NORWEGIAN INSTITUTE FOR WATER RESEARCH

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0 - 81022

WATER PRICING STUDY

FOR

THE WESTERN PROVINCE OF ZAMBIA

September 9, 1981

David G. Browne
Svein Stene Johansen,
Project Manager

The Administration of NIVA:
John Erik Samdal
Lars N. Overrein

NIVAs hustrykkeri

NIVA - REPORT

Norwegian Institute for Water Research NIVA

Royal Norwegian Council for Scientific and Industrial Research

Adress:
Postbox 333, Blindern
Oslo 3
Norway

Telephones
No 47 2 23 52 80
No 47 2 46 69 60

Report No.: 0-81022

Sub-No.:

Serial No.: 1322

Limited distribution:

Report title:

Water Pricing Study for
The Western Province of Zambia.
VA-9/81

Date: Oct. 9. 1981

Project No: 0-81022

Author(s):

David G. Browne
Svein Stene Johansen
Mette Jørstad (Appendix A)

Topic group: SEKVAT

Geographical area: Zambia

Number of pages (incl. app.): 200

Contractor:
NORAD - Norwegian Agency for International Development

Contractors ref. (or NTNF - No):

Abstract:

Recommendation for an appropriate water tariff policy for the 1980s through an examination of the NORAD financed water supply programme in the Western Province of Zambia and the present pricing policy of the Zambian Department of Water Affairs.

4 keywords, Norwegian

1. Vanntariff studie
2. Sosiale forhold
3. Økonomiske analyser
4. Driftskostnader
Vedlikeholdskostnader
Zambia
NORAD

4 keywords, English

1. Water Tariff Study
2. Social Conditions
3. Economical Analyses
4. Operation and Maintenance Costs

Project leader

Svein Stene Johansen

Section leader

Arild Schanke Eikum

For the Administration

John Erik Samdal

Lars N. Overrein

ISBN 82-577-0423-7

ACKNOWLEDGEMENT

The Norwegian Institute for Water Research (NIVA) would like to thank all the civil servants of Zambia and other persons who have participated in discussing water pricing issues, and who have also made useful information available to us.

In this connection we would like to mention Messrs Ostlandskonsult A/S for their preparation of technical information.

We would also thank the NORAD staff in Lusaka and Mongu who made the safaries and field survey possible.

NORWEGIAN INSTITUTE FOR WATER RESEARCH

Svein Stene Johansen
Project Manager

P R E F A C E

The Norwegian Institute for Water Research (NIVA) was in March 1981 engaged by the Norwegian Agency for International Development (NORAD) to undertake a Water Pricing Study for the Western Province of Zambia.

The Terms of Reference and the proposal of the study had previously been prepared by NIVA and approved by the Zambian Government and NORAD.

Because of this very special study, NIVA found it of greatest importance to use a staff with relevant experience from similar studies and who were aquainted with the local conditions and the socio-economical problems.

The Project Team consisted of

Mr. David G. Browne, Agricultural and Water Reseources Economist
Mrs. Mette Jørstad, Social-anthropologist
Mr. Svein Stene Johansen.

The latter is permanently employed by NIVA, the two other persons hired as sub-consultants.
The Project Team visited Lusaka and Western Province in March/April 1981 and had discussions with relevant authorities at central, provincial, and local levels. The team also met members of the DWA staff as well as many water consumers.

In May 1981 the social-anthropologist returned to Western Province and carried out a field study. The data from this field study will later be presented in a separate appendix to this main report.

The team-members have all contributed to this main report. As the economist had to base his analysis on the analyses made by the other team-members, he also edited the final version of the main report. The conclusions, findings, and recommendations have been thoroughly discussed at NIVA, and we do hope that the report may create discussions in Zambia which may lead to a better water management and an appropriate water pricing policy.

Svein Stene Johansen
Project Manager

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ABBREVIATIONS.

D.W.A.	Department of Water Affairs.
P.W.E.	Provincial Water Engineer.
I.B.R.D.	International Bank for Reconstruction and Development.
Z.E.S.C.O.	Zambia Electricity Supply Corporation Limited.
C.P.C.	Copperbelt Power Company.
U.N.I.P.	United National Independence Policy.
M.P.	Member of Parliament.
Z.N.P.F.	Zambia National Provident Fund.
I.D.W.S.S.D.	International Drinking Water Supply and Sanitation Decade.
N.A.C.	National Action Committee.
O & M	operation and maintenance.
c.w.p.	communal water point.
i.c.	individual connection.
r.w.s.	rural water supply.
lpcpd	litres per capita per day.
p.a.	per annum.
K	kwacha.
n	ngwee.
NIVA	Norwegian Institute for Water Research

SUMMARY

Introduction.

The major objective of the report is to recommend an appropriate water tariff policy for the 1980's through an examination of the NORAD financed water supply programme in the Western Province of Zambia and of DWA's present pricing policy.

Organisation.

At present DWA is responsible for the township supplies in Western Province, other than Mongu. The councils are only responsible for billing and revenue collection for which they receive 10% of the revenue. DWA has also been operating the Mongu township supply on behalf of the council but the council remains totally responsible for all financial aspects. However the recent Decentralization Act suggests that the district councils should take over the responsibility for the water supplies. The report points out that these institutions are less well equipped than DWA to perform the job adequately and it discusses the question of the future responsibility for the supplies. A firm recommendation is not put forward but the implications of the organisational alternatives are described. It is stressed that the new local authority set-up must not be allowed to lead to a situation of divided and ambiguous responsibilities.

DWA is faced by a wide range of problems, the most serious of which are the poor calibre of staff and shortage of recurrent finance. It is believed that staff performance at the lower levels should be improved by adequate training but there seems to be no immediate solution to the problem of the shortage of high level staff.

Financial Planning.

At present financial planning within DWA is non existent. No attempt until now has been made to examine future water tariffs or to prepare financial forecasts. This report represents a first step in this direction, but it is only possible to make very sketchy predictions and the introduction of an effective cost accounting system is vital so that Government knows what the revenues and expenditures of the supplies really are, so that the financial effects of proposed policies can be accurately gauged and planning of the water sector improved.

Future Water Demands.

The total population of the eight townships was about 59,000 at the 1980 census and it is estimated to reach 160,000 by 1995. It is also planned to supply a few thousand people outside the township boundaries. The estimated required production increases from 7,652 m^3/day in 1980 to 18,451 m^3/day in 1995. On the assumption the leakage will equal 15% of consumption, i.e. 13% of production, it is estimated that consumption from individual connections will equal 62% of water produced or 71% of consumption, and consumption from CWP's will equal 25% of water produced or 29% of consumption.

Present Pricing Policy.

The present Government pricing policy for smaller township supplies is that revenues should at least cover the costs of operation and maintenance. The report, in presenting the first attempt in recent years to estimate the relationship between revenues and recurrent costs, show that at present the revenues from the township water supplies in Western Province are failing dismally to cover recurrent costs. An important cause of this situation is that Government has, in recent years, allowed water rates to get completely out of line with the higher costs resulting from inflation.

In theory DWA operates a two part tariff with consumers being charged K4 per month for the first 35 m^3/month and 18n per m^3 for additional use. In practice the metering situation is a farce and the majority of metered consumers are charged a flat rate of K4 per month, with a few major consumers paying higher monthly rates. In addition un-metered consumers pay K5 per month. Communal point consumers theoretically pay K1/family/month. Government and council employees have this fee deducted from their salaries, but most other consumers simply do not pay and the authority seems powerless to do anything about it.

Present Revenue.

It is estimated that current revenue is between K60,000 and K70,000 of which around K40,000 is from Mongu. This level of revenue means that consumers are paying 5n per m^3 of water consumed. Since the current tariff structure implies an average rate of 16n/m^3, the authorities are levying one third of the revenue intended by the official tariff structure.

Between 70% and 80% of expected revenue is collected in Mongu but elsewhere only 40-50% of the total revenue that should be collected is actually being collected. Even if all revenue that should be collected was collected, i.e. total income almost doubles, D.W.A. would still only be receiving approximately 10n per m^3 of water consumed. This is well below the rate intended by the current tariff structure and demonstrates that a lack of metering and failure to charge on a quantity used basis is costing D.W.A. one third of the revenue intended by the tariff structure. The failure of collection leads to a similar loss.

Comparison of Present Revenue and Costs.

Although Mongu Township Council is subsidised by D.W.A., i.e. the annual fee of K50,000 it pays D.W.A. does not cover the operation and maintenance costs of the Mongu water supply, the council still makes a loss on the supply. In 1980 costs exceeded K60,000 and revenue was only K43,000. There are no indications that the financial performance will improve in 1981.

D.W.A.'s current revenue of K70,000 only meets 20-25% of the annual recurrent costs of just over K300,000. Thus in a static situation where all consumers are charged on a flat rate basis and where there is no improvement in the rate collection performance it would be necessary to increase the rates by a factor of between four and six simply to cover the recurrent costs. However if all rates were to be successfully collected, total revenue should double and rates would only need to be increased by a factor of between two and three. However if all water was charged for on a quantity used basis and if all intended revenue was actually collected, current rates would only have to be increased by approximately 60% in order to fully cover the costs of operation and maintenance.

It is estimated that the present short run marginal costs of operating the supplies are just over K40,000 p.a. Therefore current revenue covers those costs of operating the township water supplies which vary with production.

Recurrent Financial Situation.

D.W.A. is currently facing an extremely serious recurrent financial situation. In the recent past the lack of recurrent finance has adversely affected the service provided by the water supplies to consumers. For example, since D.W.A. has not been able to afford sufficient diesel fuel, pumping hours have been restricted and some consumers have gone short of water. Unfortunately the financial situation is deteriorating, and for 1981 Government actually cut D.W.A.'s allocations in financial terms, i.e. there were large drops in real terms.

Authorised recurrent expenditures are significantly less than requests and are inadequate. The new NORAD financed water supplies that are currently being planned and implemented in Western Province will increase the finance that is required for operating and maintaining the township water supplies, i.e. they will increase the financial demands on the Government's recurrent budget. If nothing is done about this situation the new schemes will not be properly utilised and will represent wasted investments.

Costs of the Township Water Supply Programme.

All costs and revenues in the report are presented in terms of 1980 prices. The annual capital cost of all eight township supplies is estimated as K1,077,000 per annum. The annual fixed cost of operation and maintenance is estimated as K439,000 increasing to K464,000 per annum. The annual variable costs of operation are only K52,800 in 1980, increasing to K92,300 in 1988. Hence the total cost of operation and maintenance increases from K492,000 p.a. in 1980 to K556,000 p.a. in 1988 and the total annual cost of the supplies increases from K1,569,000 in 1980 to K1,633,000 in 1988.

The total cost producing water falls from 65n per m^3 of water consumed in 1980 to 38n per m^3 in 1988. The overall cost during the 1980's is just under 50n per m^3, but there are large differences between the different townships. In Mongu the overall cost is under 35n per m^3 but in Lukulu the overall cost exceeds K1 per m^3.

The operation and maintenance cost of producing water falls from 20n per m^3 of water consumed in 1980 to 13n per m^3 in 1988. The overall cost during the 1980's is around 16n per m^3, but the overall cost ranges from

around 10n per m^3 in Mongu to around 40n per m^3 in Lukulu and Namushakende.

The short run marginal costs of water in six of the eight townships are very low, between 1 and 2n per m^3. But in Lukulu and Namushakende which will be operated using diesel ,the marginal costs are six to eight times higher.

The Problem in Determining an Appropriate Pricing Policy.

The major problem in determining an appropriate tariff structure is that the three major functions of water rates frequently conflict. Whereas the economic and social criteria will both suggest a low price for water from the Western Province townships supplies during the next few years, such a rate would lead to a large continuing financial deficit.

In fact it would be impossible to meet a strict financial criterion of covering all costs and it is considered that the Government's current objective of covering the costs of operation and maintenance is appropriate for the 1980's.

Consumers' Ability to Pay.

It is estimated that the ability of consumers to pay for water is as follows:-

high cost housing residents	K15+ per family/per month.
medium cost housing residents	K12 per family/per month.
low cost housing residents	K5.5 per family/per month.
informal housing residents	K2.5 per family/per month.

These figures combined with the probable water consumption of households in the different housing catagories suggests that rates up to 35n per m^3 are acceptable.

Metering.

D.W.A.'s present policy is that all consumers should be metered and the majority of connections have meters installed but, (a) most meters are not working properly, (b) the maintenance system is almost non existent, (c) inaccurate meters are still read regularly, (d) there is confusion over the meters' units, (e) although meters are read all consumers are charged flat monthly rates. Thus meters are not fulfilling any useful purpose at present. Consequently there is absolutely no point

in continuing metering unless the maintenance and administration improve dramatically and water is to be charged for on a quantity used basis.

A policy of wholesale metering involves capital, maintenance and administrative costs which may not be justified by the returns. Nevertheless water supply authorities including D.W.A. favour metering. This is because they concentrate their attention on the costs of not metering, i.e. (a) saving in operational costs since consumption/wastage tends to be reduced and (b) a subsequent saving in capital costs since reduced demand will permit delays in implementing future augmentations.

The estimated cost of metering is almost K24 per annum, and in six towns a saving of at least 600 litres per person would be required to justify metering now. In Lukulu and Namushakende the necessary savings are only 100-150 litres per person per day, and complete metering is recommended. Due to the high marginal costs of producing water in these two townships it is improbable that this will be a wasted cost even within the context of those townships' supplies. In addition a comparison of the consumption in Lukulu and Namushakende during the period 1981-5 with consumption elsewhere, together with additional data on the cost of augmentations will permit a sensible decision to be made with regard to metering in the other six townships. Here marginal costs are so low that the major purpose of metering would be to delay augmentations and it may be sensible to adopt widespread metering later in the 1980's.

However it is recommended that major consumers everywhere be metered immediately and be charged on a quantity used basis.

Communal Water Point Rating Policy Recommendation.

It is recommended that water from communal water points in the townships be provided freely to all consumers other than Government and council employees and council house tenants. This policy is practical, and attractive to consumers and politicians. It can be opposed on two major grounds. Firstly it may be claimed that it will lead to increased wastage, but free water will not lead to any more wastage than a flat rate charge would, since in both cases consumers would be paying zero marginal cost for actual usage/wastage. Secondly it may be claimed that it will lead to a loss of revenue, but in fact the real loss will be small since experience shows that the authority can only effectively collect communal point rates from pay packets and from rents. It will be almost impossible

to successfully collect the rates from the other consumers over a long period. The limited financial significance of the recommended policy can be seen by the fact that an increase in the rates paid by consumers with individual connections of 16% will fully make up for the lost revenue from providing water freely to communal point consumers.

Connection Fees.

It is recommended that low cost housing residents be charged less than medium and high cost housing residents for connection to the water supply. The recommended rates in 1980 prices are K60 and K100 respectively. Furthermore it is proposed that where a low cost house is provided with a minimum service of only one tap, the connection fee should remain at K60, irrespective of how many lengths of pipe are required to connect the house.

Recommended Tariffs.

As a result of the consultants' investigations of pricing theory, ability and willingness of consumers to pay for water, demand forecasts, costs of construction and maintenance of the supplies and the question of metering, the following price structure is recommended:-

1. Communal Water Points.

   (a) communal point consumers who are employed by Government or councils or who occupy council houses should be charged a fixed fee of K1 per month.

   (b) all other communal point consumers should not be charged.

2. Individual Connection in Lukulu and Namushakende.

   All consumers should be metered and be charged K2 per month for their first 15 m^3/month and 50n per m^3 for any additional consumption.

3. Individual Connections in the Other Six Townships.

   Only the very largest consumers should be metered and all others should be charged flat monthly rates as follows:-

Low cost housing households	K 5 per month (K4 for consumers with only one tap).
Medium cost housing households	K10 per month.
High cost housing households	K15 per month.
All non domestic consumers	K15 per month.

Major consumers should be charged flat rates ranging from K20 to K200 per month with a charge for additional consumption of 10n per m^3.

The proposed tariff structure accords with social criteria since:-

(a) the majority of communal point consumers will receive free water and those who will be charged have the ability to pay the proposed low rates.

(b) a low concessionary rate will be charged for the first $15m^3$ per month for individual connections in the two high cost towns. ($15\ m^3$ per month represents the design consumption for low cost housing connections).

(c) in the other six towns rates will be related to the ability to pay since differential flat rates based on category of housing will be charged.

In Lukulu and Namushakende the recommended tariff structure does not accord with either the economic or financial criterion, but represents a trade-off between the two objectives. Elsewhere the zero or low price for marginal usage is consistent with the economic criterion and the overall price levels meet the financial objective of covering the costs of operation and maintenance.

The recommended policy represents a compromise between meeting conflicting objectives and is based largely on the fact that the existing committment to build the supplies means that the short and medium run marginal costs will be low. However in about 6-7 years time as demands approach capacities there will be a greater need to deter consumption/wastage and greater attention will have to be paid to longer run marginal costs.

It is important that rates are increased roughly in line with inflation and it is recommended that they are increased every two years.

Projected Revenue.

The total projected revenue based on the recommended tariffs and the projected demand forecasts is K516,600 per annum in 1980 increasing to K908,100 per annum by 1988. The overall unit revenue for the period averages n18.8 per m^3 of water produced. It is estimated that the costs of collection and metering are K29,100 in 1980 increasing to K53,300 by 1988. Consequently the annual revenue, net of the costs of collection and metering, increases from K487,500 in 1980 to K854,800 by 1988.

These revenues are considerably less than the total annual costs of the water supplies and the deficit is K1,081,000 in 1980 decreasing to K778,000 by 1988. The proportion of all costs covered by revenue increases from 31% in 1980 to 52% in 1988 but the performance between townships varies significantly. For example, during 1980-88 revenue in Mongu covers 60% of all costs but the corresponding figures for Lukulu and Namushakende are 12% and under 10% respectively.

The subsidy that will be provided by the Government and the donor will on average represent about 60% of all of the costs of constructing and operating the supplies but in Lukulu and Namushakende it will be of the order of 90%. Therefore the programme is only financially viable if the Government and/or the donor is/are willing to provide these high levels of subsidy.

However the projected revenuesdo meet the financial objective of covering the costs of operation and maintenance. In 1980 revenue just fails to cover the costs of operation and maintenance, but by 1981 a recurrent financial surplus is generated. By 1988 the surplus totals K300,000 per annum. Hence it is possible for the recommended pricing policy to more than meet D.W.A.'s present and the consultants recommended, financial objective for the overall programme. Nevertheless there are very significant differences between townships and continuing recurrent deficits in Lukulu and Namushakende appear to be inevitable.

The consultants undertook a less optimistic financial projection in which it was assumed that only 50% and 25% of low cost housing households acquired their own connection. This resulted in increases in the necessary overall subsidy from around 60% to around 69% and 74% respectively. However the effect on the recurrent financial performance was much more significant If only 50% of low cost residents acquire their own connection, revenue will not meet the costs of operation and maintenance until 1985 and over the period 1980-88 total revenues fail to match the total costs of operation and maintenance. If the uptake by low cost residents is only 25%, revenue fail to meet the costs of operation and maintenance throughout the period and the overall recurrent deficit for 1980-88 approaches K900,000.

Disconnection.

The revenue collection performance even from individual connections has not been good in the past. If the performance is to be significantly improved, it is vital that a strict policy of disconnection be enforced. The consultants' recommended procedure would mean that any consumer who does not pay his bill within two months will be disconnected. It is especially important that Government tackles the problem of non payment by Government institutions. It is recommended that the reconnection fee be increased from K5 to K25 immediately.

Recommended Rural Water Policy.

It is clear that the rural water supplies being constructed under the NORAD programme must be free since the consumers will not be willing to pay. Consequently the entire cost of maintaining the rural wells will have to be borne by the Government. It is estimated that the annual cost of maintenance of the rural water supply programme increases from just over K60,000 in 1982 to over K120,000 in 1985,(in 1980 prices), and that annual maintenance cost per head will be just under K3 per annum.

If Government has limited funds for water it must restrict the number of supplies which it constructs rather than attempt to increase available funds by charging for rural water supplies since the latter strategy would be doomed to failure. Finally it is clear that the selection of well sites in the NORAD rural programme to date has been extremely poor and there is an urgent need to improve scheme selection, which must be based on accurate descriptions of existing water supply situations and needs.

National Study.

It is strongly recommended that the present study be extended to cover the entire nation. A policy for Western Province cannot be implemented in isolation from the other provinces of the country. On the other hand it would not be wise to formulate a national policy based on the study of one province alone when there are significant physical, economic and social differences between provinces.

1. INTRODUCTION.

1.1 Introduction.

The major objective of this report is to examine the present pricing policy being followed by D.W.A. in Western Province and to recommend an appropriate tariff structure for the 1980's. Consequently all issues which have any bearing on pricing policy are examined and explained in detail so that the client can understand the reasoning behind the consultant's recommendations. The client will therefore be able to determine which proposals it wishes to implement. The report also discusses a number of subsidiary issues: water consumption, organisation, and operation and maintenance which were included in the consultants' terms of reference.

The consultant's investigations concentrated on the eight township supplies which are being, or will in the near future be, constructed/augmented under the NORAD assistance programme. The reasons for this were:-

(i) the township supply programme is the most important in terms of cost, population, and potential revenue

(ii) the issues involved are more complex than those of the rural programme.

Attention is also focused on the NORAD financed rural water supply programme. However other water supplies in Western Province, for example, small piped and other supplies operated by rural councils, secondary school supplies, etc. were outside the consultants' brief and were therefore not visited and have been excluded from the study.

