environmental protection to ensure sustainable development;

* cooperate closely with regard to study and execution of all projects likely to have an effect on the regime of the watercourse system;

* exchange information and data on hydrological, hydrogeological, water quality, meteorological and ecological conditions of the watercourse system;

* keep member States informed of emergency situations likely to have a detrimental effect on the regime of the watercourse system; and

* to protect installations etc. to prevent pollution or environmental degradation.

The Protocol envisages the establishment of three types of institutions: a central Monitoring Unit, and River Basin Commissions and River Authorities in the respective basins.

4. The role of donors in water resources development and management

The information provided in section 2.2 gives some indication of the extent of donor financing relative to Government investment in water resources development in Zimbabwe, although the

proportions vary between different parts of the sector. For example, in the rural water supply sub-sector, donor support for the district integrated projects has reached as high as 96% of total investment in some years. On the other hand, although the relative percentages of donor investments in DWR-related activities have steadily increased in the past decade - from 23% in 1985/86 to 49% in 1994/95 - the level of donor dependence is still much lower in this sub-sector than for primary rural supplies. However, breakdowns of the different votes within DWR for the projected period 1994/95 - 1997/98 would reveal that the actual and anticipated percentages of donor inputs range from between 50% of the costs of construction of conservation works, to 17% of the costs of constructing major new works, to 74% of construction of rural water supplies, and finally 7% of investigation costs.

Considering donor financing the water sector more broadly, an attempt has been made - through combining various data sources on a wide range of water sector programmes and projects - to provide below a tentative and fairly rough picture of the scope of external investment. It should be noted, however, that it was not possible through the limited data available, to specify the time scale for different programmes and projects, and so the period covered by Table 2 is defined loosely as "current".

Table 2: Current level of external investment in water sector programmes by major donors
(Amounts given in US$ millions)

Donor	Investment	Percentage
African Development Bank**	68.14	24
German Government	50.82	16
Italian Government	34.26	11
Norwegian Government	34.05	10
World Bank**	26.00	8
Swedish Government	22.41	7
Canadian Government	14.13	4
Danish Government	14.02	4
Netherlands Government	9.61	3
Japanese Government	8.81	3
Belgian Government	6.45	2
European Union	6.45	2
Other (Australia, UNICEF, USAID, NGOs)	29.77	9
TOTAL	324.92	100

Data sources: USAID/Stanley Consultants Report (1995), various project documents and Emergency Drought Recovery and Mitigation Programme (EDRMP) documentation
*** Banks provide mainly loans. Most other funds are in grant form.*

In addition to the above, it may be of interest to note the general trends in the key areas of focus of major donors in the water sector (Table 3). An awareness of such trends may be useful both to water sector agencies and to donors themselves, in identifying areas of common interest that can be further developed. As things stand at present, there is insufficient coordination across the sector - with specific exceptions such as the NRWSSP, ZACPLAN and - increasingly - the Water Resources Management Strategy, to ensure optimal use of the available resources.

Table 3: Interest of donors in different types of sector programmes

Type of programme: Interested donors

Primary water supplies: Norway, Netherlands, Denmark, Britain, Sweden, Japan, Germany, Belgium, UNICEF, European Union
Urban water infrastructure: African Development Bank, World Bank
Large dams: Italy
Major water conveyance works: Sweden, Italy
Irrigation dams: Germany, Japan, Netherlands
Water Resources Mgt Strategy: Norway, Netherlands, Germany, Britain
Catchment management: Netherlands, Germany, Norway
Natural resources management: Canada
Drought mitigation: World Bank
Institutional development: Germany, Norway, Canada
Groundwater studies: Britain, Sweden
Regional water resources: Norway, Sweden, Denmark, USAID, Canada

The role played by donors in the water sector is quantitatively significant in an overall sense as well as within specific aspects of the sector, and there is evidence of quite substantial dependence on external finance. To this extent, donors are in a double-bind. On the one hand, they are faced with too much recipient dependence at a time when recipient responsibility and sustainability are key development cooperation objectives. On the other hand, they have a certain degree of influence over sector priorities and directions. On the positive side, this latter situation provides donors with opportunities to raise issues of concern which are not being addressed within the sector, or simply to provide information about relevant new global trends and ideas or about appropriate experiences from elsewhere. On the negative side, there is the danger of donor priorities pulling the sector in too many conflicting directions, undermining the possibilities for a more consolidated approach to sector development.

There is room for far more active coordination between the donors in the sector, as well as internally within individual donor agencies, where vital linkages between relevant programmes are not always made. Initiatives such as the donor round table on environment are welcome starts. However, of even greater importance is the need for enhanced coordination amongst all relevant agencies in the water sector who have a responsibility for providing a comprehensive policy framework and strategic guidance to donors and other interested parties.

APPENDIX 5

INSTITUTIONS VISITED AND PERSONS MET

Agritex
R J Chitsiko, Dept. of Engineering Services

Commercial Farmers' Union
Oliver Newton, Representative on WRMS Steering Committee

Confederation of Zimbabwe Industries
Pat Henson

Dept. of Water Resources
Vavarirai Choga, Operations Division
David Durham, Planning & Hydrological Division
Hugh Williams, Planning Branch
Sam Sunguro, Groundwater Branch
Stefan Helming, GTZ Institutional Development Project

District Development Fund
Reston Muzamhindo, Water Division

Environment and Remote Sensing Institute
Caxton H. Matarira

Institute for Water and Sanitation Development
Ngoni Mudege

IUCN - The World Conservation Union
Tabeth Matiza Chiuta

Matabeleland Zambezi Water Trust
Kenneth Small, Advisor

Ministry of Health and Child Welfare
William Rukasha, Dept. of Environmental Health
N Tembo, Dept. of Environmental Health

Ministry of Lands and Water Resources
Dr. Mlambo, Chairman of WRMS Steering Committee

Ministry of Local Government, Rural and Urban Development
Andrew Mlalazi, Dept. of Physical Planning
Abbiah Mpamhanga, Chairman of NAC

Ministry of Environment and Tourism
Mfaro Moyo

Mvuramanzi Trust
Peter Morgan
Anthony Water keyn

National Coordination Unit for Rural Water Supply and Sanitation
George Nhunhama
Benedict Majaya

National Economic Planning Commission
Gideon Sigobodhla
Lovemore Mujuru

Royal Netherlands Embassy
Johan de Waard

SWECO
Bo Sedin

Swedish Embassy
Karl-Anders Larsson, Sida
Eva Westman, Sida
Göran Hedebro, SAREC

University of Zimbabwe
Mandivamba Rukuni, Dept. of Agricultural Economics and Extension
Richard Owen, Geology Department

World Bank
Stephen Brushett

Zimbabwe Cereals Producers Association
Peter Wells

Zimbabwe Chamber of Mines
David Robinson

Zimbabwe Energy and Environmental Research Organisation (ZERO)
Beki Maboyi

Zimbabwe Energy Supply Agency
Fred E. Chimowa
Edward K. Tsikirayi

Zimbabwe Farmers' Union
Mercy Kaviza
Emerson Zhou

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