1.2 Data Limitations.

The consultants found that the data they required was often scarce and that which was available was sometimes of doubtful quality. The particular question of the lack of financial data is discussed in Section 2.9 . However very basic data was not always available and on occasions officers could not answer simple questions on subjects on which they should have been well informed. Furthermore different sources within D.W.A. often gave contradictory information. This means that the consultants have had to depend on insufficient and unreliable data. Consequently some of the figures in this report are only informed

guesstimates. Nevertheless it is believed that they are accurate enough for the present purpose i.e. to establish the basis for a sound water pricing policy.

1.3 Calculation Base.

The study of the financial performance of the township water supplies ignores inflation, i.e. it is undertaken entirely in 1980 prices. It is further assumed that all supplies commence operating and yield revenue from 1980. This obviously does not accord with the real situation. However the methodology adopted will lead to the formulation of an appropriate level of tariffs and to an accurate assessment of the financial performance of the township supplies providing that the major assumptions adopted in the study, in particular that rates increase roughly in line with inflation,are reasonable. Furthermore calculations based on, for example, the various schemes coming into operation at various points in time up to 1984/5 would add considerably to the arithmetic, would be dependent on similar assumptions and would not increase the accuracy of the conclusions.

2.1 Department of Water Affairs.

The Department of Water Affairs, (DWA), which is part of the Ministry of Agriculture is the sole agency of the Government of Zambia for coordinating the development of national water resources. It also constructs and extends water supplies in the rural areas, develops and maintains canals and provides engineering advisory services for water supplies to the Government. Operation and maintenance of rural water supplies is the responsibility of district councils but D.W.A. provides assistance for major repairs or even for the entire operation of facilities.

The organisation chart of the Department as of 1st April, 1981, is shown in Figure 2.1 . The headquarters are located in Lusaka and D.W.A. is represented in all nine provinces. The organisation chart for Western Province as of 1st April, 1981, is shown in Figure 2.2.

2.2 Responsibility for the Township Water Supplies.

D.W.A. completed the takeover of the operation and maintenance of rural township water supplies from the Works Department or local councils in 1975. It now operates about 50 such schemes including six in Western Province and prior to the Local Administration Act 1980 the major responsibility for these rural township supplies rested with D.W.A. The local D.W.A. offices operated, maintained and partly administered the schemes. The councils did the billing and collected the revenue, though D.W.A. read the meters. In effect the councils acted as revenue collection agents and passed on to D.W.A. at rather irregular intervals, 90% of total revenue collected. They retained 10% to cover their costs of collection.

Mongu Urban Township Council should have had complete responsibility for the Mongu Water Supply but since it did not have the competence to operate and maintain the supply it has issued funds (K50,000 per annum) to D.W.A. for the last four years to undertake this function. The council remains totally responsible for all financial aspects including billing, meter reading and revenue collection. The arrangement is not particularly satisfactory:

(a) the liaison between the council and D.W.A. could be improved. For example the P.W.E. and the Secretary of the council did

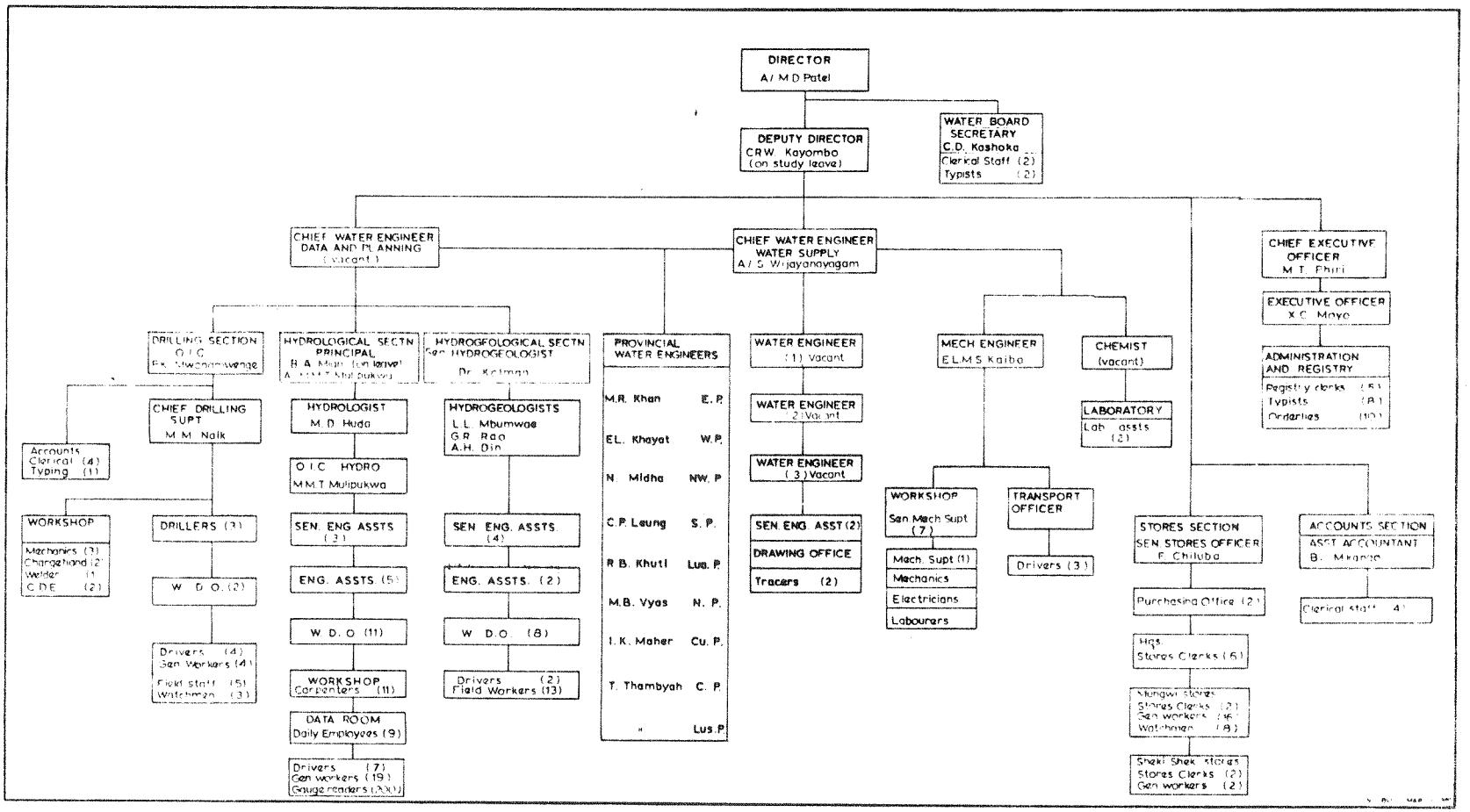
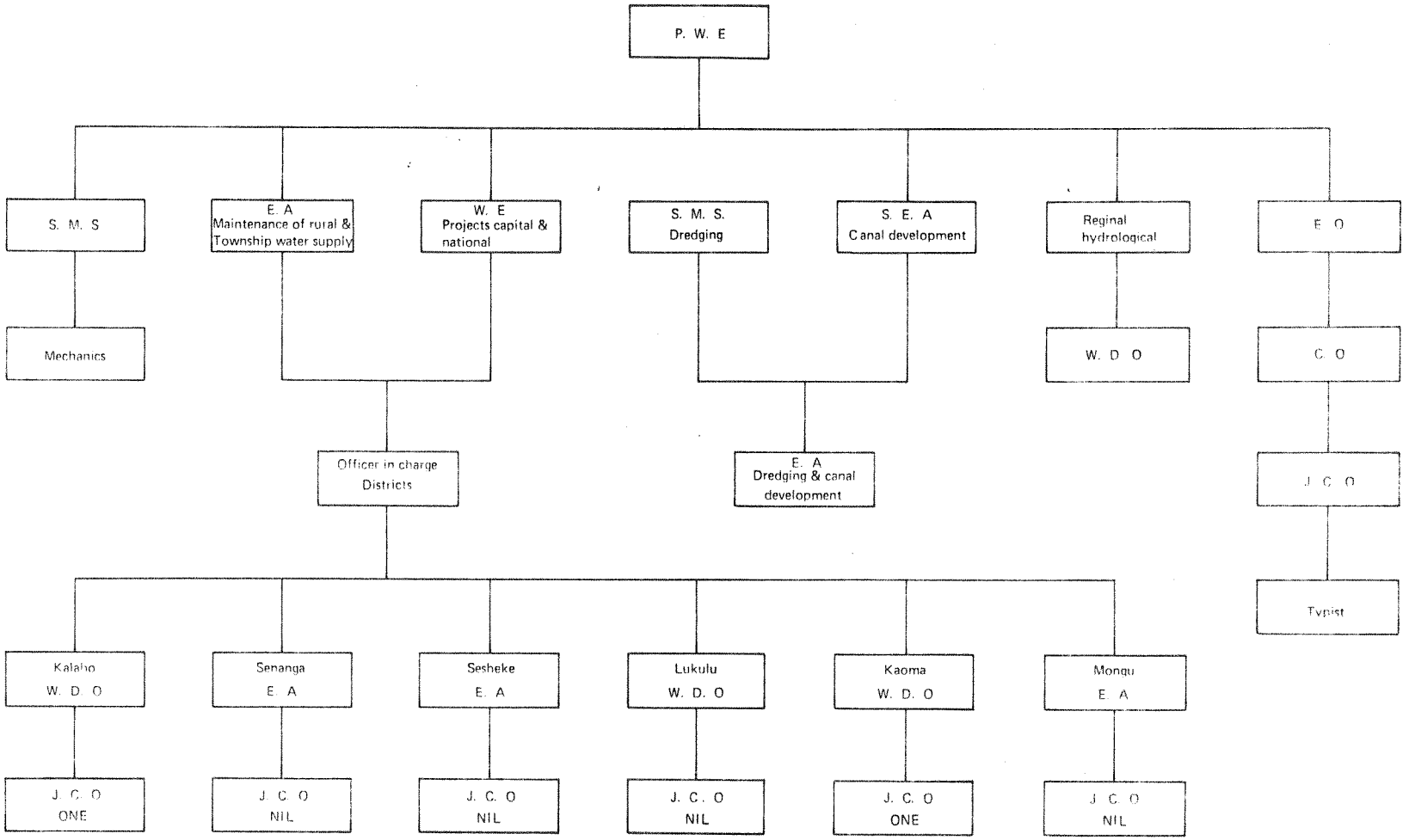


FIG. 2.1 ORGANISATION CHART
DEPARTMENT OF WATER AFFAIRS
(April 1981)



Abbreviation :

P.W.E = Provincial Water Engineer
S.M.S = Senior Mechanical Superintendent
S.E.A = Senior Engineering Assistant
E.A = Engineering Assistant
W.E = Water Engineer
E.O = Engineering Officer
W.D.O = Water Development Officer
C.O = Clerical Officer
J.C.O = Junior Clerical Officer

FIG. 2. 2 ORGANISATION CHART DEPARTMENT OF WATER AFFAIRS WESTERN PROVINCE (April 1981)

not meet during their first three months together in the town. Regular meetings between such officials could only assist in sorting out any problems.

(b) although the council is financially responsible for the supply its annual fixed fee probably does not cover all of D.W.A.'s costs. Due to the poor cost accounting system it is not known what these costs are. However the consultants estimate in Section 4.8 that the current operation and maintenance cost of all the township supplies is around K300,000 per annum. Since Mongu is by far the largest out of seven supplies, the costs almost certainly exceed K50,000 per annum.

2.3 Major Problems Facing D.W.A.

D.W.A. in Western Province faces major problems of staffing and poor management. The former which includes over-manning at the lower levels, but insufficient experienced professional staff, low calibre of staff and workers, poor discipline and lack of incentives is discussed in Section 2.4 . Poor management and inefficient organisation mean that D.W.A. does not optimise the use of its limited resources. For example it was reported that officers in charge of the smaller township supplies can spend up to one week away from their station to collect a cheque. The poor revenue collection performance which is pertinent to this study is largely due to the inadequate organisation/administration of both D.W.A. and the councils.

D.W.A. in Western Province also operates under the handicaps of poor back-up from headquarters, transport and communication difficulties, shortages of spare parts and lack of recurrent finance. Many of these problems are the subject matter of a management rather than a tariff study. However:-

(a) a tariff study has a very limited value if the water supplies operate poorly,

(b) it is impossible to divorce many of the other problems facing D.W.A. and the councils from the financial problem, i.e. from the lack of recurrent finance. This is illustrated by the example of the transport problem described below.

The lack of vehicles and communication facilities hinders both operation and maintenance and development activities. The transport problem is particularly serious with the shortage of vehicles being exacerbated by the long distances involved and by poor roads. For example the D.W.A. Kalabo office had no transport at the time of the consultants visit. It was claimed that its Landrover had been sent for repair in 1979 and that its boat had been unoperational for some time. However it was reported that despite the shortage of transport the P.W.E. did not take up an offer of some free second-hand Landrovers. This apparent anomaly was explained by the fact that he believed that his office could not afford to run them. This is certainly true if as the consultants were informed, the P.W.E. has as little as K350 per month available for petrol. This sum would permit a mileage of between 2000 and 3000 Kms for the entire fleet, a distance which is ridiculously insufficient compared with needs. Therefore the transport that NORAD intends to provide will help to solve the transport problem only if D.W.A. has sufficient recurrent finance to use them efficiently. It is also necessary for efficient management,operation and planning that the improvements to the vehicle fleet and workshop are accompanied by the introduction of (i) proper vehicle and workshop costing systems(ii) a systematic method of vehicle allocation, and (iii) more efficient replacement and purchasing arrangements. An extension to the store at the provincial headquarters is also required.

A number of the existing problems may be solved, at least in part, by the ongoing NORAD financed programme. In fact the involvement of NORAD is the major hope for an improvement to the situation described above, and the position in five years time will be largely dependent on the role that NORAD has played during the intervening period.

2.4 The Staff Problem.

At present there are two major characteristics of the staffing situation:

(a) the overstaffing at the lower levels.
(b) the poor calibre of some of the staff.

The consultants perceived that over-manning is one of the more serious problems facing D.W.A. This opinion was endorsed by all Government staff with whom the question was discussed. However for sound social reasons

Government workers' jobs are protected by legislation and even where it is possible to make individuals redundant Government is loath to do so. Most of the townships water supplies have around 12-15 staff many of whom do very little during a day's work. The consultants are certain that any form of work study would reveal most disturbing results. It is estimated that at least 25-30% of the existing staff could be dispensed with, without any loss of operational efficiency.

Although it is clear that the organisation is overstaffed there is accordingly to D.W.A., an overall vacancy rate of 30% in its establishment. Appendix 2.1 presents this establishment. However the most serious problem does not relate to overall numbers but to a lack of good professional staff. At the professional level there is a vacancy rate of 50%. Many key posts have been vacant for considerable periods, though some are currently under recruitment. Many posts particularly at the middle and junior professional and technical levels are filled by staff lacking the necessary qualifications, experience and ability.

2.5 Measures Required for Improving the Staffing Situation.

2.5.1 Senior Staff.

The present shortage of senior professional staff is especially serious since the efficient administration and operation of the new expensive township water supplies currently being planned and implemented will largely depend on such people. Unfortunately the consultants have nothing useful to say on this point. Clearly it is necessary to strengthen the provincial organisation by increasing the professional engineering, administrative, accounting and personnel management staff but where will D.W.A. obtain such people with the necessary abilities?

2.5.2. Junior Staff.

Although the calibre of many of the existing staff is not high they could still perform their tasks more efficiently if (a) there was greater discipline (b) they were better trained and (c) there were incentives for doing their jobs well and for the better staff to remain with D.W.A.

It could be instructive for D.W.A. to examine why ZESCO operates more effectively then D.W.A., and the billing and rate collection system will be used as an example. The first reason is that ZESCO does not have the

problem of charging for communal consumption which is unrelated to staffing. The only way for D.W.A. to solve this problem would be to implement the recommendation spelt out elsewhere in this report that communal points should be free for all consumers other than council and Government employees and council house tenants. However the main reason is that ZESCO staff perform their duties more effectively. ZESCO tries to recruit staff of a higher calibre than D.W.A. does, although in locations such as Mongu ZESCO is not always able to obtain the calibre of manpower that it would wish. Their meter readers and billing staff have at least Form II. They have better technical and administrative training and pay better wages. For example meter readers earn around K150 per month. Although their management salaries are only slightly higher they provide better fringe benefits.

A revenue billing and collection system will only work properly if low level staff are well trained to carry out the very simple tasks involved. Any system must be tailored to the competence of the staff available but the tasks of visiting meters, recording the correct reading, transferring this correctly to the bills, calculating the resulting bill, despatching the bills, collecting the money, issuing receipts, keeping updated records of individual consumers payments, issuing warnings to non payers and giving accurate information regarding those due for disconnection, only require staff with very limited abilities. But if one examines the existing records in some townships one might get a different impression. Although D.W.A. does not need to recruit highly qualified staff for such tasks they must ensure that they appoint staff who are sufficiently competent that they will, after training, perform considerably better than many existing staff do. The vital requirement is that senior and middle management train the junior staff, make sure that they properly understand their jobs, and fulfill their own function as bosses in ensuring that their juniors demonstrate application to their tasks. At present many staff have no idea of what standards should be achieved. For example one junior clerical officer's estimate of the number of working days required in his township for billing would mean that a clerk would only prepare 10 bills per day. Even technical staff sometimes display complete incompetence. For example an electrician made a wrong electrical connection and seriously damaged electrical equipment.

It is therefore necessary that training programmes be introduced for a wide range of junior administrative and technical staff. The present training courses for operators should be extended, though possibly 4 months is long enough at one time. Additional courses for other technical staff should also be introduced. All courses should be supplemented by on the job training programmes preferably with a technical instructor visiting the personnel of their place of work. The recommendations entail the need to increase the number of training school technical instructors. It is also recommended that courses are designed for junior administrative staff, and that NORAD provides one person in the near future to prepare and deliver appropriate courses.

2.6 Decentralization.*

The Local Administration Act 1980 established district councils and committees with wide ranging administrative and financial responsibilities. For example their specific functions include: "to provide and maintain supplies of water, and for that purpose to establish and maintain waterworks and water mains". Furthermore a council"may impose fees or charges for ..... any service provided by the council". In addition the "council shall cause to be prepared and shall adopt annual estimates of revenues and expenditures for approval by Parliament".

Thus although at the time of the consultants' visit there was still considerable uncertainity as to how the Act would work in practice, it appears that the intention is that the district councils should run the water supplies and be responsible for rate collection. However it is less clear whether councils will have the power to determine the rating policy and tariff structure. The Act gives the councils the power to pass their own by-laws to govern their own destinies. Any charges levied by the councils "shall be regulated by by-laws or imposed by

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* The consultants are not certain that their understanding of Government's decentralisation intentions are completely correct. It is based on the Act itself and on discussions with Government personnel. Nevertheless it was extremely difficult to clarify Government intentions and to incorporate the implications for pricing policy and revenue collection procedures. Since it is a matter of importance for the present study it was felt that the subject should not be ignored. Consequently it is hoped that this section of the draft report in particular, will be critically reviewed by the Zambian Government, so that any misunderstandings will be corrected in the final report.

resolution of the Council with the approval of the Minister". Thus in general the councils will impose charges based on by-laws which they themselves have passed. In theory they will, among other things, determine their own water rates. Consequently they could, at least in the early years until they have understood the difficult conflicting issues involved, impose a totally inappropriate rating policy. This is very likely to happen if Central Government displays limited interest in the question of water rates. One reason is that the councils will be political bodies and might base decisions on considerations of short term popularity, whereas the serious implications may not be felt for some time. Another is that the Act stipulates that all receipts should be paid into a general fund and that all payments should be made out of the same fund. Thus a disastrous financial performance of the water undertaking could be masked by other profitable activities or alternatively be lost in a larger financial mess. On the other hand one attribute of decentralisation is that water revenues will no longer be sent to Lusaka and simply become a small element in Central Government revenue. They will remain with the authority responsible for the supply which will thus find the financial viability of their water undertaking, at least in part, dependent upon their own revenue collection performance. If district councils are left to formulate their own rating policies the only real control on the establishment of realistic pricing policies would be donor insistence that certain conditions relating to water rates be put on future loans/grants for water supplies. The legal agreements for such loans concerning the operation of the water supplies would of course be entered into by the Government of Zambia. It would then have to ensure that the local authorities responsible for the supplies abided by the conditions of the loan. In this way the councils will be pressurised to adopt sound water rating policies.

However if as is to be hoped Central Government believes that water rates represent an important area of policy, it is possible to interpret the Act so that Government can impose appropriate water rating structures on the councils, or at least modify the councils own proposals. The Act states that the councils' by-laws, (a) must not conflict with other law, (b) have to be confirmed by the Minister (c) can be amended or revoked by the Minister. Thus Government could determine water pricing policy at the national level and it is hoped that this will occur, so that this present revenue study and its potential follow up national study will be both relevant and useful. Finally it is vital that the present somewhat

unclear situation be clarified as soon as possible so that the legal relationships between the different responsible institutions and their responsibilities are unambiguous.

2.7 Possible Problems of Decentralization.

Decentralisation could exacerbate one or two existing problems. For example it might make it even more difficult then it would have been under the old situation to tackle the over-manning problem in the water sector by rendering some of the excess workers redundant. As discussed in Section 2.4. Government is always loath to sack workers. Nevertheless it may have been possible under the pre-December 1980 situation to have made some impression on the situation after studies such as this one quantified the financial effects of the overmanning. Under the new set-up it will be even more difficult. Firstly the Prime Minister has pledged that jobs must not be lost. During discussions the consultants heard of a case where one local authority employee had been sacked and the labour commissioner had already requested an investigation. Secondly the decisions to make men redundant will have to be made locally, even if they have to be endorsed centrally. It will therefore be even more difficult for district councils to sack men without the cushion of 400 K of impartiality. Councils will be political bodies and even after having inherited all the existing workers,they may be under pressure from their people to increase unnecessary employment.

The councils will be supported by district secretariats under district executive secretaries. Thus the councils should have professional/ sub-professional support,but it may be difficult for councils in some parts of the country to obtain and keep highly competent staff. In addition although the staff will provide information and advice, the actual decisions will be made by the politicians.

One unfortunate inheritance of the new district councils is the debts of the former councils. For example a national newspaper ran a story in April concerning a debt of K.42,000, including K.7,890 owed to D.W.A for unpaid water charges, that has been inherited by Kaoma district council from the former rural council and it was stated that it could be considerably larger. It is hoped that such debts will be cancelled out by the funds that Government has proposed to set aside for this purpose.

It appears that the debts in Kaoma are small compared with those of some other rural councils. Since councils ran up debts and got themselves into such unsatisfactory financial positions when they had very limited responsibilities it can be seen how important it will be that the new councils run their activities, including water supplies, on a sound financial basis. If they do not they could soon accumulate very large debts.

At present the financial procedures within the water sector are dominated by considerations of control (i.e. to prevent dishonesty) rather than by the requirements of planning. It is likely that the changes in local administration will, at least in the short term, exacarbate this shortcoming. Clearly control is necessary but so is data for planning.

It may not be possible or even necessary for councils to run services such as water supplies in such a way that revenues fully cover all costs. For example it may be possible for shortfalls to be made up by Central Government grants for which there is provision in the Act and which may be no more than Government is currently providing for the same services through D.W.A. However, it is vital that the councils fully understand their water rating policy and its implications and properly enforce it. Unfortunately there is a danger that not all councils will show sufficient awareness of the problem and determination to enforce all necessary measures e.g. disconnection. In this case the financial situation of services will inevitably become unsatisfactory and this could lead to a deterioration in the services themselves.

2.8 Future Responsibility for the Water Supplies.

The main objective of this section is not to recommend which organisation should be responsible for the water supplies but to point out a number of alternatives. However it is hoped that all future responsibilities will be clearly defined. It would be preferable that just one organisation is completely responsible for the water supplies since this would minimise the problems of supervision and coordination. If both councils and D.W.A. are involved in major roles there is always the possibility that each will blame the other for inefficiencies. Unfortunately the intentions of the 1980 Local Administration Act combined with the technical limitations of the councils suggest that this may not be possible.

In one sense this section is superfluous since the Local Administration Act has specified that District Councils shall be responsible for all aspects of water supplies. However it must be remembered that whilst D.W.A. is primarily a technical organisation councils are mainly political bodies which do not have the competence to operate, maintain and administer the supplies on their own. In the past the councils have found it extremely difficult to attract the right staff and there is no evidence to suggest that the situation will rapidly change. Since the largest council, Mongu, has found it impossible to operate its water supply there is little chance that the other councils will be able to do so. Hence it will probably be necessary for D.W.A. to play a significant role in running the water supplies. Therefore it is necessary to specify the role that D.W.A. should play and its relationship with the councils. A number of possibilities are listed below:

(a) the administration and all financial aspects of the water supplies are the responsibility of the councils. D.W.A. continues to operate and maintain the supplies and bills the councils on one of five alternative bases:

  (i) a fixed annual sum agreed in advance which is expected to cover all D.W.A.'s costs.
  (ii) a fixed annual sum agreed in advance which will only cover a part of D.W.A.'s costs
  (iii) its actual monthly costs
  (iv) on a bulk metered basis
  (v) on a percentage of revenue basis. The present 90% would appear to be a suitable figure.

(b) At the other extreme D.W.A. would have full responsibility for the supplies. This would mean that they would take over the administrative role currently undertaken by the council in Mongu and the revenue collection role presently performed by the other councils. It is worthwhile noting that during the consultants' discussions with council officials there was no great enthusiasm for involvement in water supplies. They tended to suggest that rural councils could sensibly hand over the rate collection function to D.W.A. D.W.A. officers in the townships also tended to favour this possibility since they felt that D.W.A. would than obtain their rates more quickly than they do at the moment. They were generally quick to point out that they would then need more staff but this may not be necessary if existing staff were properly

trained or in some cases replaced. If D.W.A was to collect the rates it would also assist in effectively disconnecting debtors, since D.W.A. would no longer have to wait for information from the councils before taking action. The consultants favour this alternative but it is not consistent with the apparant intentions of the 1980 Local Administration Act.

(c) the third alternative is that although D.W.A. would continue to operate and maintain the supplies the administration and financial aspects would remain divided between the councils and D.W.A. This is unsatisfactory since it is desirable that a scheme is administered by a single organisation so that the opportunities for a lack of coordination are minimised and so that there is no ambiguity as to who is responsible. For example to have an effective system of revenue collection one body should be responsible for meter reading, billing and revenue collection.

Therefore the choice should rest between the first two alternatives and while the consultants tend to favour the second one they appreciate that it is inconsistent with the 1980 Local Administration Act and that the first alternative whereby the administration and all financial aspects of the water supplies are the responsibility of the councils will probably be preferred.

It would seem reasonable that if the councils claim responsibility for the supplies that they should also be responsible for any debts. Consequently if the councils assume overall responsibility for the supplies it is recommended that D.W.A. should bill the councils either on the basis of (i) or (iii) listed above. In this case any subsidies required would have to be funded by the councils out of their general revenue funds. In 1980 the annual budgets of most of the councils in Western Province were around K300,000 for all expenditures. Since 40% of this came from beer surtax grants and the remainder from rates, personal levy, licenses and trading activities, it is unlikely that councils' income will increase much faster than inflation, unless the decentralisation process is accompanied by significant financial transfers from central to local Government. Consequently unless this happens the councils will be unable to heavily subsidise the water supplies. If they are not able to provide the necessary finance the Ministry of Local Government should fund the subsidises.

Financial responsibility would provide the local councils with a real incentive to carry out their billing and collection functions efficiently. If the local councils are given the responsibility for billing all water consumers they will have certain advantages that D.W.A. would not have. For example they could simply add water rates to rents for all council house tenants. This would be particularly useful for collecting water rates from communal point consumers.

If as is possible, some councils feel that they cannot yet administer the water supplies, control all the financial aspects and pay D.W.A. the full costs of operation and maintenance,then D.W.A. should remain completely responsible for all aspects of the supply. This would also mean that they would have to read meters, bill consumers and collect the revenue since a division of those responsibilities could well perpetuate the current unsatisfactory rate payment situation. Wherever D.W.A. has full responsibility any subsidy required to operate and maintain the supply should be provided by the D.W.A. budget as happens at present.

2.9 Cost Accounting.

D.W.A.'s existing cost accounting and control is poor or non existent. It is important that steps are taken to remedy the situation. Although a Government financial and budget system exists it is usually not fully pursued by the officers responsible. Furthermore the accounting system and financial procedures which do exist are dominated by considerations of control rather than by the needs of planning. Obviously control is vital but a balance must be achieved. An improved system would both improve the current level of control and meet certain planning requirements. However in some cases the control should be relaxed. For example the requirement that all purchases exceeding K500 must go to the Tender Board guarantees slow and inefficient procurement with a consequent debilitating effect on operation and maintenance. It would be worthwhile considering whether the cost of this is greater than the cost associated with a less rigorous purchasing procedure.

The result of the poor cost accounting is that the information available on both revenues and expenditures is very sketchy. Consequently any financial estimates, such as operational cost estimates used in this study, are only intelligent guesstimates since they are partly dependent upon unreliable data. For example it is difficult to estimate how much of D.W.A.'s recurrent expenditure is attributable to township water supplies. Firstly a proper allocation of administrative overhead to (i) development activities (ii) operation and maintenance of township water supplies and (iii) other operational activities can only be made by guesswork. Secondly many items are paid for by budget headings which are unrelated to the activity being carried out. The information relating to revenue is also incomplete. The water billing records are incomplete, revenue and billing summaries of outstanding accounts are rarely prepared and there have been no efforts made to prepare genuine operating statements which relate revenues to expenditure.

D.W.A. has not yet developed any financial planning. No attempt until now has been made to examine future water tariffs or to prepare financial forecasts. This report represents a first step in this direction but it is only possible to make very sketchy predictions. For example no reliable figures could be prepared until the authority

has data from actually operating the new supplies which will in turn depend on an efficient cost accounting system being introduced.

The present study has not been too seriously affected since it is primarily concerned with order of magnitude ratios between costs and benefits. However if future studies and Government planning of the water sector are to be useful in the long run it is important that the Goverrnment knows what the revenues and expenditures of the supplies really are, so that the financial effects of any proposed policies can be accurately gauged. It is hoped that the provision of a cost and management accountant for D.W.A. proposed recently by the World Bank becomes a reality. This would assist D.W.A. to implement improvements in accounting, budgeting, and report procedures with a view to establishing efficient financial management, planning and control.

3. POPULATION AND WATER DEMANDS.

3.1 Present Population.

Table 3.1 presents the populations of the eight townships in 1969 and 1980 as estimated by the censuses of those years.

Table 3.1

Township Populations.

Township	Population census 1969	Population census 1980	Growth Rate %
Kalabo	3109	7398	8.2
Kaoma	2717	6731	8.6
Limulungu	2545	5730	7.7
Lukulu	894	1503	4.8
Mongu	9600	24919	9.1
Namushakende	821	1868	7.8
Senanga	3619	7204	6.5
Sesheke	2590	3500	2.7
Total	25895	58853	7.7

It can be seen that the overall growth rate in the eight townships was 7.7%. with individual rates ranging from 2.7% in Sesheke to 9.1% in Mongu.

These high rates of growth contrast with that of Western Province as a whole. During 1969-80 the overall provincial rate of growth was only 1.6% compared with the national growth rate of 3.1% and Western Province's own growth during 1962-9 of 2.1%. Consequently the rate of growth in the rural areas of Western Province was very low. Table 3.2 presents the rural population of the districts of Western Province.

Table 3.2

Rural Populations.

District	Population census 1969	Population census 1980	Rate of growth 1969-80 %
Kalabo	90731	90535	0.0
Kaoma	48220	63418	2.5
Lukulu	37300	41493	1.0
Mongu	76529	84371	0.9
Senanga	84983	94458	1.0
Sesheke	43929*	51135	1.4
Total	381692	425410	1.0

* The populations of the small townships of Katima Mulilo and Mulobezi in 1969 are assumed to total 2500.

Thus the rural population has only been growing at 1% per annum with the exception of that in Kaoma district which has increased at 2.5%.

3.2 Seasonal Variations.

The population of Limulungu can double when people come in from the flooded plain. The 1980 census took place in August and this is usually a time when the population of Limulungu is still high. However in 1980 there were many less people in from the plain than there usually are at that time of the year. Discussions held locally suggest that the census figure is a sensible figure to use for water consumption purposes for the greater part of the "usual" year but that a considerably larger figure, perhaps around 10,000 should be used for the seasonal peak months. This seasonal fluctuation in the potential number of consumers of the Limulungu water supply is of course very important for design decisions i.e. whether a high level of unutilised capacity for the greater part of the year or certain supply constraints during the peak demand period is the more acceptable. Naturally the costs of the two alternative strategies should be shown explicitly by the planners/designers so that Government can make a rational decision. However from the revenue point of view this seasonal in-migration is less important, since revenue received only over a limited period makes a limited impact on overall revenue calculations. For example even if the population of Limulungu is double the "normal" population for four months of the year, and even if the migrants pay as much for water on average as the permanent residents, and if the revenue from the migrants is totally ignored, the annual revenue will only be underestimated by 25%. In practice the majority of migrants will use communal points and will use much less water on average than the permanent residents. In addition they will pay less than the overall average price of water. If the recommendation of this report that communal point water be free is accepted, they will pay nothing. Consequently their contribution to total revenue will not be very significant.

The population of Mongu fluctuates similarly in relation to the flooding, but the effect on Mongu's population is proportionately much less significant than the effect in Limulungu. Therefore the effect on the revenue in Mongu is probably insignificant.

3.3 Size of Household.

The recent censuses have suggested that the average household consists of five people, though this seems intuitively to be on the low side. There are however always definitional problems associated with the word "household" and for the purposes of this report an average of five persons will be used.

3.4 Present Population Served by Individual Connections.

Table 3.3 presents the approximate number of individual connections in the townships together with the number of people served, assuming an average of five persons per connection. The fourth column shows the percentage of the population served using the same assumption. It can be seen that the overall percentage served is approximately 15%. In two towns Lukulu and Sesheke the figure is considerably higher but it is not known whether these figures are accurate. The final column shows the same characteristic but with the assumption changed to an average of six persons per connection. It can be seen that since all percentages are increased by 20% there is no significant change to the general picture, and it can be said with some confidence that overall, at least 15% of the population of the townships are currently served by individual connections.

Table 3.3

Present Population Served by Individual Connections.

Township	Population	Number of individual connections	Number of persons served by individual connections	Percentage of the population served by individual connections when the average house/hold is	
				5 persons /I.C. (%)	6 persons /I.C. (%)
Mongu	24,919	771	3,855	15.5	18.6
Kalabo	7,398	195	975	13.2	15.8
Kaoma	6,731	202	1,010	15.0	18.0
Lukulu	1,503	104	520	34.6	41.5
Namushakende	1,868	37	185	9.9	11.9
Senanga	7,204	180	900	12.5	15.0
Sesheke	3,500	230	1,150	32.9	39.4

Table 3.4 presents an estimate of the percentage of low cost housing residents who currently have individual connections. The actual figures in the last column are sometimes very dubious. This is due to the fact that they are based on rather poor data and extremely uncertain residuals, so that any individual figure could be very wrong. Nevertheless it appears that the majority of low cost residents do not have individual connections today, though the actual percentage is not known.

Table 3.4

Individual Connections in Low Cost Housing Areas.

Township	Approximate population currently using individual connections	Approximate population in medium and high cost housing	Approximate low cost housing population using individual connections	Percentage of low cost residents using individual consumptions (%)
Kaoma	1,000	700	300	11
Kalabo	1,000	800	200	10
Lukulu	450	150	300	60
Mongu	3,900	3,400	500	4.5
Namushakende	200	170	30	2.5
Senanga	900	600	300	15
Sesheke	1,100	400	700	35

3.5 Population Projections.

There would appear to be no reason why the high rates of population growth in the townships should not continue. It is noteworthy that the only district, Kaoma, where the rural rate of growth exceeded the provincial rate of growth, has the greatest agricultural potential. However in order to be reasonably conservative at the same time as using the historical data, a maximum rate of 7% per annum will be used for township projections for the period 1980-1995. This figure will be used for Kalabo, Kaoma, Limulungu, Mongu, Namushakende and Senanga. For both Lukulu and Sesheke Ostlandskonsult's figure of 4.73% (i.e. doubling in 15 years will be used). This represents an increase in the recent growth in Sesheke which may have been limited by local uncertainties.

3.6 Review of Consumption Criteria.

Ostlandskonsult used the following figures for domestic consumption:-

High/medium cost residential	250 lpcpd
Low cost residential	100 lpcpd
Informal housing - huts	40 lpcpd.

These figures were based on their own measurements and on discussions with the D.W.A. The consultants initial reaction was that these figures were rather high. However examination of the data presented by Ostlandskonsult in their reports and the consultants own investigations suggest that they are good estimates of current usage. For example an Ostlandskonsult study in Mongu resulted in per capita consumption figures of 251.3 litres/day in a high cost area and 174.3 litres/day in a medium/low cost area. A study in in Namushakende suggested an average figure of 234 lpcpd in a medium/high cost area.

The consultants examined a cross section of 18 medium cost houses with meters which were apparently working and found that average consumption is $45m^3$/month or 250-300 litres/capita/day. A smaller sample of high cost houses gave a figure of over 300 litres/capita/day. In Kaoma 86 out of 140 meters were theoretically working. However if that is true the average consumption of metered consumers is 700 litres/day. When 33% of the meters with the highest readings were disregarded consumption was still 250-300 lpcpd.

Therefore it cannot be said that the design figures are too high, and all the evidence suggests that the figures used for design are appropriate for that purpose, with but one reservation. The figures were divorced

from price and metering considerations, and yet demand for water is never completely inelastic. If, for example, all water consumption was metered and charged on a quantity consumed basis, what effect would this have on present consumption even at todays low official rates of 18n/m^3 for use above 35 m^3? If the price was suddenly increased several fold there would be a very dramatic decrease in consumption as soon as consumers received the message via higher bills, and possibly sooner. The question of elasticity of demand is discussed in Section 3.8.

At present consumers are paying very little for water (c.f. Section 4.5). Thus one could expect per capita consumption to fall from its present high levels once a realistic pricing policy is introduced.

3.7 Estimate of Current per Capita Overall Average Consumption.

Present per capita consumption can also be estimated by measuring total consumption and dividing by the present population.

In 1979 Ostlandskonsult's investigations revealed the total daily consumption i.e. production less leakage, in five townships. The figures are shown in Table 3.5.

Table 3.5

Total Daily Consumption

Township	Estimated Daily Consumption (m^3)	Comments
Kaoma	518	From water balance study
Limulungu	80	Production = 103m^3/day. Losses may well exceed the assumed figure.
Mongu	1643	Production = 2230m^3/day. Losses = 27%.
Namushakende	149	Water balance study showed consumption as 171m^3/day. But it was suggested that the study was undertaken at a time when consumption was 15% above average.
Senanga	200	Production = 251^3/day, 20% losses assumed.

The data from Table 3.5 is used in Table 3.6 in combination with 1979 populations, (it is assumed that the populations increased by 7% from 1979 to 1980), to estimate per capita consumption.

Table 3.6

Average Daily Per Capita Consumption

Township	Township consumption m^3/day	Population 1979	Average consumption litres/capita/day
Kaoma	518	6290	82
Limulungu	80	5355	15
Mongu	1643	23889	69
Namushakende	149	1746	85
Senanga	200	6732	30

Unfortunately these figures are not particularly enlightening. They simply tell us what we already know i.e. that there are very serious supply constraints in Limulungu and Senanga. There was also a less serious constraint in Mongu and if this had not existed the Mongu figure would have been somewhat higher. Thus it might be guesstimated that current per capita consumption (including non-domestic use but excluding leakages) is, or would be if there were no supply constraints,around 80-90 litres per day. The consumption figures do include some consumption by residents outside the boundaries and therefore are not included in the population figures, but in percentage terms this consumption is not very significant. Although the 80-90 litre/capita/day figure is not too solidly based it is the best that can be estimated on the basis of existing data. If leakages, as is hoped are held to 15% then 100 litres/capita/day is a good working figure for the overall average necessary water production.

3.8 Problems of Forecasting Demand.

There are a number of problems to be faced in making demand forecasts for the township water supplies. Firstly existing overall production figures will understate demand in those towns where there are serious supply constraints. On the other hand the current high levels of leakage in some towns may mean that production figures overstate demand. However the consumption exercises undertaken by Ostlandskonsult, took both these factors into account, i.e. they measured consumption in localised areas during periods when there was no supply constraint for the sample areas , and they measured actual leakage.

Hence one can have some confidence in their proposed consumption figures for existing consumers at existing real prices. Furthermore since it is unlikely that there will be any significant increases in the overall level of real incomes in the next few years one can accept present consumption estimates as reasonable criteria for the next few years. As regards new customers the best that one can do is to assume that their consumption will

be similar to the average consumption of the housing category in which they live. There are no good reasons for doing otherwise.

The greatest problem is that it is difficult to estimate alternative future demands based on alternative rate structures and levels.

The main reason is that there is no data available on the pattern of demand for water in the townships i.e. on the elasticity of demand. All that can be done is to make certain general assumptions:-

(a) some of the poorer consumers may not be willing to pay to use the supply whenever an alternative exists even if it is a poor quality source.

(b) if the only alternative is very far or grossly polluted the demand of the poorer consumers may be highly inelastic i.e. they pay whatever price is demanded for their very basic minimum needs, but even if the price is reduced their increased use will be small.

(c) much of the higher income consumers' use will be for luxury purposes and thus their demand may be more sensitive to price unless their expenditure on water takes a sufficiently small proportion of their income that their demand is not price elastic.

(d) the demand of those who can just about afford individual connections is likely to be the most sensitive to price.

Such generalisations are not very helpful in allowing one to quantify the elasticity of demand.

The consultant's inability to quantify elasticity of demand in a study which should recommend a pricing policy is probably the greatest weakness in this report and Section 3.9 ignores the problem.

However this is a common problem in dealing with tariff policy in developing countries. The impact of price changes on quantity demanded is rarely known and usually demand forecasts are not adjusted to reflect any projected changes in tariffs. The omission is of course inevitable when the relevant price elasticity data is insufficient and does not even matter where capacity will be the overriding constraint on quantity demanded. Furthermore the omission will not be so important if (a) all the demand forecasts are so approximate that playing around with the elasticity of demand would be doing no more than giving an impression of precision in a situation where it is impossible to achieve it (one could argue along these lines with regard to

the water supplies in Western Zambia) or if (b) proposed price changes are only slight in real terms.

3.9 Demand Forecasts.

Tables 3.7.1-3.7.8 present the water demands for the eight townships for 1980 and 1995, The first column of these tables shows the design consumption criteria proposed by Ostlandskonsult. The only major different criterion used by the consultants relates to schools consumption. Where schools have their own supply the consultants have assumed that the school will not use the township supply. It is appreciated that the designs allow for supplying all schools and this is certainly sound since it is possible that all schools will start to use the township supplies. However the main focus of the present exercise relates to revenue and it would be rather optimistic to assume high revenue from schools when they already have their own supplies. Where schools do not have their own supplies the consultants have reduced the consumption to 50 litres per head. A school with 900 pupils would be faced with an annual water bill of around K5,000 if pupils use an average of 100 litres per day. It is assumed that in the face of such bills the school authorities will take measures to restrict pupils consumption.

The first columns after the row headings in all the tables show Ostland-skonsult's estimates of the population in 1980. The consultants revisions of these figures based on the 1980 census are shown in the third columns. In general Ostlandskonsult's figures for the allocation of the population between the different housing categories in 1980 have been accepted without further investigations. It has also been assumed that Ostlandskonsult found it easier to count the population living in high, medium and low cost housing than the people living in informal housing. Thus where the 1980 census suggests that Ostlandskonsult underestimated the present population the larger part of the increase has been included in the informal housing population.

The second columns after the row headings in all the tables show Ostland-skonsult's estimates of the demand in 1980. The consultants revisions of these figures based on the revised populations are shown in the fourth columns.

The fifth columns show Ostlandskonsult's estimates of the population in 1995. The consultant's revisions of these figures are shown in the seventh columns. Firstly the total population of every township has been revised in accordance with the information presented in Section 3.5 Secondly the projected population has been allocated between the various housing

categories in a rather different way from that proposed by Ostlandskonsult.

It has been assumed that the proportion of the population living in informal housing, in 1995, will be the same as today. At a first glance this may seem a rather pessimistic assumption concerning the housing development in the townships of Western Province i.e. that it represents a poor house construction performance. However this is not true. It means that the number of formal houses will be increasing at the same rate as the projected population increase i.e. 7% per annum in most towns. It is felt that any higher rate of increase would be unrealistic. The subject was discussed with a senior official in the Town and Country Planning Department in Lusaka who endorsed the consultants' proposal. Furthermore the same department had earlier commented that Ostlandskonsult's assumptions concerning informal housing were over-optimistic.

It is assumed that 90% of the formal houses that will be constructed during 1980-1995 will be low cost, and that medium and high cost houses will only constitute 10% of the newly constructed units. This is in line with the Township Development Plans prepared in the early 1970's by the Town and Country Planning Department. Their actual projections varied from town to town but the average for townships in Western Province was 8% high/medium cost houses, 92% low cost houses. It was stated that one reason for the relatively low percentage of high/medium cost houses is that most Government departments are now established in the townships under consideration and that most high level posts are filled so that there will be less need for an increased number of high cost housing units in the future.

Ostlandskonsult assumed that where there are people living in informal housing outside a township boundary that the population would remain unchanged over time. The argument that these communities act as a staging post for rural people moving to the townships is valid but the assumption that they will not increase is unrealistic. The consultants have assumed that these populations will double over 15 years.

The sixth columns show Ostlandskonsult's estimates of demand in 1995. The consultants' revisions of these figures based on the revised populations are shown in the final columns.

Although it is probable that all residents of high and medium cost housing will have their own connections it is less certain that all residents of low cost housing will have their own taps. The data presented in Section 3.4 suggested that the majority of the low cost housing residents

do not have their own tap today. Nevertheless the consultant's basic demand forecasts have adopted Ostlandskonsult's assumption that all residents of high, medium and low cost housing will have their own individual connections, since it is hoped that they will have their own taps. However due to the uncertainty that is attached to the percentage of low cost housing residents that will have their own connections, this percentage is varied later in the report to study the financial significance of altering this parameter.

Table 3.7.1

Water Demand - Kalabo.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	5,000		7,400		10,000		20,410	
250	High/medium housing	600	150	800	200	2,000	500	1,290	323
100	Low cost housing	1,500	150	2,000	200	8,000	800	6,430	643
40	Informal housing	2,900	116	4,600	184	-	-	12,690	508
	Total domestic		416		584		1,300		1,474
10% of domestic	Industry/commerce		41		58		130		147
100/50	Secondary school	900	90	900	45	1,800	180	1,800	90
200	Hospital	200	40	200	40	400	80	400	80
40	Prison	100	4	100	4	200	8	200	8
	Total town consumption		591		731		1,698		1,799
15%	Leakage		89		110		254		270
	Total town demand		680		841		1,952		2,069
40 incl. leakage	Informal outside boundary	2,000	80	2,000	80	2,000	80	4,000	160
	Total demand		760		921		2,032		2,229

Table 3.7.2

Water Demand - Kaoma.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	4,000		6,730		8,000		18,570	
250	High/medium housing	600	150	700*	175	1,200	300	1,270*	318
100	Low cost housing	2,000	200	2,800*	280	6,800	680	8,620*	862
40	Informal housing	1,400	56	2,930	117	-	-	8,080	323
	Total domestic		406		572		980		1,503
10% of domestic	Industry/commerce		40		57		98		150
100	Secondary school/FTC	1,050	105	50	5	2,100	210	100	10
200	Hospital	50	10	50	10	110	22	110	22
40	Prison	50	2	50	2	100	4	100	4
	Total town consumption		563		646		1,314		1,689
15%	Leakage		84		97		197		253
	Total town demand		647		743		1,511		1,942
40 incl. leakage	Informal outside boundary	2,000	80	2,000	80	2,000	80	4,000	160
	Total demand		727		823		1,591		2,102

* It is assumed that the school water supply will supply the pupils and the resident population of 100 high/medium cost housing residents and 200 low cost housing residents in 1980, and the pupils and 200 high/medium cost housing residents and 400 low cost housing residents in 1995.

Table 3.7.3

Water Demand - Limulungu.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised (m^3)
	Population	11,900		5,730		23,800		15,810	
250	High/medium housing	500	125	400	100	1,000	250	820	205
100	Low cost housing	3,000	300	2,000	200	7,500	750	5,800	580
40	Informal housing	8,400	336	3,330	133	15,300	612	9,190	368
	Total domestic		761		433		1,612		1,153
3% of domestic	Industry/commerce		23		13		48		35
	Total town consumption		784		446		1,660		1,188
15%	Leakage		118		67		249		178
	Total demand		902		513		1,909		1,366

Table 3.7.4

Water Demand - Lukulu.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	1,400		1,500		2,800		3,000	
250	High/medium housing	150	37	150	38	800	200	220	55
100	Low cost housing	500	50	500	50	2,000	200	1,080	108
40	Informal housing	750	30	850	34	-	-	1,700	68
	Total domestic		117		122		400		231
3% of domestic	Industry/commerce		4		4		12		7
100/50	Secondary school	250	25	250	13	500	50	500	25
200	Hospital	80	16	80	16	160	32	160	32
	Total town consumption		162		155		494		295
15%	Leakage		24		23		74		44
	Total town demand		186		178		568		339
40 incl. leakage	Informal outside boundary	1,540	62	1,540	62	1,540	62	3,080	123
	Total demand		248		240		630		462

Table 3.7.5

Water Demand - Mongu.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	18,000		24,920		36,000		68,750	
250	High/medium housing	2,400	600	3,000	750	7,400	1,850	5,110	1,278
100	Low cost housing	7,400	740	9,000	900	28,600	2,860	28,000	2,800
40	Informal housing	8,200	328	12,920	517	-	-	35,640	1,426
	Total domestic		1,668		2,167		4,710		5,504
10% of domestic	Industry/commerce		124		217		310		550
	Other		37		100		46		200
	Total town consumption		1,829		2,484		5,066		6,254
15%	Leakage		274		373		760		938
	Total town demand		2,103		2,857		5,826		7,192
250	High/medium outside	400	100	400	100	550	138	800	200
100	Low cost outside	2,120	212	2,120	212	4,020	402	4,240	424
40	Informal outside	9,790	391	9,790	392	8,090	324	19,580	783
	Total consumption outside		703		704		864		1,407
15%	Leakage		105		106		135		211
	Total demand outside		808		810		999		1,618
	Total demand		2,911		3,667		6,825		8,810

Table 3.7.6

Water Demand - Namushakende.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	1,500		1,870		3,000		5,150	
250	High/medium housing	170	43	170	43	300	75	410	103
100	Low cost housing	1,000	100	1,200	120	2,700	270	3,360	336
40	Informal housing	330	13	500	20	-	-	1,380	55
	Total domestic		156		183		345		494
3% of domestic	Industry/commerce		5		5		10		15
100	Farm Institute	60	6	60	6	120	12	120	12
200	Health centre, hospital	40	8	40	8	80	16	80	16
	Total town consumption		175		202		383		537
15%	Leakage		26		30		57		81
	Total town demand		201		232		440		618

Table 3.7.7

Water Demand - Senanga.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	3,500		7,200		7,000		19,880	
250	High/medium housing	500	125	600	150	1,500	375	1,060	265
100	Low cost housing	1,100	110	2,000	200	5,500	550	6,120	612
40	Informal housing	1,900	76	4,600	184	-	-	12,700	508
	Total domestic		311		534		925		1,385
10% of domestic	Industry/commerce		31		53		93		139
100	Secondary school	1,000	100	-	-	1,000	100	-	-
200	Hospital	100	20	100	20	200	40	200	40
40	Prison	50	2	50	2	100	4	100	4
	Total town consumption		464		609		1,162		1,568
15%	Leakage		70		91		174		235
	Total town demand		534		700		1,336		1,803

Table 3.7.8

Water Demand - Sesheke.

Unit consumption (litres)	Consumer category	1980 population	1980 demand (m^3)	1980 revised population	1980 revised demand (m^3)	1995 population	1995 demand (m^3)	1995 revised population	1995 revised demand (m^3)
	Population	3,500		3,500		7,000		7,000	
250	High/medium housing	400	100	400	100	1,000	250	640	160
100	Low cost housing	2,000	200	2,000	200	6,000	600	4,160	416
40	Informal housing	1,100	44	1,100	44	-	-	2,200	88
	Total domestic		344		344		850		664
10% of domestic	Industry/commerce		35		35		85		66
100	Secondary school/F.T.C.	960	96	30	3	1,860	186	60	6
200	Hospitals	230	46	230	46	380	76	380	76
40	Prison	80	3	80	3	160	6	160	6
	Total town consumption		524		431		1,203		818
15%	Leakage		79		65		180		123
	Total town demand		603		496		1,383		941
40 incl. leakage	Informal outside boundary	1,500	60	1,500	60	1,500	60	3,000	120
	Total demand		663		556		1,443		1,061

3.10 Summary of Water Demands.

Table 3.8 presents the water demands for every township for the years 1980, 1982, 1985, 1988 and 1995. They were calculated on the assumption of a linear increase from 1980 to 1995. Although it can be argued that a linear increase is not the optimum assumption it is the simplest. In a situation where there is considerable uncertainty surrounding a number of parameters there is merit in simplicity. Furthermore the differences in projected demands between a linear increase and any other reasonable assumption are not large in percentage terms. All figures in Table relate to required water production, i.e. projected consumption plus an allowance of 15% for losses.

Table 3.8

Township Water Demands.
(m^3/day)

Township	1980	1982	1985	1988	1995
Kalabo	921	1,095	1,357	1,619	2,229
Kaoma	823	994	1,249	1,505	2,102
Limulungu	513	627	797	968	1,366
Lukulu	240	270	314	358	462
Mongu	3,667	4,353	5,381	6,410	8,810
Namushakende	232	283	361	438	618
Senanga	700	847	1,068	1,288	1,803
Sesheke	556	623	724	825	1,061
Total	7,652	9,092	11,251	13,411	18,451

Table 3.9 presents a summary of the division of water produced between consumption from individual connections, consumption from communal points and leakage, expressed in terms of the average number of cubic metres per day over the year.

Table 3.9

Summary of the Distribution of Water Produced.

(average m^3 per day).

	1980				1995			
	Water produced (m^3)	Leakage (m^3)	Use from CWPs (m^3)	Use from ICs (m^3)	Water produced (m^3)	Leakage (m^3)	Use from CWPs (m^3)	Use from ICs (m^3)
Kalabo	921	120	254	547	2,229	291	647	1,291
Kaoma	823	107	187	529	2,102	274	462	1,366
Limulungu	513	67	133	313	1,366	178	368	820
Lukulu	240	31	88	121	462	60	175	227
Mongu	3,667	479	909	2,279	8,810	1,149	2,209	5,452
Namushakende	232	30	20	182	618	81	55	482
Senanga	700	91	184	425	1,803	235	508	1,060
Sesheke	556	73	96	387	1,061	139	192	730
Total	7,652	998	1,871	4,783	18,451	2,407	4,616	11,428

Tables3.10&3.11 present the distribution of water produced in 1980 and 1995 respectively between consumption from communal points, consumption from individual connections, and leakages expressed in percentages of the total water produced.

It can be seen that there are very significant differences between the different townships. The variation is mainly linked with the variation in the proportion of informal housing.

There is very little change in the overall situation between 1980 and 1995. Consumption from individual connections expressed as a percentage of total water produced falls from 62.5% to 62%,and water from communal points, increases from 24.5% to 25%. The reason for the slight increase in the percentage of water from communal points,despite the fact that the proportion of the population using communal points does not increase, is that a lower proportion of those with individual connections are living in high and medium cost houses. Consequently there is a slight reduction in the overall average consumption of all consumers having individual connections. Based on the assumptions inherent in Tables 3.10 and 3.11 it can be said that over the entire period, consumption from individual connections represents around 62% of water produced or 71% of total consumption.

Table 3.10

Summary of Distribution of Water Produced - 1980

Township	Consumption from individual connections expressed as % of total water produced (%)	Consumption from communal points expressed as % of total water produced (%)	Leakage expressed as % of total water produced (%)	Consumption from individual connections expressed as % of total consumption (%)	Consumption from communal points expressed as % of total consumption (%)
Kalabo	59.4	27.6	13.0	68.3	31.7
Kaoma	64.3	22.7	13.0	73.9	26.1
Limulungu	61.0	26.0	13.0	70.2	29.8
Lukulu	50.4	36.6	13.0	57.9	42.1
Mongu	62.1	24.9	13.0	71.5	28.5
Namushakende	78.4	8.6	13.0	90.1	9.9
Senanga	60.7	26.3	13.0	69.8	30.2
Sesheke	69.6	17.4	13.0	80.1	19.9
Total	62.5	24.5	13.0	71.9	28.1

Table 3.11

Summary of Distribution of Water Produced - 1995

Township	Consumption from individual connections expressed as % of total water produced (%)	Consumption from communal points expressed as % of total water produced (%)	Leakage expressed as % of total water produced (%)	Consumption from individual connections expressed as % of total consumption (%)	Consumption from communal points expressed as % of total consumption (%)
Kalabo	57.9	29.1	13.0	66.6	33.4
Kaoma	65.0	22.0	13.0	74.7	25.3
Limulungu	60.0	27.0	13.0	69.0	31.0
Lukulu	49.1	37.9	13.0	56.5	43.5
Mongu	61.9	25.1	13.0	71.2	28.8
Namushakende	78.0	9.0	13.0	89.8	10.2
Senanga	58.8	28.2	13.0	67.6	32.4
Sesheke	68.8	18.2	13.0	79.2	20.8
Total	62.0	25.0	13.0	71.2	28.8

4. PRESENT FINANCIAL SITUATION.

4.1 Present Water Pricing Policy.

At present Government policy is that urban water supplies should be financially viable and should generate sufficient revenue to cover all their costs including capital costs. However it is becoming increasingly clear that the smaller urban supplies cannot meet all their costs from their revenues. Discussions with officials in the Ministry of Local Government suggest that Mongu theoretically comes into this category but the most cursory examination of the costs involved reveal that the policy is totally untenable.

The present policy for smaller township supplies is that they should cover their operation and maintenance costs. The Director of Water Affairs has recently said "As a matter of policy water supply should be run on a no profit, no loss basis". and phrases such as "steps should be taken to increase the revenue so that it meets, at least the direct expenses of operation and maintenance" have appeared in D.W.A. policy statements. The direct expenses usually being listed as (i) staff costs of the direct work force (ii) electricity, diesel, lubricants and chemicals and (iii) normal maintenance of buildings, machinery and equipment.

At the time of the last rate increase it was stated that it was hoped that with the proposed rates, supplies will be run on a"no profit, no loss basis". It was indeed just a hope, although it was recognised that "in line with this policy we should identify where and by how much revenues fall short of operation and maintenance costs and the reasons why". Section presents the first attempt in recent years to estimate the relationship between revenue and recurrent costs. Unfortunately it demonstrates that at present the revenue from township water supplies in Western Province are failing dismally to cover recurrent costs. The viability of this target in the future is examined later in this report.

4.2 Present D.W.A. Water Rates.

The current rates for township water supplies are presented in Table 4.1.

Table 4.1

Present and Previous Township Water Rates.

Type of Connection	Current Tariff	Previous Tariff
Metered connections	K4 for the first $35m^3$ or part thereof.	K3* for the first $32m^3$ or part thereof.

Table 4.1 (Cont'd).

Type of Connection	Current Tariff	Previous Tariff
Metered connections (continued)	Consumption above $35m^3$/ month is 18n per m^3.	Consumption above $32m^3$/month was charged at 9-11n per m^3.
Unmetered connections	K5 per month.	K 4* per month.
Communal tap	K1/month/family	K0.45/month/family.
Connection fee	K100 including one length of pipe.	K25 including one length of pipe.
Reconnection fee	K5.	

* With some variations from town to town.

At present the majority of consumers in most towns are metered so the most common fee for a house connection is K4 per month. However there are a considerable number paying K5 per month and in Limulungu most consumers are charged K5 per month. There are a few larger consumers particularly in Mongu who pay higher fixed monthly rates, for example the hotels, Zesco and the prison.

Those consumers who pay for access to communal taps pay K1 per month but as is discussed in Section 9.2 many consumers do not pay. Government and council employees who have the fee deducted from their salaries form the majority of those who pay. Sometimes communal taps are specifically provided free to consumers. For example there are two public communal taps in Namushakende for which the rural council pays the monthly bill of K5 per communal point.

These water rates are very low compared to the costs of operating the supplies (c.f. section 4.8). This is largely due to two major factors (a) inflation and (b) the political difficulties associated with increasing water rates. The latter means that D.W.A. has always not been able to increase the rates as often, or as by as much, as it would have liked. The present tariffs were first proposed in June, 1977, but were not implemented with Government approval until January, 1979. In addition Government did not sanction an increase in the unmetered connection fee to K6. In fact it was probably correct since it would have increased the illogical fee differential between metered and unmetered connections. But this reason was not given, it was simply considered to be too large an increase.

ZESCO has also faced Government reluctance to increase public utility prices. Typically they face long delays in obtaining Government approval for any increases, the approval may be limited to certain categories of consumers for example industrial, and their proposed increase may be

modified. The only increase within the last four years was one of 10% granted two years ago. During this period costs have probably doubled.

Permitting rates for public services to get out of line with higher costs resulting from inflation must be seriously examined by Government, and is discussed in section 6.9.

A major justification given for the 1979 increases in D.W.A. water rates was "to improve the management of the Township Water Supply System". However this is fallacious reasoning. Rate increases are not directly reflected in D.W.A.'s budget since the revenue goes directly to the Ministry of Finance. Furthermore the rate increase made a very small difference to the subsidy needed by D.W.A. and would have had little, if no effect on the quality of management. The justification for the increase should have been to realign rates with policy i.e. with marginal costs or whatever. Inflation having caused rates to get even further out of line with costs, there were serious dangers of mis-allocation and misuse of scarce national resources.

4.3 Present Urban Rates and Pricing Policy.

Rates charged by other local authorities in Zambia may not necessarily be at the most appropriate level. However an examination of these tariffs will show whether or not rates in Western Province are high or low compared with other locations.

Table 4.2

Present Urban Water Rates.

Category	Monthly rate in Lusaka	Monthly rate in Chingola	Monthly rate in Chipata
Low Density Housing.			
Minimum charge for first $36m^3$	K5.00	K6.00	K6.40
Rate for additional use per m^3	K0.20	K0.20	K0.20
High Density Housing			
Minimum charge for first ...m^3	K1.65($23m^3$)	K2.00($18m^3$)	*
Rate for additional use per m^3	K0.18-K0.22	K0.16-K0.20	*
Unmetered Houses	**	**	K4.00
Industrial/Commercial users			
Minimum charge for first $36m^3$	K7.60	K8.00	K8.00
Rate for additional use per m^3	K0.22-K0.18	K0.33	K0.30

Notes.

In practice flat rates are usually charged in high density areas.

* Rates as for low density housing but mostly unmetered.

** Varies but typically K4-5.

N.B. All tariffs have been converted to a m^3 basis even where rates are still based on a 1,000 gallons basis.

Table 4.2 summarises the rates charged by one very large supply Lusaka, one medium urban supply Chingola and one smaller township supply , Chipata. It can be seen that their rate structures are similar. However there is sometimes considerable inefficiency in the billing and the consultants saw bills for individual connections in both high and low density areas in Lusaka where the consumers were being charged sums far below the official price schedule. Nevertheless the following represent typical water rates in Zambia today:-

	Minimum charge	Rate for additional use (K/m^3)
Low Density Housing	K6.00 ($36m^3$)	K0.20
High Density Housing	K2.00 ($20m^3$)	K0.20
Unmetered Houses	K5.00	
Industrial/Commercial	K8.00 ($36m^3$)	K0.30

The general urban pricing policy up to 1975 was to charge lower rates for high consumption. Although this is a rational policy when there is a lot of spare capacity it was no longer appropriate for many urban supplies in Zambia in the 1970's when the demand of many schemes approached or reached the capacity of the supply.

In 1975 the policy was revised so that reasonable fixed rates for every category of consumer were charged for the first 8,000 gallons ($36m^3$) and higher rates were charged for higher consumption. However the higher rates were, other than for the high density housing consumer category which was charged a very low rate for its basic consumption, only marginally higher than the effective unit rate for the first 8,000 gallons. The most important divergence is that Lusaka still charges its largest consumers on a reducing rate/increasing use basis.

A major feature of all these supplies is that rates have been falling in real terms. Since April 1976 Chipata has had only one increase in May, 1978. Most increases were in the 10-15% range except for the unmetered

flat rate increase of 25% and the additional industrial consumption rate increase of 40%. Thus during a period when costs have doubled rates have increased by no more than 20% on average.

Since May, 1978 rates in Chingola have only been increased once in October, 1979. The industrial rates were doubled but the overall domestic increase was 20-25%, much less than the cost increase over the last three years. Similarly in Lusaka rate increases have lagged behind cost increases. The increases in January, 1981 were approximately 10% on average.

4.4 Present Revenue from the Western Province Township Water Supplies.

It is extremely difficult to determine the annual revenue raised by every water supply. Kaoma will be used here to demonstrate this difficulty. The files of the Kaoma water office were examined in an attempt to reconcile apparently conflicting figures. An initial request to the D.W.A. office Mongu for revenue raised at Kaoma for 1978, 1979 and 1980 brought the following response.

	(K)
1978	4648.88
1979	1012.41
1980	8753.20

This is clearly a very erratic performance of which the average figure may or may not be meaningful. Discussion with the officer who had prepared the figures revealed that they were not in fact revenue raised from consumers but D.W.A. receipts from the rural council, i.e. 90% of revenue. Examination of correspondence from the Kaoma Rural Council clearly revealed that the Council had remitted K5,055.91 for 1979. It also showed that D.W.A. was still claiming the money long after it had been paid by the rural council. This figure plus the amount that was remitted by the rural council of K3,697.49 for January-June, 1980 or January-July, 1980 (there is a discrepancy between different papers examined by the consultants) appears to equal the 1980 remittances calculated by D.W.A. Mongu. Hence in this case one can make certain assumptions i.e. that that D.W.A. 1980 figure in fact represents receipts from the council for January, 1979 - July, 1980. However it is not possible to tie up the following information with the K3,697.49 figure.

	Revenue collected by council	Remitted by rural council to D.W.A.
Jan-March, 1980	K1,009.00	K 908.10*
April, 1980	K 823.50	K 741.15
May, 1980	K 536.95	K 483.30
June, 1980	K 684.44	K 616.40
July, 1980	K1,732.02	K1,558.82*
	K4,785.91	K4,307.77

* These two figures were not taken directly from the books but were assumed to be 90% of the stated collection figure, but why is K3,697.49 not similar to K4,307.77? Clearly there is an error somewhere but officers with whom the question was discussed could not throw any light on the situation. Furthermore in examining the records the consultants found a considerable number of errors and thus all figures presented in this section are unlikely to be accurate. However to determine the precise figures would have been an unjustifiably time consuming activity.

Based on the information presented above it appears that the following represents reasonable estimates of money collected in Kaoma and remitted to D.W.A.

	Total collection (K/annum)	Remitted to D.W.A. for, even if not in, the relevant year (K/annum)
1978	5,000	4,500
1979	5,500	5,000
1980	7,000	6,300

Thus it would appear that although revenue is still extremely limited it is increasing.

Table 4.3 presents the data for revenue remitted to D.W.A. by the rural councils for 1978-80 as supplied by D.W.A. Mongu.

Table 4.3

Revenue Remitted to D.W.A. by Rural Councils. (K/annum)*

Township	1978	1979	1980
Kalabo	4,267	1,054	4,483
Kaoma	4,649	1,012	8,753
Lukulu	546	1,569	2,879
Namushakende	808	1,505	2,158
Senanga	-	-	5,605
Sesheke	866	3,230	-

*All figures have been rounded to the nearest kwacha.

All the above figures relate to the time when the receipts were booked by D.W.A. rather than to the year of collection. Clearly some of the 1980 Kalabo receipts apply to collection in 1979. This assumption is supported by the fact that Kalabo rural council reported collecting K4,021 in 1980 giving them a committment to remit K3,619. At March, 1981 they had only remitted K3,345 of this sum with K274 still outstanding. Thus over K1,000 of the 1980 Kalabo figure applies to collection in 1979.

The consultants have modified Table 4.3 using various snippets of acquired information and common sense. This is shown in Table 4.4.

Table 4.4

Revenue Remitted to D.W.A. by Rural Councils. (K/annum)

Rural Council	1978	1979	1980
Kalabo	3,500	2,200	3,600
Kaoma	4,500	5,000	6,300
Lukulu	1,000	1,500	2,200
Namushakende	1,000	1,500	1,800
Senanga	-	4,000	4,500
Sesheke	1,500	2,500	2,500

In some cases the modified data is little more than a guess but is nevertheless the best estimate based on currently available data. The estimate for Senanga was the most difficult. Here it was assumed that 70% of the

revenue submitted in 1980 was collected in 1979 and that much of the 1980 collection will be submitted in 1981. An earlier letter from the P.W.E's office in Mongu to the Director of Water Affairs estimated that at the time of writing (mid 1977) revenue in Senanga was averaging K370 per month or approximately K4,000 per annum.

Although it must be admitted the the D.W.A's revenue performance in Western Province is poor it does not compare badly with some other provinces. For example in 1979 D.W.A. Southern Province collected only K10,000, but even excluding Mongu, Western Province is currently collecting over K20,000.

4.5 Revenue Implications for the Current Price of Water.

Table 4.5 presents the approximate current revenues calculated in Section 4.4 together with the estimated present total demands for water calculated in Section 3.9. It can be seen that if present demands were to be satisfied but revenues were to remain constant the authority would only be earning between 1.1n. and 3n. per m^3 of water produced, and between 1.2n and 3.4n per m^3 of water consumed.

More significant are the results from five townships of comparing the revenues currently raised with the 1979 water consumption estimates. It can be seen that the authorities are only earning between 3.3n and 6.8n per unit of water consumed. Since the current tariff structure implies an average rate of around 16n per m^3 the authorities are levying under one third of the intended revenue.

Table 4.5

Current Revenue Implications.

Township	Approximate annual revenue (K/annum)	If estimated 1980 demands were fulfilled: Water production (m^3/day)	Water consumption (m^3/day)	Revenue per m^3 production (n per m^3)	Revenue per m^3 consumption (n per m^3)	Present consumption (m^3/day)	Present revenue per m^3 consumption (n per m^3)
Kalabo	3,600	921	801	1.1	1.2		
Kaoma	6,300	823	716	2.1	2.4	518	3.3
Limulungu	2,000	513	446	1.1	1.2	80	6.8
Lukulu	2,200	240	209	2.5	2.9		
Mongu	39,000	3,667	3,189	2.9	3.4	1,643	6.6
Namushakende	1,800	232	202	2.1	2.4	149*	3.3
Senanga	4,500	700	609	1.8	2.0	200	6.1
Sesheke	2,500	556	483	1.2	1.4		

* The consultants' estimate of average daily consumption in Namushakende based on their own on the spot investigation was 137m^3/day. In view of the inaccuracies inherent in such investigations the two figures are close and the consultant's estimate endorses the results of Ostlandkonsult's study.

4.6 Actual and Expected Revenues.

According to town council officials in Mongu there are 697 individual metered connections, 74 unmetered individual connections and 353 communal consumers in Mongu. Thus expected monthly revenue is as follows:

697 x K4	= K2,782
74 x K5	= K 370
353 x K1	= K 353
Total	= K3,505

However since there are a number of large consumers who pay considerably more than K5 per month, the approximate monthly revenue should be over K4,000 per month i.e. over K50,000 per annum. The actual collection in 1980 was as follows:

Revenue from individuals	K28,620
Revenue from institutions	K 7,940
Revenue from communal points	K 2,060
Total	K38,620

Of the K28,620 that was derived from private individual connections only K2,400 came from unmetered houses. Thus K26,220 came from private metered connections. Virtually all institutional connections are metered, so K34,160 of the total individual connection income of K36,560 came from metered connections.

Between 70% and 80% of the overall income that should have been collected was actually received, but under 50% of the revenue that should have been derived from communal water points was actually received and much of that was from council employees.

However the revenue performance in the other townships was considerably poorer than that of Mongu.

Table 4.6 presents the amount of revenue that should be collected by the township councils if all consumers paid their bills. The first column shows the amount estimated by D.W.A. based on the numbers of metered connections, standpipes and communal tap users believed by D.W.A. Mongu, to exist. Unfortunately figures estimated by the consultants based on information provided in three towns concerning the numbers of connections are rather different. These are shown in the second column. The third column shows the current estimated annual revenue including the councils' 10% collection fees.

Table 4.6

Expected and Actual Revenue

(K/annum)

Water Supply	D.W.A. estimate of 100% revenue collection	Consultants estimate based on local information	Revenue actually collected
Kaoma	5,112	15,740	7,000
Kalabo	12,108	6,780	4,000
Lukulu	5,640		2,400
Mongu	no data	50,000	39,000
Namushakende	2,760	3,000	1,800
Senanga	11,280		5,000
Sesheke	13,500		2,800
			62,000

The consultants have a high degree of confidence in the information provided in Namushakende but less in that provided in Kaoma and Kalabo. However the D.W.A's own estimate of what revenue should be collected in Kaoma is clearly wrong since actual revenue considerably exceeds this figure. In addition D.W.A's estimate of what revenue should be collected in Kalabo is questionable. That figure included an estimate of K10,700 for individual consumers. The officer in Kalabo estimated that 75% of revenue from individual connections is actually collected. This is consistent with revenue actually collected and with the other data he gave the consultants concerning the number of water supply connections in Kalabo but not with D.W.A's estimate.

Despite the obvious inconsistencies* it can be concluded that when Mongu is excluded only about 40-50% of the total revenue that should be collected is actually being collected.

* There are a number of startling differences, for example D.W.A. Mongu reported a total of 79 individual connections (metered and standpipes) in Kaoma compared with a figure of 202 reported at the Kaoma water office.

Nevertheless even if all revenue that should be collected was collected i.e. total income almost doubles, D.W.A. would still only be receiving approximately 10n per m^3 of water consumed. This is well below the rate intended by the current tariff structure and demonstrates that a lack of metering and failure to charge on a quantity consumed basis is costing D.W.A. a significant part of the revenue intended by the tariff structure.

It can be concluded that D.W.A is only collecting just under one third of the income intended by the tariff structure and that half of this loss is due to the fact that all consumers are charged flat monthly water rates and the other half is due to failures of revenue collection.

4.7 **Comparison of Water Supply Income and Expenditure - Mongu Township Council.**

There were between 30 and 40 new connections in Mongu in 1980 and 65 reconnections. With connection and reconnection charges of K100 and K5 respectively, income from these sources totalled just over K4,000. Thus together with the revenue from water rates of K39,000 total income in 1980 was approximately K43,000.

At present Mongu Town Council pays D.W.A. K50,000 per annum to cover the operational costs of the Mongu water supply. Although this sum is currently insufficient to cover all the costs the council still makes a loss on the supply. Their other costs totalled just over K10,000 in 1980 of which over K8,000 was for emoluments. Thus they incurred costs of just over K60,000 compared with an income of K43,000, i.e. the consumers received a subsidy of K17,000 from the council in addition to the subsidy that the council received from D.W.A. The council's estimates for 1981 purport to show that the revenue will cover costs. However this is based on an assumed increase in revenue of about 60% which local officials claimed was realistic but which was based mainly on increased consumption from the new housing developments. It is therefore suggested that the overall financial performance is not likely to improve in 1981, especially since the wage bill is expected to increase by K6,000 to just over K14,000.

4.8 Comparison of Water Supply Income and Expenditure - D.W.A.

Section 4.6 demonstrated that in 1980 the total revenue from the township

water supplies was between K60,000 and K70,000. Section 5.4.1estimates that the present staff cost for township water supplies is around K180,000 with a further sum of K50,000 attributable to provincial head office staff i.e. township water supply overhead. These costs,together with the Provincial Water Engineer's estimates of the expenses for diesel fuel, oil, electricity, chemicals and spare parts are presented in Table 4.7.

Table 4.7

Estimate of the Actual Cost of Operation and Maintenance of the Western Province Township Water Supplies in 1980.

Item	Cost (K/annum)	Source
Direct staff costs	180,000	Consultant's estimate
Overhead staff costs	50,000	Consultant's estimate
Diesel	19,000	P.W.E. Mongu
Oil	8,000	P.W.E. Mongu
Electricity	26,000	P.W.E. Mongu
Chemicals	12,500	P.W.E. Mongu
Spare parts & repairs	10,000	P.W.E. Mongu
Total	305,500	

Current annual revenue of between K60,000 and K70,000 only meets about 20% of the annual operation and maintenance cost of K305,500. Even when overhead staff costs are excluded revenue only meets 25% of the cost of operation and maintenance. Section 2.9 pointed out that cost accounting in D.W.A. is poor or non existent, and that it is difficult to draw accurate financial conclusions. For example,the consultants' estimate of the current total water supply staff cost of K230,000 could be wrong by several tens of thousand of kwacha. Nevertheless the revenue and operation and maintenance cost figures calculated above contrast sufficiently that one can say with confidence that revenue only covers a small fraction, probably between 15% and 25% of all recurrent costs. Thus in a static situation where consumers are charged on a flat rate basis and where there is no improvement in the rate collection performance it would be necessary to increase the rates by a factor of between four and six simply to cover the recurrent costs of operating and maintaining the supplies. However rates would not have to be increased as much if the rate collection performance were to improve. Section 4.6 estimated that outside Mongu only about 40% of the rates that should be collected are actually collected but that in Mongu at least 70% are collected. If all rates were successfully collected the total revenue should increase to almost K120,000. In this case rates

would only need to be increased by a factor of between two and three. However if all water was charged for on a quantity used basis and all intended revenue was actually collected current rates would only have to be increased by approximately 67% in order to fully cover the costs of operation and maintenance.

The contribution that rates are currently making to total costs is difficult to ascertain, since any estimates of capital costs would be extremely tenuous. It would be reasonable in some towns to assume that the entire cost has been written off long ago. However there are relatively recent investments, for example in Mongu. Furthermore if any allowance was made for depreciation etc., it would be based on low historic costs which would not cover replacement at current costs.

However it does appear that revenue currently covers the short run marginal costs, i.e. those costs which vary directly with production, of operating the township water supplies. It is difficult for the consultants to estimate the short run marginal costs exactly since they do not know:-

(a) what proportion of the diesel/oil costs of K27,000 are used for the water supply engines and for transport. The latter cost can be considered fixed since a small increase in water production in every township is unlikely to increase the vehicle fleet's mileage.

(b) what proportions of the K26,000 electricity bill were for (i) the basic fixed charges and (ii) for energy consumed.

It will be assumed that two thirds of the diesel bill was for the water supplies and that 40% of the electricity bill represented the variable element. It will be further assumed that the spare parts and repair expenditure of K10,000 is part of the general maintenance costs and is not primarily a variable cost. Hence the short run marginal cost is as follows:-

	(K/annum)
Diesel/oil	18,000
Electricity	10,400
Chemicals	12,500
Total	40,900

Hence the present short run marginal cost is just over K40,000. This is reasonably consistent with the "projected 1980" short run marginal cost of K53,000 (c.f. section 5.5.3) since one would expect the latter to be somewhat higher because usage at present is restricted in a number of towns by capacity constraints. Therefore the short run marginal costs at present are covered by revenue.

request, travelling on duty to 54%, maintenance of plant and vehicles to 44%, maintenance of township water supplies to 56%, maintenance of rural water supplies to 61% and maintenance of fieldworks to 58% of the original request.

When it is realised that the requests by D.W.A. were mainly based on what they estimated that they needed rather than on the assumption that all requests would be cut dramatically it can be understood that the situation is very serious. If just two of the headings which are most pertinent to this study are examined more carefully this will emphasise the seriousness. Vehicles are currently maintained in a poor state, and yet, only 44% of the financial request for vehicle operation and maintenance was granted. If Western Province was to receive D.W.A's estimate of its minimum requirement it would need almost 54% of the national approved estimate for the maintenance of plant and vehicles. Maintenance of township water supplies was allocated 56% of its requirements. In financial terms this represents an 11.5% reduction from the 1980 approved estimate, and in real terms a fall of over 30%. There are of course, no fewer township supplies to maintain than there were in 1980 when the financial allocation was already insufficient. Furthermore although the large wage increases given in December, 1980 are covered by another vote, D.W.A. will still require significantly greater funds in 1981 simply to provide the same level of service as in 1980. Similar comments apply to maintenance of rural water supplies and fieldworks (approximately 20% reduction in real terms). The latter reduction is significant for township supplies inasmuch as some of the workers involved in township supplies are actually paid under head 211. (c.f. section 5.4.1) Table 4.9 shows that it is inevitable that the financial allocations will be insufficient in 1981. 90% of the K495,000 requested for Western Province under heads 209, 210 and 211 is for salaries and associated payments which eventually must be paid if staff are not to be made redundant. This cannot be cut by the necessary amount. Similarly the finance for fuel and spares which is already very small, and which is vital for efficient operation of the water supplies will be insufficient if it is cut from the request.

Unfortunately this means that even if D.W.A. overspends as it inevitably will and has to be bailed out by additional Government financial allocations, fuel and spares allocations will be insufficient since unpaid workers may present a greater problem to the Government than limited pumping hours

Table 4.8

Western Province 1981 Financial Requirements Under Heads 209, 210 and 211.

(K)

Expenditure Head	Salaries	Housing	ZNPF	Increments	Fuel & Spares	Total
209 Maintenance of township water supplies	41,016	7,344	2,025	2,051	26,500	80,936
210 Maintenance of rural water supplies	12,660	2,256	624	633	13,000	29,172
211 Maintenance of fieldworks	281,748	14,136	7,083	70,437	11,670	385,074
						495,182

Table 4.9 summarises Western Province requests for these and all other important heads together with the total requests for all provinces. In addition the amounts allowed in the Government's financial estimates for 1980 and 1981 are shown in the final columns.

Table 4.9

Department of Water Affairs Requests and Approved Estimates 1981.

Expenditure Head (all under 89/06)	Western province request	National request	Approved estimate 1981	Approved estimate 1980
1.Personal emoluments	-	765,200	731,900	619,800
2.01 General expenses	58,253	1,078,246	626,100	417,300
02 Travelling on duty	40,107	494,670	266.800	227,600
07 Maintenance of plant & vehicles	18,760	80,000	35,000	35,000
09 Maintenance of township water supplies	80,936	968,000	540,000	610,000
10 Maintenance of rural water supplies	29,172	359,000	220,000	210,000
11 Maintenance of fieldworks	385,074	1,002,000	580,000	580,000
All other Heads under 89/06			98,600	62,000
Total			3,098,400	2,761,700

Table 4.9 shows that with the exception of "Personal Emoluments" the Ministry of Finance drastically slashed all D.W.A.'s financial requests. All senior staff in Western Province are covered by personal emoluments but most other water supply related expenditures come under one or other of the slashed heads. General expenses of which the most important sub-items are wages for office staff, and services, were cut to 58% of the

4.9 D.W.A. Development Finance - Present Situation.

The financial constraints currently faced by the Government of Zambia are reflected in the water sector allocations. D.W.A.'s capital request for 1981 was just over K25 million but only K4.395 million was authorised. This was a slight reduction from the sum authorised for the previous year. Furthermore K2 million represents the NORAD programme in Western Province. Thus:-

(i) the NORAD programme is currently the most important development taking place under D.W.A.

(ii) the financial constraints faced by the Government are resulting in a very slow and decelarating pace of water supply development in the provinces, i.e. the financial situation in the sector from a capital availability point of view is extremely serious.

(iii) hopes for any improvement must rest totally on aid. At present most of the development funds authorised for water are based on aid and constitute approximately 2% of all capital expenditure. Given all other demands on Government funds one could not expect a significant increase in this percentage without additional outside assistance.

However the capital expenditure availability gives less concern than the recurrent financial situation. At worst, no development finance would simply mean that events are standing still, whereas insufficient recurrent finance means that existing assets cannot be properly utilised, and that they and the services provided to the public deteriorate in a situation where they are already extremely unsatisfactory.

4.10 D.W.A. Recurrent Finance - Present Situation.

Table 4.8 presents a breakdown of the Western Province financial requests for 1981 for the important financial budget heads 209, 210 and 211.

resulting from lack of fuel. Even in the past when overall financial restrictions on D.W.A. were not as severe as they will be in 1981 shortages of recurrent funds have led directly to limitations on the number of pumping hours and on the quantity of water supplied to the consumers in some towns. When one considers that items such as fuel and spares represent relatively small marginal costs, (in 1980 the costs of electricity, diesel, oil, chemicals and spares totalled K75,000,parts of which were fixed costs), compared with the relatively higher **fixed costs,** (over K200,000 in 1980), the situation is ridiculous. It leads to intermittent water supply services and to consumer complaints (c.f. section 12.3). It is only because consumers are charged on a flat rate basis that this shortage of recurrent finance does not currently lead directly to a loss of revenue. In the rural areas the lack of recurrent finance is a major cause of handpumps and mechanical pumps not being repaired.

It is forecast that although fuel and spares only account for a small percentage of recurrent expenditure and are more vital for the efficient operation of the water supplies than are many of the workers, efficient operation will be affected by insufficient finance for fuel and spares. The P.W.E. will have to overspend by large amounts as has occurred in the past. Already by the end of March, 1981, D.W.A. was accumulating debts since its monthly expenditures had been exceeding its monthly recurrent financial allocations.

The only way of of this difficult situation would be to make large numbers of workers redundant. Section 2.4 explained that many of the present work force are surplus to requirements but a rationalisation of the work force although necessary on financial grounds may pose a tremendous political problem. Here is a nasty choice, that can only be made by the Government of Zambia, which will require courage to look at the reality of the situation and to act accordingly. The situation has been exacerbated by the fact that in December, 1980, all workers were given significant pay increases which increased the labour bill by about 40%. Although this will be covered by a special vote in 1981, it could well reduce the allocations available for other expenditures in the future.

It can therefore be concluded that the present financial position of D.W.A. and the township water supplies in Western Province is extremely serious. Authorised recurrent expenditures are significantly less than D.W.A.'s requests and are inadequate. The new NORAD financed water supplies that are currently being planned and implemented in Western Province will increase the resources that are required for operating and maintaining township supplies. They will also increase the financial demands on the Government's recurrent budget. It is therefore, desirable that:-

(a) Government increases the recurrent financial allocations to match requirements.

(b) NORAD continues its assistance after scheme completion with resources for operation and maintenance.

(c) a very significant labour rationalisation programme takes place.

(d) the amount of revenue from water rates is increased very significantly, (under the existing financial system this would only reduce the recurrent demand indirectly but should influence Government to provide increased recurrent finance).

Although it is desirable that all four events occur it is not absolutely necessary. What is vital is that at least some of them do. If none of them happen the new schemes will not be properly utilised and they will represent wasted investment.

Furthermore it is important that the Government, while having to place stringent limitations on all its expenditures due to the overall economic situation, appreciates that if a realistic water pricing policy is followed, a shortage of recurrent finance that leads to a limitation on pumping hours is likely to cost in revenue a sum greater than the "costs saved".

5. FUTURE COSTS OF THE TOWNSHIP WATER SUPPLIES.

5.1 Capital Cost Estimates.

The consultants have used the capital cost data prepared by Ostlandskonsult. These capital costs are presented in Table 5.1.

Table 5.1

Capital Costs of the Water Supplies.

Township	Estimated capital cost (K)	Source of Estimate
Kalabo	1,185,000	Tender price.
Kaoma	1,839,000	Preliminary design report.
Limulungu	1,350,000	Final design report.
Lukulu	550,000	Tender price plus an estimate for reticulation.
Mongu	3,530,000	Preliminary design report.
Namushakende	571,000	Tender price.
Senanga	590,000	Final design report.
Sesheke	960,000	Feasibility report.
Total	10,575,000	

Ostlandskonsult's costs are based on mid 1980 prices except in Mongu (late 1980 prices) and Sesheke (1979 prices). It was not considered justified to amend either of these estimates. In the case of Mongu the time difference was minor. The cost estimate for Sesheke was so approximate that any alterations would only be window dressing.

For the purposes of calculation all the estimated capital costs are assumed to be mid 1980 costs. This is not always exactly true but it is accurate enough (a) in the light of the lack of precision of the existing cost data and (b) for the purposes of the present study.

5.2 Annual Capital Costs.

In calculating the annual capital cost of an investment one must make assumptions about (i) the life of the project and (ii) the appropriate discount rate.

The various components of the water supply schemes have useful lives of between 10 and 30 years. It would be possible to examine every scheme, component by component, applying the component's life in calculating the precise annual capital cost. However it has been decided to assume an overall project life of 20 years. This is simple and gives an annual capital cost as accurate as one needs for present purposes. It should

be borne in mind that although some of the capital costs being used for the current calculations are based on tender prices, others are still rather uncertain. Furthermore a breakdown of the project costs based on the study/design documents shows that on average 15% of the costs are for components having a 10 year life, 25% of the costs are for components having a 20 year life, and 60% of the costs are for components having a project life of 30 years. This results in an overall capital recovery factor (at 8%) of .10115 compared with the 20 year capital recovery factor of .10185 i.e. well under 1% difference. Furthermore the annual capital cost is not particularly sensitive to the project life assumed. For example, if it were assumed that the project life was 30 years the annual capital cost would only decrease by 15%.

However the annual capital costs are rather more sensitive to the rate of interest selected. It is guesstimated that the opportunity cost of capital in Zambia is 8% and this rate will be used in this report. In the light of interest rates in force today and the fact that many project costs are typically discounted at rates of 15% the rate selected for the analysis of 8% may seem rather low. However the entire analysis is being performed in 1980 prices and given an inflation rate of 20% the effective financial discount rate being used is 28%.

The annual capital costs based on the above assumptions are presented in Table 5.2.

Table 5.2

Annual Capital Costs of the Township Water Supplies.

Township	Annual capital cost (K)
Kalabo	120692
Kaoma	187302
Limulungu	137498
Lukulu	56018
Mongu	359531
Namushakende	58156
Senanga	60091
Sesheke	97776
Total	1077064

5.3 Provincial Headquarters Staff for Operation and Maintenance.

In order to operate and maintain the township water supplies efficiently

the provincial headquarters must provide the following services:-

(i) a central workshop to repair vehicles, pumps and engines.

(ii) a central store.

(iii) an administration unit including a transport office.

(iv) a central laboratory.

Figure 5.1 presents an organisation chart for the operation and maintenance of the water supplies. Table 5.3 presents a detailed list of staff requirements for operation and maintenance. It also shows the consultants estimates of staff costs. It can be seen that the total cost of head office staff required as support for the direct operation and maintenance labour force is almost K87,000 per annum.

5.4 Direct Operation and Maintenance Costs.

This section presents the consultants estimates of the cost of operating and maintaining the township water supplies. The major cost components are (i) labour (ii) chemicals (iii) energy (iv) general maintenance and (v) transport.

5.4.1. Labour Costs.

The future manpower costs can be estimated on two bases:-

(a) the estimated cost at current salary/wage levels based on the desirable labour force.

(b) the estimated cost at current salary/wage levels based largely on the current labour force supplemented by any additional requirements. Since most water supplies are currently over-staffed any additional requirements would necessarily be skilled men.

In order to estimate the latter, the current cost of labour for operation and maintenance of the township supplies must be estimated. Unfortunately this is a difficult task due to clerical/accounting inconsistencies in D.W.A.

The Western Province financial request for 1981 under heading 209 'Maintenance of Township Water Supplies" totalled K80936 of which K26500 was for fuel and spares, leaving K54336 for salaries, housing allowance; ZNPF contributions and salary increments. This request was based on 1980 costs and represents a requirement , after salary increases, of around K80000.

However it is clear that the cost of staff considerably exceeds this figure. Table 5.4 presents the cost of township water supply staff based on lists of names and 1981 salaries supplied by D.W.A. Mongu.

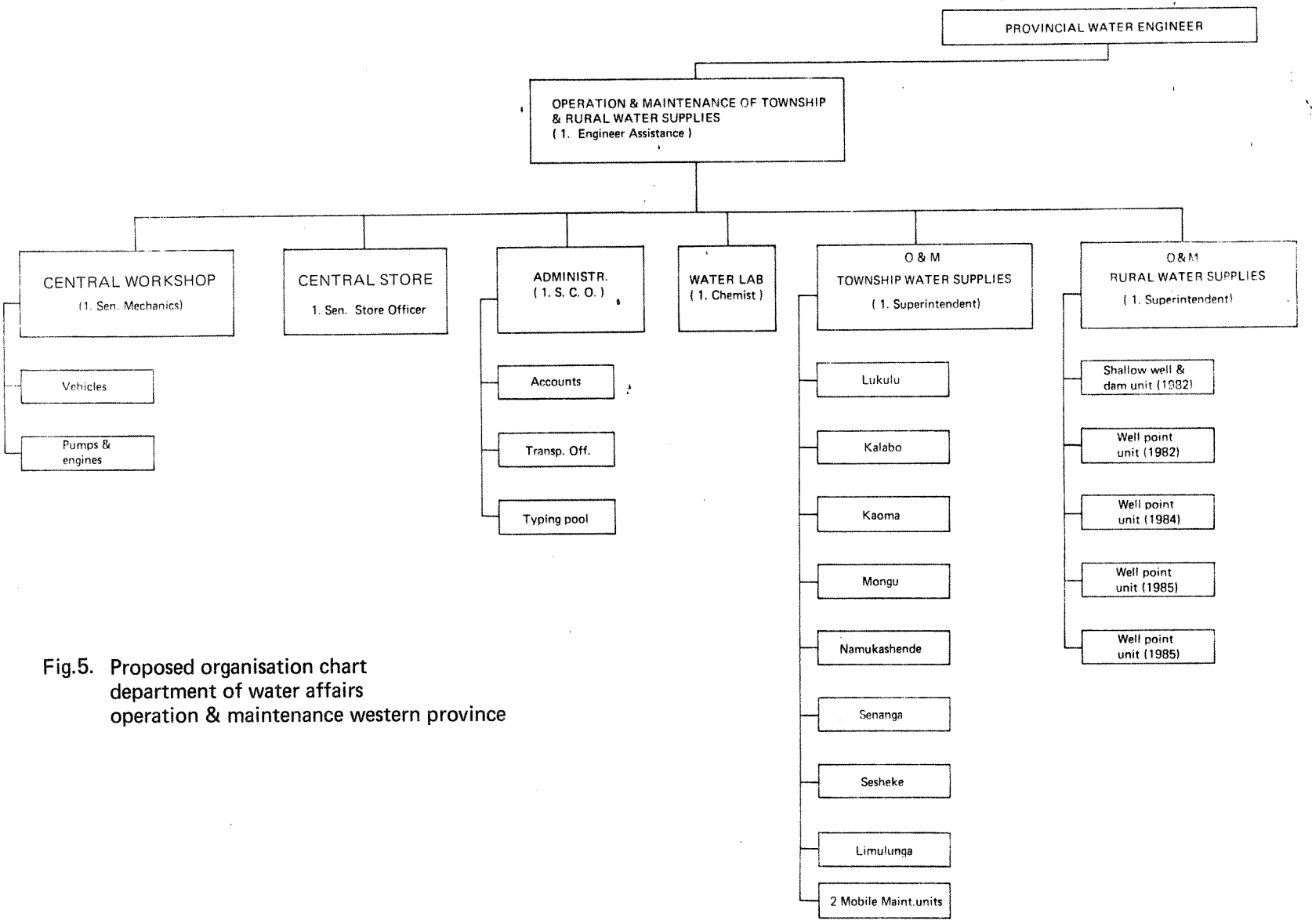

Fig.5. Proposed organisation chart
department of water affairs
operation & maintenance western province

Table 5.3

Provincial Head Office Staff Requirements and Costs for Operation and Maintenance.

(December 1980 prices).

Staff category	Present salary (K/annum)	Number	General administration	Central workshop	Central store	Water laboratory	Total labour cost (K/annum)
Water engineer	8,400	1	8,400				8,400
Engineering assistant	5,700	1	5,700				5,700
Senior mechanical superintendent	5,700	1		5,700			5,700
Senior store officer	3,912	2		3,912	3,912		7,824
Junior clerical officer	1,668	2	1,668		1,668		3,336
Typist	3,000	2	6,000				6,000
Mechanic	4,128	6		24,768			24,768
Chemist	6,600	1				6,600	6,600
Accountant	3,852	1	3,852				3,852
Assistant laboratory technician	2,820	1				2,820	2,820
Driver	1,500	4	3,000	3,000			6,000
Watchman	960	6	2,880	2,880			5,760
Total number		28					
Total labour cost (K/annum)			31,500	40,260	5,580	9,420	86,760

Table 5.4

Direct Costs of Township Water Supply Staff 1981.

Township	Cost (K)
Kalabo	17400
Kaoma	21528
Lukulu	16620
Mongu	40056
Namushekende	13056
Senanga	18336
Sesheke	14364
Total	141360

The numbers of staff on the list from which these costs were compiled were reasonably close to the number of staff reported employed on every supply from other sources,(Ostlandskonsult's report, consultants' visits to supplies etc.),with the exception of Kaoma where the number reported was considerably greater than that on the list. Nevertheless one can have some confidence that the list provided by D.W.A. Mongu was reasonably accurate. Furthermore bearing in mind the average salary increase it was not inconsistent with the corresponding figure provided by D.W.A. Mongu for 1980 of K81500, which would have led one to expect a 1981 figure of K120000.

The reason why the figure of K141360 shows no resemblance to the figure of K80000 that one would have expected based on the request under heading 209 is that many of the township water supply staff are paid under other headings, notably 211. The total 1981 figure for salaries and other labour costs under headings 209, 210 and 211 is over K500000. Unfortunately, there is no way to disaggregate this figure without undertaking a major exercise that was beyond the scope of the fieldwork of this study. However discussions with D.W.A. staff suggested that K200000 for water supply operation and maintenance staff was not unreasonable. Since the D.W.A. Mongu figure for rural water supply staff cost is around K50000 we can accept a current figure for township water supply staff of K141360 and will round it to K150000.

These figures only include junior staff, middle level and senior staff costs being specifically excluded. The cost of the latter including housing and other benefits is around K100000, of which around K30000 can be allocated to individual township water supplies. The reminder is attributable to township water supplies only on a provincial basis, or to other activities.

Thus the present staff cost for township water supplies is around K180000 per annum with a further sum of at least K50000 attributable to Provincial Head Office staff i.e. township water supply overhead.

Table 5.5 presents the consultants' estimates of direct staff requirements and costs (in 1981 prices) for operating and maintaining the township water supplies, on the optimistic assumption that staff will be kept to a minimum i.e. that numbers of junior staff will not exceed requirements. In order to utilise staff efficiently it is proposed that two mobile maintenance units are established.

Ostlandskonsult have estimated that all the supplies except one will require two shifts in the near future. The exception is Namushakende where one shift will suffice until the end of the decade. Therefore three engine minders are included for every supply except Namushakende where two will suffice, and Mongu where four men will be required. It has also been assumed in estimating the requirements detailed in Table 5.5 that the engine minders are qualified as plumbers and will do minor repairs and installation of house connections.

Table 5.5 shows that the total cost of direct operation and maintenance staff based on the consultants' recommended level of staffing is K151644 per annum at December 1980 prices. This figure is well below the present cost of around K180000 per annum. This is of course due to the present level of overstaffing at the lower levels. It would be unrealistic for the consultants to assume that most of these staff will be made redundant since Government employees enjoy job security.

Table 5.6 presents a summary of direct operation and maintenance staff costs for the township water supplies. The first column shows the costs if desirable levels of staffing are achieved. The second column shows the probable staff costs if most of the present staff were to be retained. It can be seen that the additional unnecessary staff would add over K50000 per annum,(i.e. approximately 35%),to the real requirement of K151000,increasing the cost to around K205000 per annum. This figure is somewhat higher than the current cost of K180000 per annum since the consultant's estimate allows for a few more higher calibre staff.

Table 5.5

Direct Operation and Maintenance Staff Requirements and Costs for the Township Water Supplies.

(December 1980 prices)

Staff category	Salary/wage (K/annum)	Number of Staff	Kalabo	Kaoma	Limulungu	Lukulu	Mongu	Namushakende	Senanga	Sesheke	Total labour cost (K/annum)
Superintendent	K5,700	1					1				5,700
Officer in charge WDO	K3,912	5	1	1		1			1	1	19,560
Junior clerical officer	K1,668	1					1				1,668
Typist	K3,000	1					1				3,000
Mechanic	K4,128	2					2				8,256
Plumber	K2,820	6		1			3		1	1	16,920
Operator/engine minder	K2,820	24	3	3	3	3	4	2	3	3	67,680
Driver/cox	K1,500	9	2	1			4		1	1	13,500
Watchman	K 960	16	2	2	2	2	2	2	2	2	15,360
Total number for every township		65	8	8	5	6	18	4	8	8	
Total annual cost (K/annum)			17,292	18,612	10,380	14,292	46,284	7,560	18,612	18,612	151,644

Table 5.6

Summary of Township Water Supply Operation and Maintenance Labour Costs.

Township	Costs based on desirable levels of staffing. (K/month)	Cost if no redundancies are effected. (K/month)
Kalabo	17292	22000
Kaoma	18612	31000
Limulungu	10380	15000
Lukulu	14292	20000
Mongu	46284	55000
Namushakende	7560	15000
Senanga	18612	25000
Sesheke	18612	22000
Total	151644	205000

Although it might be hoped that the number of staff would conform to the minimum requirement, it is most unlikely that approximately 40 low level staff will be made redundant in practice, and it is considered realistic to use the higher cost figure in the overall cost estimates.

5.4.2. Chemicals.

Chlorination is required at all the township water supplies. In addition a ph. adjustment is necessary at Namushakende. Table 5.7 presents the annual cost of chemicals for the period 1980-90 at 1985 prices. The figures are based on the following assumptions:-

(a) the demand forecasts presented in section 3.9

(b) a linear increase in demand.

(c) 1.5 grams of calciumhypochlorite per m^3 of clean water produced.

(d) 7 grams of soda per m^3 of clean water produced.

(e) calciumhypochloriate and soda costs of K6 per kg. and K1.70 per kg. respectively.

Table 5.7

Annual Cost of Chemicals. (K/annum)

Township	Calcium hypochloride cost	Soda cost 1980	Total cost 1980	Total cost 1982	Total cost 1985	Total cost 1988	Total cost 1990
Kalabo	3025		3025	3598	4457	5317	5890
Kaoma	2704		2704	3264	4105	4945	5505
Limulungu	1685		1685	2059	2619	3180	3554
Lukulu	788		788	885	1031	1177	1274
Mongu	12046		12046	14299	17678	21056	23309
Namushakende	762	1008	1770	2163	2751	3340	3733
Senanga	2300		2300	2783	3508	4232	4715
Sesheke	1826		1826	2047	2379	2712	2933
Total	25136	1008	26144	31098	38528	45959	50913

5.4.3 Energy.

Lukulu and Namushakende will use diesel generators. All other supplies will be connected to the national electricity grid.

Table 5.8 presents the fixed and variable energy costs for the period 1980-90 in 1980 prices. Table 5.9 presents the total energy costs.

The assumptions on which Tables 5.8 & 5.9 are based are as follows:-

(a) the demand forecasts presented in section 3.9.

(b) a linear increase in demand.

(c) Ostlandskonsult's estimates of energy requirements.

(d) a diesel fuel cost of K0.30 per litre.

(e) ZESCO's current tariff D1 (latest 1979 revision) for electricity costs, which is as follows:-

Tariff D I - Consumers Maximum Demand in kVA below 300

Fixed monthly charge in Kwacha - 16.90

Maximum demand charge per kVA per month in Kwacha - 2.90

Unit charge in Ngwee - 1.30

Sales Tax - 10%

Table 5.8

Fixed and Variable Annual Energy Costs of the Township Water Supplies (K/annum)

Township	Fixed costs	Variable costs 1980	1982	1985	1988	1990
Kalabo	950	703	836	1,036	1,236	1,369
Kaoma	2,980	1,721	2,078	2,612	3,147	3,504
Limulungu	3,171	1,165	1,423	1,811	2,199	2,457
Lukulu	-	5,760	6,471	7,537	8,603	9,314
Mongu	8,913	9,053	10,746	13,285	15,825	17,518
Namushakende	-	6,925	8,461	10,765	13,069	14,605
Senanga	1,142	745	901	1,136	1,371	1,527
Sesheke	798	605	678	788	899	972
Total	17,954	26,677	31,594	38,970	46,349	51,266

Table 5.9

Total Annual Energy Costs of the Township Water Supplies (K/annum)

Township	1980	1982	1985	1988	1990
Kalabo	1,653	1,786	1,986	2,186	2,319
Kaoma	4,701	5,058	5,592	6,127	6,484
Limulungu	4,336	4,594	4,982	5,370	5,628
Lukulu	5,760	6,471	7,537	8,603	9,314
Mongu	17,966	19,659	22,198	24,738	26,431
Namushakende	6,925	8,461	10,765	13,069	14,605
Senanga	1,887	2,043	2,278	2,513	2,669
Sesheke	1,403	1,476	1,586	1,697	1,770
Total	44,631	49,548	56,924	64,303	69,220

5.4.4. General Maintenance Costs.

The general maintenance cost is calculated as a percentage of the construction cost. The actual percentages on which the calculations are based are presented in Table 5.10.

Table 5.10

The Relationship of Maintenance Costs to Construction Costs.

Project component	Annual maintenance cost as a % of construction cost. (%)
Intake works	1
Boreholes	1
Pumps, all types	3
Diesel engines and accessories	3
Electrical motors	3
Piping, all types	1
Treatment works building	1
Storage tanks, steelworks	3
Roads, earthworks	1

Table 5.11 presents the annual maintenance costs of the township water supplies based on the estimated capital costs and the percentages shown in Table 5.10.

Table 5.11

Annual Maintenance Costs of the Township Water Supplies.

Township	Annual maintenance cost (K)
Kalabo	13,300
Kaoma	28,500
Limulungu	15,000
Lukulu	5,000
Mongu	45,000
Namushakende	6,600
Senanga	6,700
Seshake	15,000
Total	135,100

5.4.5. Transport Costs.

It is estimated that in 1982 six four-wheel drive Landrovers will be required. It is assumed that they will have a useful life of 3 years since they will be serviced by the new workshop in Mongu.

In 1985 it will be necessary to provide one lorry in addition to replacing the other six vehicles. It is also necessary to provide one boat for Kalabo in 1982, the cost of which is assumed to be similar to that of a Lanrover. The costs in 1980 prices of Landrovers and lorry are assumed to be K18,000 and K40,000. The operational costs are assumed to be as follows:-

Lorry	K0.30 per km.
Landrover	K0.20 per km.
Boat	K0.10 per km.

Table 5.12 presents the projected allocation of vehicles.

Table 5.12

Allocation of Vehicles.

Mongu - Superintendent	1 Landrover
Mongu - Maintenance Team	2 Landrovers
Kaoma	1 Landrover
Senanga	1 Landrover
Sesheke	1 Landrover
Kalabo	1 Boat

The lorry will be based in Mongu from 1985.

The vehicle allocation shown in Table 5.12 has been used as the basis for estimating the annual transport costs of every supply. These costs are presented in Table 5.13.

Table 5.13

Allocation of Vehicle Costs.

	Number of Vehicles	Allocation of Vehicles between Supplies.							
		Kalabo	Kaoma	Limulungu	Lukulu	Mongu	Namushakende	Senanga	Sesheke
Headquarters	3	.3	.2	.3	.3	1	.3	.3	.3
Kalabo	1	1							
Kaoma	1		.7		.3				
Senanga	1							1	
Sesheke	1								1
Total	7	1.3	.9	.3	.6	1	.3	1.3	1.3

The assumptions implicit in Table 5.13 are:-

1) The vehicles in Kalabo, Senanga and Sesheke are used exclusively for those supplies.
2) The vehicle in Kaoma is partly used for Lukulu.
3) On average one of the headquarters vehicles will be used in Mongu, one will be used primarily for Limulungu and Namushakende and "more than one" vehicle will be travelling to the five distant supplies.

It is assumed that the Landrovers based at headquarters average 30,000 kms per annum but that the other vehicles only average 20,000 kms per annum. The headquarter's vehicles taking maintenance teams to all locations will cover a greater mileage, and repair times for Mongu based vehicles should be less.

Hence the costs per vehicle are as follows:-

Headquarter based vehicles:

Annual capital cost = K18,000 x 0.388 = K6,984
Operational cost = K0.20 x Kms 30,000 = K6,000
K12,984

Other vehicles:

Annual capital cost = K18,000 x 0.388 = K6,984
Operational cost = K0.20 x Kms 20,000 = K4,000
K10,984

Hence the total costs are approximately K13,000 and K11,000 per annum respectively. It is assumed that the operational costs of the boat are only 50% of those of a Landrover. Hence the annual cost of the boat = K9,000.

The annual costs of the lorry are as follows:

Annual capital cost = K40,000 x 0.388 = K15,520

Operational cost = K0.30 x kms 30,000 = K 9,000

Annual total cost = K24,520

i.e. approximately K25,000 per annum.

This cost is assumed to be allocated as follows:

	Percentage total of cost	Annual cost (K/aanum)
Kalabo	10%	2,500
Kaoma	10%	2,500
Limulungu	5%	1,250
Lukulu	15%	3,750
Mongu	25%	6,250
Namushakende	5%	1,250
Senanga	15%	3,750
Sesheke	15%	3,750
Total	100%	25,000

The annual transport costs for every township have been calculated on the basis of the cost and vehicle allocation data shown above and are presented in Table 5.14.

Table 5.14

Annual Transport Costs.

Township	Annual cost to 1984 (K/annum)	Annual cost from 1985 (K/annum)
Kalabo	12,900	15,400
Kaoma	10,300	12,800
Limulungu	3,900	5,150
Lukulu	7,200	10,950
Mongu	13,000	19,250
Naumshakende	3,900	5,150
Senanga	14,900	18,650
Sesheke	14,900	18,650
Total	81,000	106,000

5.5 Fixed and Variable Elements of the Operation and Maintenance Costs.

5.5.1. Introduction.

As water production increases most of the operation and maintenance costs will remain fixed during the 1980's.

The general maintenance cost is assumed to remain fixed. This may not be completely accurate but is a reasonable approximation of the truth. Furthermore since the basis of the calculation of maintenance costs is so approximate any minor adjustments to these figures would only be window dressing.

The transport cost is also likely to remain fixed as water use increases since the number of necessary journeys will not alter significantly.

ZESCO's tariff structure means that part of the cost of energy will be a fixed cost.

The labour cost is also assumed to remain fixed since the likely level of staffing will suffice at least until 1990.

Hence the only costs that will vary significantly with consumption are those for chemicals and diesel, together with part of the cost of electricity.

5.5.2. Fixed Costs of Operation and Maintenance.

Table 5.15 brings together all the fixed costs of operation and maintenance.

The first column shows the annual maintenance costs as estimated in Section 5.4.4.

The second column shows the annual transport costs as estimated in Section 5.4.5.

The third column shows the fixed elements of the annual energy costs as estimated in Section 5.4.3.

The fourth column shows the annual labour cost. Section 5.4.1 showed that the estimated cost of head office support staff is K87,000 p.a. It also showed that the consultants' estimate of the cost of the minimum staffing requirement for operation and maintenance is K151,000 p.a. but since it is unlikely that DWA will be able to make the necessary number of redundancies the probable cost is around K205,000 p.a. However a total staff cost for operating and maintaining the township water supplies of K292,000 (K87,000 + K205,000) would be an overestimation of the cost for two reasons. Firstly part of the head office support staff cost will be attributable to other activities, for example rural water supplies. Secondly the maintenance costs,(based on percentages of construction costs),include the cost of labour and thus inclusion of the total labour costs would mean that there would be some double counting. It is guesstimated that a figure of 70% of all overhead and direct staff costs is an appropriate figure for costs which (a) are attributable to township water supplies and (b) are not included in the maintenance costs. This results in a figure of K204,400 p.a. Since all these figures are only approximations the consultants will assume that it is K205,000 since they can then conveniently and reasonably assume that this would be distributed between the townships in the same way that the total direct operation and maintenance labour costs were distributed in Section 5.4.1.

Table 5.15

Annual Fixed Operation and Maintenance Costs (K/annum)

Township	Annual maintenance cost	Annual transport cost	Anuual fixed energy cost	Annual labour cost	Total annual fixed cost of operation and maintenance
Kalabo	13300	12900	950	22000	49150
Kaoma	28500	10300	2980	31000	72780
Limulungu	15000	3900	3171	15000	37071
Lukulu	5000	7200	-	20000	32200
Mongu	45000	13000	8913	35000	121913
Namushekende	6600	3900	-	15000	25500
Senanga	6700	14900	1142	25000	47742
Sesheke	15000	14900	798	22000	52698
Total	135100	81000	17954	205000	439054

5.5.3 Annual Variable Costs.

Table 5.16 presents the annual variable costs for 1980, 1982, 1985 and 1988. The figures represent the summation of the cost of chemicals detailed in Table 5.7 and the variable element of the cost of energy detailed in Table 5.8.

Table 5.16

Annual Variable Costs of the Township Water Supplies.
(K/annum)

Township	1980	1982	1985	1988
Kalabo	3728	4434	5493	6553
Kaoma	4425	5342	6717	8092
Limulungu	2850	3482	4430	5379
Lukulu	6548	7356	8568	9780
Mongu	21099	25045	30963	36881
Namushekende	8695	10624	13516	16409
Senanga	3045	3684	4644	5603
Sesheke	2431	2725	3167	3611
Total	52821	62692	77498	92308

5.6 Summary of Operation and Maintenance Costs.

Table 5.17 summarises the total annual costs of operation and maintenance for 1980,1982, 1985 and 1988 by township.

Table 5.17

Summary of Township Operation and Maintenance Costs
(K/annum)

Township	1980	1982	1985	1988
Kalabo	52878	53584	57143	58203
Kaoma	77205	78122	81997	83372
Limulungu	39921	40553	42751	43700
Lukulu	38748	39556	44518	45730
Mongu	143012	146958	159126	165044
Namushakende	34195	36124	40266	43159
Senanga	50787	51426	56136	57095
Sesheke	55129	55423	59615	60059
Total	491875	501746	541552	556362

Table 5.18 summarises the total and costs of operation and maintenance for 1980, 1982, 1985 and 1988 by cost component. The variable cost component being composed of the chemical and variable energy costs. Table 5.19 presents the cost components expressed as percentage of the total operation and maintenance costs. The main features are:-

(i) the variable costs only represent between 10% and 17% of all operation and maintenance costs.

(ii) labour is the largest component of the operation and maintenance costs representing between 37% and 42% of total cost.

(iii) transport represents between one fifth and one sixth of the total operation and maintenance cost.

Table 5.18

Total Operation and Maintenance Costs.
(K/annum)

	Variable costs	Maintenance cost	Transport cost	Labour	Fixed energy costs	Total operation and maintenance cost.
1980	52821	135100	81000	205000	17954	491875
1982	62692	135100	81000	205000	17954	501746
1985	77498	135100	106000	205000	17954	541552
1988	92308	135100	106000	205000	17954	556362

Table 5.19

Breakdown of Operation and Maintenance Costs.
(expressed as % of total operation and maintenance costs)

	Variable costs (%)	Maintenance cost (%)	Transport cost (%)	Labour cost (%)	Fixed energy Costs (%)	Total (%)
1980	10.74	27.47	16.47	41.67	3.65	100.00
1982	12.49	26.93	16.14	40.86	3.58	100.00
1985	14.31	24.95	19.57	37.85	3.32	100.00
1988	16.59	24.28	19.05	36.85	3.23	100.00

5.7 Total Annual Costs.

Tables 5.20.1 - 5.20.4 bring together all the annual costs of the township water supplies for 1980, 1982, 1985 and 1988 respectively.

The first columns show the annual capital costs as estimated in Section 5.2.

The second columns show the annual fixed costs of operation and maintenance from Table 5.15.

The third columns show the annual variable costs of operation and maintenance from Table 5.16.

The fourth columns show the total annual costs of operation and maintenance i.e. they represent the addition of the second and third columns.

The fifth columns show the annual fixed costs i.e. they represent the addition of the first and second columns.

The last columns show the total annual costs i.e. they represent the summation of (a) the first and fourth columns and (b) the third and fifth columns.

The features of the annual costs include:-

(i) the capital cost represents between 66% and 69% of all annual costs and correspondingly,

(ii) the operation and maintenance costs only represent between 31% and 34% of all annual costs.

(iii) fixed costs represents between 94% and 97% of all annual costs and correspondingly,

(iv) variable costs only represent between 3% and 6% of all annual costs.

Table 5.20.1

Annual Cost Summary 1980
(K/annum)

Township	Annual capital cost	Annual fixed operation and maintenance costs	Anuual variable costs	Annual operation and maintenance costs	Annual fixed costs	Annual total costs
Kalabo	120692	49150	3728	52878	169842	173570
Kaoma	187302	72780	4425	77205	260082	264507
Limulungu	137498	37071	2850	39921	174569	177419
Lukulu	56018	32200	6548	38748	88218	94766
Mongu	359531	121913	21099	143012	481444	502543
Namushakende	58156	25500	8695	34195	83656	92351
Senanga	60091	47742	3045	50787	107833	110878
Sesheke	97776	52698	2431	55129	150474	152905
Total	1077064	439054	52821	491875	1516118	1568939

Table 5.20.2

Annual Cost Summary 1982
(K/annum)

Township	Annual capital cost	Annual fixed operation and maintenance costs	Annual variable costs	Annual operation and maintenance costs	Annual fixed costs	Annual total costs
Kalabo	120692	49150	4434	53584	169842	174276
Kaoma	187302	72780	5342	78122	260082	265424
Limulungu	137498	37071	3482	40553	174569	178051
Lukulu	56018	32200	7356	39556	88218	95574
Mongu	359531	121913	25045	146958	481444	506489
Namushekende	58156	25500	10624	36124	83656	94280
Senanga	60091	47742	3684	51426	107833	111517
Sesheke	97776	52698	2725	55423	150474	153199
Total	1077064	439054	62692	501746	1516118	1578810

Table 5.20.3

Annual Cost Summary 1985
(K/annum)

Township	Annual capital cost	Annual fixed operation and maintenance costs	Annual variable costs	Annual operation and maintenance costs	Annual fixed costs	Annual total costs
Kalabo	120692	51650	5493	57143	172342	177835
Kaoma	187302	75280	6717	81997	262582	269299
Limulungu	137498	38321	4430	42751	175819	180249
Lukulu	56018	35950	8568	44518	91968	100536
Mongu	359531	128163	30963	159126	487694	518657
Namushakende	58156	26750	13516	40266	84906	98422
Senanga	60091	51492	4644	56136	111583	116227
Sesheke	97776	56448	3167	59615	154224	157391
Total	1077064	464054	77498	541552	1541118	1618616

Table 5.20.4

Annual Cost Summary 1988
(K/annum)

Township	Annual capital cost	Annual fixed operation and maintenance costs	Annual variable costs	Annual operation and maintenance costs	Annual fixed costs	Annual total costs
Kalabo	120692	51650	6553	58203	172342	178895
Kaoma	187302	75280	8092	83362	262582	270674
Limulungu	137498	38321	5379	43700	175819	181198
Lukulu	56018	35950	9780	45730	91968	101748
Mongu	359531	128163	36881	165044	487694	524575
Namushakende	58156	26750	16409	43159	84906	101315
Senanga	60091	51492	5603	57095	111583	117186
Sesheke	97776	56448	3611	60059	154224	157835
Total	1077064	464054	92308	556362	1541118	1633426

5.8. Unit Costs of Water.

Table 5.21 presents the estimated unit costs of water over the period 1980-88. They have been calculated by dividing the total annual costs shown in Tables 5.20.1 - 5.20.4 by the water demands detailed in Section 3.10.

Table 5.21

Average Costs of Water Consumed.
(ngwee per m^3)

Township	1980	1982	1985	1988
Kalabo	59.4	50.2	41.3	34.8
Kaoma	101.3	84.1	67.9	56.7
Limulungu	109.0	89.5	71.3	59.0
Lukulu	124.4	111.5	100.9	89.6
Mongu	43.2	36.7	30.4	25.8
Namushakende	125.4	104.5	85.9	72.9
Senanga	49.9	41.5	34.3	28.7
Sesheke	86.7	77.5	68.5	60.3
Overall	64.6	54.7	45.3	38.4

It can be seen that the overall cost of water falls from 65 n to 38 n from 1980-88. The overall cost of water during the 1980's is under 50 n. There are however very significant differences between the townships. There are a number of technical factors causing the large cost differences but it would appear that economy of scale is one determinant. The largest supply Mongu has the lowest unit cost whilst the two smallest supplies Lukulu and Namushakende have the highest unit costs.

Mongu, Senange and Kalabo are the lower cost supplies. The unit costs in all these townships in 1980 are under 60 n per m^3 and fall to under 35 n per m^3 in 1988.

Kaoma, Limulungu and Sesheke are the middle cost supplies. The unit costs in all these townships in 1980 are between 85 n and 110 n per m^3 and fall to around 60 n per m^3 in 1988.

Namushakende and Lukulu are the high cost supplies. The unit costs in both these townships are around 125 n per m^3 in 1980 and they only fall to around 70 n and 90 n respectively by 1988.

Table 5.2.2 presents the unit costs of water based on operation and maintenance costs only, i.e. all capital costs of the water supplies are excluded. They have been calculated by dividing the total operation and maintenance costs shown in Table 5.17 by the water demands detailed in Section 3.10.

Table 5.22

Operation and Maintenance Costs per Unit of Water Consumed (ngwee per m^3)

Township	1980	1982	1985	1988
Kalabo	18.1	15.4	13.3	11.3
Kaoma	29.6	24.8	20.7	17.5
Limulungu	24.5	20.4	16.9	14.2
Lukulu	50.9	46.2	42.9	39.9
Mongu	12.3	10.6	9.3	8.1
Namushakende	46.4	40.2	35.1	31.0
Senanga	22.9	19.1	16.6	14.0
Sesheke	31.2	28.0	25.9	22.9
Overall	20.3	17.4	15.2	13.1

It can be seen that the overall operation and maintenance cost per m^3 of water falls from 20n to 13n from 1980 to 1988. The overall average cost during the 1980's is around 16n per m^3. But this overall cost ranges from around 10 n per m^3 in Mongu to around 40n in Lukulu and Namushakende.

There are again very significant differences between the supplies. The most interesting point is that there is a very close corralation between the ranking of the supplies (a) with respect to total cost and (b) with respect to operation and maintenance cost only. This is demonstrated in Table 5.23.

Table 5.23

Ranking of the Township Supplies by Cost.

	Ranking with respect to total unit cost	Ranking with respect to O & M unit cost
Kalato	3	2
Kaoma	4	5
Limulungu	5=	4
Lukulu	8	8

Table 5.23 (Cont'd.)

Mongu	1	1
Namushakende	7	7
Senanga	2	3
Sesheke	5=	6

N.B. The supplies are ranked from the lowest cost, upwards.

There is even a high level of correlation between the rankings with respect to (a) unit capital costs and (b) unit costs of operation and maintenance. The only major difference being that Limulungu ranks as the highest on the unit capital cost criterion. However in general it is true that those schemes which have the higher unit capital costs also have the higher unit operation and maintenance costs and that those schemes which have the lower unit capital costs also have the lower unit operation and maintenance costs.

The figures in both Tables 5.21&5.22 are expressed in terms of cost per m^3 of water consumed. Thus the costs per m^3 of water produced would be approximately 13% lower, since production is 15% higher than consumption due to the need to provide for the inevitable losses.

5.9 Marginal Costs of Water.

The consultants do not have the data to calculate the long run marginal costs of the township water supplies. However the shorter run marginal costs will not significantly alter during the first half of the 1980's since considerable spare capacity will exist at every supply. In order to estimate the marginal cost of water during the 1980's the variable costs presented in Table 5.16 are compared with water demands shown in Section 3.10. The difference in the variable costs between any two years for a given township is compared with the corresponding water demands. The resulting marginal costs are presented in Table 5.24. For any given town the marginal cost is constant. This is a result of the assumptions stated earlier that the only costs that would not be fixed during the period 1980-1988 would be those for energy and chemicals. Both of these costs increase in direct proportion to the quantity of water produced.

Table 5.24

Marginal Cost of Water in the Township Supplies.
(ngwee per m^3)

Township	Marginal cost per unit of production	Marginal cost per unit of consumption
Kalabo	1.11	1.28
Kaoma	1.47	1.69
Limulungu	1.52	1.75
Lukulu	7.50	8.63
Mongu	1.58	1.81
Namushakende	10.26	11.80
Senanga	1.19	1.37
Sesheke	1.20	1.38
Overall	1.88	2.16

The two main features of Table 5.24 are:-

(i) that the marginal cost of six of the eight township supplies is very low, between 1 and 2 n per m^3.

(ii) that the marginal costs of the two supplies Lukulu and Namushakende are not connected to the electricity grid and which therefore use diesel are quite high in absolute terms and very high when compared with the other six supplies. They are roughly six to eight times higher.

6. BACKGROUND TO WATER PRICING POLICY.

6.1 Introduction.

Water supplies can be financed in a variety of ways: at one extreme by government development and continuing recurrent grants to pay for all the capital and operation and maintenance costs. At the other extreme by water charges which cover all running costs and which repay the full capital costs over time. The appropriate policy for Western Province township water supplies will lie somewhere between these extremes and the appropriate level of subsidization will depend partly on the way in which the authorities regard water supplies, for example, whether they regard them as public utilities or as social services. Historically water supplies in Zambia have been regarded as public utilities which should cover their costs, but in the more recent past government has implicitly tended to view the smaller township water supplies, and communal facilities in particular, as social services. Consequently as was mentioned in Section 4.1 , the present policy is that the smaller township supplies are only required to cover their operation and maintenance costs with government subsidising part, if not all, of the capital costs.

The major problem in determining the optimum water pricing policy is that three major functions of water rates described in detail below, (Sections 6.2,6.3 & 6.5), usually conflict and reconciliation may be a complex task involving trade offs between the financial, economic and social objectives. The decisions involved are largely political and they should be guided by, and consistent with, Government's high level objectives. An understanding of the major functions of, or major criteria for determining, water rates is therefore necessary so that these inherent conflicts and the problems and consequences of alternative pricing strategies can be properly comprehended.

6.2 The Economic Criterion.

6.2.1 Introduction to the Economic Criterion.

The economic function of pricing policy is to influence consumer behaviour so that economically sound investment resource allocation decisions are made and efficient use of resources is achieved, i.e. so that capacity is expanded at the appropriate rate and that capacity is as fully used as possible. Economic theory shows that this can be done by basing the price

of water on the marginal cost of production i.e. by charging consumers a price for the water which reflects the costs of supplying that additional water. Theoretically consumers will then adjust their consumption so that the incremental cost of producing additional water is equal to the incremental value of that water to them. If price exceeds marginal cost demand will be unnecessarily restricted and the level of under-utilisation will be greater than it should have been i.e. a greater part of the investment than is necessary will be wasted for some time. If price is less than marginal cost the quantity of water demanded will increase and the capacity will soon become a constraint. Augmentation which cannot be justified on economic grounds will be needed. The extent to which price can be used to give an effective signal to the consumer of the real resources being used and an indication to the planners of the effective demand is dependent upon the price elasticity of demand for water. Section 3.8 shows that little data exists on these elasticities. However it is probable that there will be a sufficient degree of price elasticity to make this a feasible objective of policy.

The township water supplies in Western Province have high fixed capital cost elements with significant economies of scale, so that marginal cost is below average cost. Furthermore a large element of the operation and maintenance costs will be fixed. Hence over a considerable operational range unit costs of the supplies will fall with increasing utilisation, and the marginal costs will be low until consumption approaches capacity. Therefore the economic criterion is likely to suggest a low price until demand approaches capacity. Furthermore in most townships the longer run marginal costs of Phase II are likely to be lower than average costs since most of the components of Phase I will be designed to the year 1995. However when further augmentations are required almost all components of the supplies will have to be replaced or augmented and marginal costs will increase dramatically. An economic criterion would suggest a high price based on this high marginal cost prior to such augmentations being required. This would ensure that these augmentations are not demanded until they are economically justified. In particular a surcharge on large consumers may be appropriate, at this time. Although the long run marginal costs of large urban supplies are often high and increasing and exceed average

cost because more distant and more expensive sources must be used for new augmentations, it is unlikely that the long run marginal costs of Western Province township water supplies will increase significantly above average costs since in most cases it will only be necessary to increase the supply from the same source. Hence although existing data does not enable one to estimate the long run marginal costs of the Western Province township water supplies, it is guessed that they could be similar to the average cost of the 1980's (in real terms). In any case where the long run marginal cost exceeds the average cost the high price suggested by the economic criterion should easily satisfy the financial criterion and a large financial surplus may be generated. However in this report the emphasis is placed on determining a pricing policy for the 1980's, during which period marginal costs will be well below average costs.

6.2.2 Problems Associated with the Economic Criterion.

Theoretically it is fine to say that "if a price equal to marginal cost is charged and consumers demonstrate their willingness to pay this price it means that they value marginal consumption at least as much as the cost of producing that unit. Consequently the market mechanism will signal to the authorities when an augmentation to the supply is justified". In practice it is not this easy. As was mentioned in Section 6.1 and as is shown by the following sections the efficiency criterion may conflict with the financial and social criteria. However as is demonstrated later in this chapter it is often possible to reconcile these conflicts to some extent, and there are often other problems associated with marginal cost pricing which are more intractible.

Firstly there is the theoretical problem of definition and the practical problem of measurement, i.e. it is extremely difficult to ascertain what marginal cost is. The problem of definition arises from the indivisibilities inherent in water supplies, and there are a number of alternative approaches to marginal cost which are ignored in this report. A cursory examination of comparing alternative methods was made by the consultants but it was clear that a more sophisticated approach than that which has been adopted did not produce any useful results. Firstly most of the data used is so approximate that any marginal analysis has to be treated with care. Secondly the costs of future augmentations which are required for some of the alternative approaches to marginal costing such as "average incremental

cost"* are completely lacking. Consequently this report will restrict itself to the most simplistic concepts of marginal cost.

(a) the short run marginal cost which is equal to the short run variable costs of production provided that the supply is not up against capacity. These costs will be quantified for every town and are very low in most townships i.e. given the new supply and a labour force to operate it there are few extra costs associated with actually using the supply.

(b) the long run marginal cost which takes into account the costs of future augmentations. No attempt is made to quantify these costs. However this is at present unimportant since this report restricts its consideration of the appropriate pricing policy to the 1980's, during which time there is considerable spare capacity. Although certain components will be augmented towards the end of the decade, they will be relatively limited investments. Even when planning augmentations the marginal costs of the new supplies may be quite low once the decision to augment has been taken, since there are often significant economies of scale associated with water supplies.

Theoretically the short run marginal cost should be charged until demand reaches capacity. At this point price should be increased so as to ration supply. Price should be increased until long run marginal cost is being charged and the supply is fully utilised. At this point further investment is justified but once the investment has been made the efficiency criterion would suggest dropping the price to short run marginal cost since the only real costs now involved are the costs of operation and maintenance. Although this strategy leads to an efficient use of resources when the supply is operating below capacity and provides an accurate signal for justifying new capacity, it is impractical for a real life situation since the "lumpiness" of water supply investments would lead to vast fluctuations in prices whereas for practical purposes it is desirable to maintain a stable structure with gradual increases in price.

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* For an outline of this and other approaches to marginal cost see "Alternative Concepts of Marginal Cost for Public Utility Pricing: Problems of Application to the Water Sector". World Bank Staff Working Paper No. 259 IBRD Washington May 1977.

Secondly even if a problem of vast fluctuations in price did not exist the efficiency criterion may require frequent price increases. It is unlikely that it would be possible to obtain political acceptance for this. In addition the revision of the tariff structure may itself be a difficult and costly exercise and a policy based primarily on marginal cost criteria may conflict with the need for a system that is easily understood and easy to administer.

Thirdly a strict efficiency criterion would require temporal changes in price, for example higher prices during peak demand periods.

Fourthly marginal cost pricing does not take externalities into account, and finally the market price marginal cost needs to be corrected for market distortions if accurate resource allocation decisions are to be made.

However in this report most of these problems will be by-passed by (i) only considering the simplest definitions of marginal costs and (ii) by concentrating attention on the appropriate pricing policy for the next few years during which time marginal cost will be low.

6.3 The Financial Criterion.

6.3.1 Introduction to the Financial Criterion.

A strict financial criterion requires that revenues cover all operating and capital costs, including depreciation and interest charges. Thus whereas the economic approach ignores sunk costs, the financial or accounting approach includes all such costs and is concerned with total and average costs. It means that water rates have to be based on total average costs and large discrepancies can occur between the structure of prices and costs.

During the early years of the Western Province township water supply programme when demand is well below capacity the rates would be higher than the prices indicated by economic considerations. Conversely when demand is approaching capacity which could only be increased by very high cost augmentations, (for example when Phase III is necessary), the financial criterion may indicate a lower price than is appropriate.

I.B.R.D. has been a leading voice in urging that water supplies are public utilities which should observe strict financial criteria although its attitude appears to have softened in recent years. In 1967 Ripman argued that subsidisation of water supplies in developing countries inhibits financing and is a major cause of the critical and worsening shortage. The subsidies actually provided are too small so the service inevitably deteriorates. It is certainly true that in some developing countries a lack of finance has led to a deterioration of existing water supplies and to a curb on the development of new supplies. This has happened in Zambia with respect to the operation and maintenance of some supplies. In Western Province finance has been a constraint for both repairs and operation (fuel etc.). But more importantly it could become an even more serious factor in the future. However it is false to assume that subsidies will never make up any shortfall and that non fulfillment of strict financial criteria in the rating policy will inevitably lead to a poor service.

Although the Bank's attitude has softened one still hears statements such as pricing based on financial criteria contributes to good management by permitting improved service, efficient use of personnel and other resources. Anyone who insists for example that communal point users must be charged should first examine the question of why are we bothering to supply these consumers at all. Nevertheless financial viability cannot be neglected and some financial criterion must be selected, such as, revenues must cover operation and maintenance costs with Governments/ donors financing all capital costs, i.e. the present policy. This is acceptable provided that the Government fully appreciates all the implications of such a policy and is prepared to finance all capital development either directly or indirectly through donors. In the case of the programme currently being examined where foreign aid in the form of grants is already committed to certain projects, the role of financial criteria is less certain and it could be argued that the covering of operation and maintenance costs is a more appropriate criterion than the more stringent one of covering all costs. The crucial point is that whatever criterion is selected the authority must seriously attempt to adhere to it unless it is later shown that the social and economic costs of doing so make it appropriate to alter the originally selected financial criterion. It is vital that the problem of finance is tackled before the new schemes are operational. It will be necessary to make financial projections based on various sets of assumptions regarding pricing policy and to examine the financial implications. If they appear to be unacceptable the pricing policies will

have to be re-examined and altered. One of the major purposes of this report is to provide a base for such financial exercises.

6.3.2 Justification for Less Stringent Financial Criteria.

The weighting that will be given to the different criteria will in part depend upon how water supplies are viewed by Government. Firstly there is a strong case for regarding water supplies in Western Province primarily as a social service. If this is accepted then financial criteria are less important than if the supplies were regarded as public utilities. Secondly Government may view water supplies as a "merit want" which they elevate above the market place. For example, if it is believed that significant externalities,(for example health benefits), exist,the willingness to pay for water may underestimate the social benefits. Alternatively consumers may not realise the true value of the water supply even for themselves. Consequently they may use less than optimum amounts of water unless it is heavily subsidised or free. In these cases the role of financial criteria may again be rather limited.

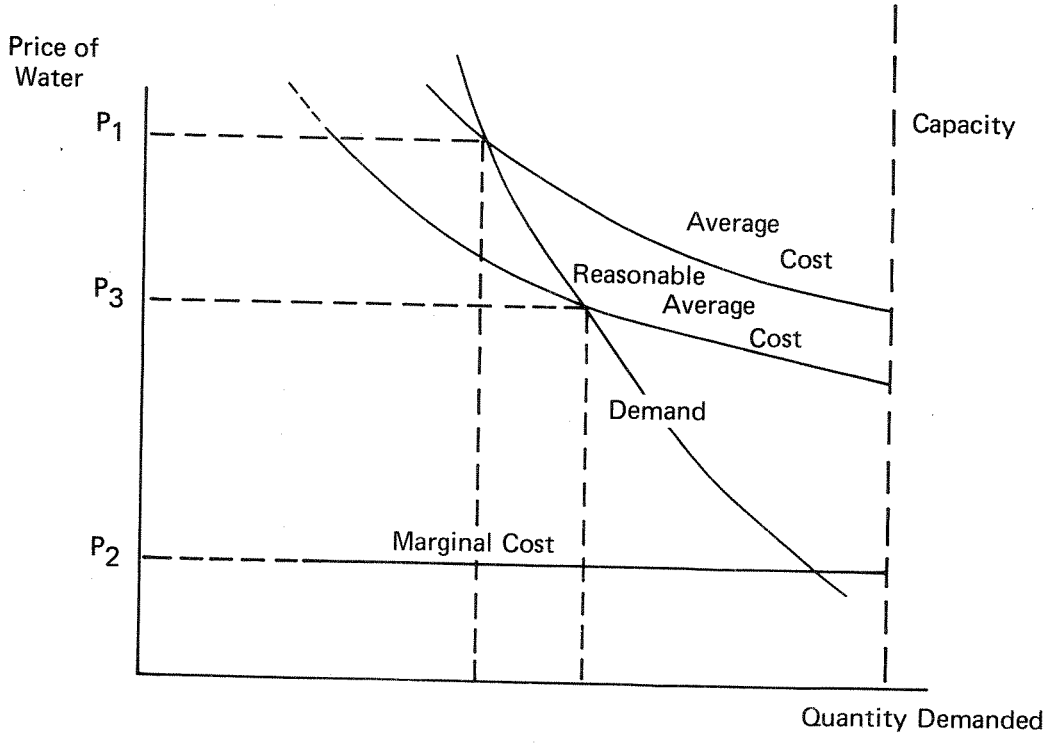
An extremely strong argument against strict financial criteria is that if the supplies must cover all their costs demand would be extremely low and it would not be justified to expand the township supplies now. Consequently the decision which Government has made to invest in the eight township supplies is either incorrect or an endorsement of paying limited attention to financial criteria. The consultants believe that latter suggestion is true and would argue that advocates of strict financial criteria tend to ignore the low level of incomes of communal point consumers, the amenity value, externalities, indivisibilities, and economies of scale of water supplies.

The most telling argument against a strict financial criterion is that if the price of over 50n per m^3 necessary to cover all costs was charged for all water consumed, consumption would fall and a price increase would be required. If this was implemented a further fall in consumption would occur and a further price increase would be required ..... ad infinitum. Consequently the adoption of a strict financial criterion is completely impossible.

There is often a strong case for not meeting financial criteria where the water supply organisation is not very efficient.

Figure 6.1 shows the average cost curves of a water supply assuming (i) an inefficient and (ii) a reasonably efficient, organization. The short term marginal cost is assumed to be low for example just the additional chemical and energy costs. It can be seen that if strict financial criteria were applied that price P_1 would be charged and that if economic criteria were used price P_2 would be charged. However if the water agency was more efficient a rate of P_3 would meet financial criteria. Hence although Government might say that at any rate below P_1 they are subsidising the consumers, one could also say that at any rate above P_3 the consumers are subsidising the water authority's inefficiency. Since there is no reason why consumers should pay for Government inefficiency there is a strong case for arguing that the Government should not pass on the full cost to the consumers. Consequently P_3 should be the maximum price charged. In practice this price will be difficult, if not impossible, to determine. However it supports the argument that rates do not need to meet strict financial criteria in Western Province.

Figure 6.1



6.3.3 Major Consumers.

It is often possible to view major consumers as important contributors to the achievement of financial viability, since social criteria are less important when considering such consumers. However there is very limited scope for utilising major consumers in this way in the townships of Western Province. They are very limited in number and their total demand accounts for under 15% of all water demanded. Furthermore a major part of this is for Government institutions such as hospitals. Industrial/commercial demand is very limited.

6.3.4 Recommended Financial Criterion.

It has been shown above that the adoption of a strict financial criterion would be (a) undesirable, and (b) impossible. Nevertheless some financial criterion must be used and enforced in order that the supplies do not become completely unviable. Intuitively the current Government objective of covering all operation and maintenance, collection and certain overhead costs seems an attractive compromise since its achievement would mean that development expenditures will not lead to a continuing increasing burden on the recurrent budget. In addition it is an objective that is easily defined, quantified and understood. Consequently it is recommended that the current financial criterion is a suitable financial target for a future pricing policy.

6.4 Subsidisation.

Any consideration of subsidisation of township water supplies in Zambia must take into account that other services are heavily subsidised. This is illustrated below.

The sale of electricity to small/medium sized towns in Zambia is highly subsidised. Most such towns are classified under the heading "Rural" in ZESCO's accounts where the term"Rural"means those towns supplied with electricity which are not connected to the Copperbelt, Midland, Southern supply grid. Although Mongu would be typical of the towns under this category it is in fact classified under "Southern Area" since the national grid reaches Mongu. Nevertheless an examination of the financial ramifications of supplying electricity to towns classified as "Rural" demonstrates the high level of subsidisation provided by ZESCO to townships which are not dissimilar from those being considered in this water supply study.

The latest annual accounts available from ZESCO were those for 1977/8. It is understood that the organisation's profits of that period have since deteriorated and ZESCO has been making losses. Nevertheless the principles concerning subsidisation of smaller towns is not affected. Table 6.1 presents the overall financial picture of ZESCO's operations in 1976/7 and 1977/8.

Table 6.1

Accounts of ZESCO's operations in 1976-8.
(million K).

	1976/7	1977/8
Electricity Sales		
Rural sales	1.3	1.6
All other sales	30.4	45.2
Total sales	31.7	46.8
Other Income	1.3	1.9
Turnover		
Rural area	1.4	1.6
All other areas	31.7	47.1
Total turnover	33.1	48.7

Table 6.1 (Cont'd.)

	1976/7	1977/8
Operating Expenses and Finance Charges		
Rural area	4.4	5.8
All other areas	27.6	37.2
Total	32.0	43.0
Profit/Loss		
Rural area	-3.0	-4.2
All other areas	+4.1	+9.9
Total	+1.1	+5.7

An examination of Table 6.1 reveals the following facts:-

(i) ZESCO heavily subsidises its sales to the smaller towns in Zambia i.e. its "rural" sales.

(ii) The"rural"losses cancelled out over 73% and 42% of ZESCO's profits from its other operations in 1976/7 and 1977/8 respectively. These figures are rather dramatic when it is realised that retail sales to the "Rural Area" account for only 4% of ZESCO's retail sales and for only about 1% of total sales, (the greater part of the electricity generated was sold in bulk to C.P.C. (mines) and exported. This provided 57% of ZESCO's revenue in 1977/8 and while it is true that the greater part of ZESCO's profits come from these bulk sales only the"Rural Area"made losses).

(iii) Those losses are due to the high cost of generation in the "Rural Areas"rather than to low consumer charges. "Rural"sales only covered just over 29% and 27% of costs in 1976/7 and 1977/8 respectively. In other words ZESCO was subsidising "rural"consumers to the extent of over 70% of the cost of the product.

Even though the Mongu supply area receives it's electricity from the main Southern supply line it also benefits from subsidised electricity. The area manager reported that monthly sales average K8,000 per month, while average monthly operating expenses average K15,000. Thus even when depreciation, finance charges and the part of head office expenses attributable to Mongu are excluded, consumers are being subsidised by about 50% of costs. When those charges are included the level of subsidisation in Mongu approaches that of the towns categorised as "Rural Area".

Thus despite the fact that the average unit price of retail sales in the"Rural Area"was higher than that of retail sales in the main supply areas, ZESCO's operations on the Copperbelt, in Lusaka, and its exports heavily subsidise its sales to rural areas, where rural areas means towns of the size of Mongu, Kaoma, etc.

Recent studies have also shown that there is also a considerable degree of subsidisation in public housing in Zambia. For example, the income of the Mongu housing account failed to meet its expenditures in 1980 and had to be subsidised by the council's general fund.

Thus if one can justify subsidisation of water supplies on economic and social criteria in towns like Mongu, there should be no reason in principle why such supplies should not be subsidised. Any opposition based on Government financial constraints would only be valid if it could also be shown that it is more worthwhile to subsidise electricity than to subsidise water supplies in the townships of Western Province.

6.5 Social and Other Criteria.

The social criterion is subjective and includes objectives such as relieving poverty, meeting basic needs, redistributing income, etc. It would require that D.W.A. provides all inhabitants of the supply area with a certain minimum quantity of water at a price they can afford to ensure satisfactory health standards, i.e. no consumers should be excluded from using the supply on the basis of price. Social criteria may often suggest that the service is worth more than the people are willing to pay. Thus a low price is indicated in order to make the supply widely available to low income groups.

In addition to considering economic, financial and social criteria the architects of a pricing policy/tariff structure must ensure that it is administratively simple and can be handled effectively by the probable calibre of staff. It must also be acceptable to consumers, local leaders and politicians.

6.6 Reconciliation of Conflicting Criteria.

In both the short and medium terms the economic and social criteria will both suggest a low price for water from the Western Province township supplies. Consequently there is unlikely to be a conflict between these criteria at least during the early years of the schemes. However even when marginal cost is low a marginal cost policy may have to be modified if that low price is still sufficiently high to exclude some poor people from using the supply or discourage them from taking the necessary minimum quantity.

Unfortunately where as in the case of Western Province during the 1980's marginal costs are low and there is considerable spare capacity, or where long run marginal cost is decreasing no tariff policy will be entirely satisfactory. The low water rate suggested by the economic and social criteria, i.e. a rate well below average cost,would lead to a large continuing financial deficit and would therefore conflict with the financial criterion.

Alternatively if strict financial criteria were adopted use of the scheme would be limited, the level of under-utilisation would increase, the rating system would be inequitable and some or even a majority of consumers may be excluded from the supply altogether.

There are three major alternatives available to the authority that will partially reconcile the conflicting objectives of the policy.

1. The water supply authority can act as a discriminating monopolist and practice price discrimination between different groups of consumers i.e. base charges on what the traffic will bear. There are three clearly identifiable groups in the scheme townships, communal point users, individual connection consumers and industrial/commercial/institutional consumers. The social objective of very low prices or even free water for the poorest section of the society can be met by low, or as is recommended zero, rates for communal points. The financial criterion can be met in part by higher rates for other consumers. In particular it would involve higher prices for industrial and commercial consumers. It would partially reconcile social and financial criteria but in Western Province it would be far from perfect with regard to the efficiency criterion.

2. It may be possible to reconcile the efficiency and financial criteria by charging consumers fixed basic fees in order to raise revenue, combined with a low cubic metre rate for additional consumption based on marginal cost, to encourage full use of the facility. However this strategy potentially conflicts with social criteria and the fixed charge must be low enough so that it does not deter anyone from consumption altogether. Therefore it may be necessary to have differential fixed charges so as not to penalise low use consumers. As when rates are based on flat rate charges, these differential basic fixed charges should be related to different catagories of consumer, for example, low cost housing, other domestic, institutional, commercial and industrial. However all consumers may pay the same rate for usage above that covered by the fixed fee.

3. The third possible way to achieve reconciliation is to utilise a two part tariff system. This may be especially appropriate where marginal cost is high since is can lead to a high level of reconciliation between the three major criteria. Concessionary low rates would be charged for communal consumption and for minimal use from private domestic connections to provide for basic health needs, to encourage use up to the desirable minimum level and to satisfy social criteria. Above this minimum consumption level the rates can be increased to that demanded by the economic criterion, i.e. to be in line with the high marginal cost. This strategy will achieve a high level of reconciliation between economic and social criteria. Wastage will be discouraged, resources should be used efficiently and the reduced demand will enable expensive augmentations to be delayed. In addition the financial criterion will be satisfied whenever marginal cost exceeds average cost and a financial surplus may even be generated.

However during the early years of the Western Province township schemes when there will be considerable spare capacity and low marginal costs, even a two step tariff will not be able to reconcile the financial criterion with the low price demanded by the economic and social criteria. However the social criterion can be satisfied by a low rate for a certain limited consumption. Consequently a two-part tariff will enable social criteria to be fulfilled and will permit a straight trade off decision between the financial and economic criteria unimpeded by social considerations when

determining the price for additional usage.

When the supplies approach capacity the situation described above will occur.

The marginal costs will increase since they will reflect the costs of further augmentations and the economic criterion will require that the price is increased to discourage demand. Thus at this point although financial and economic criteria are unlikely to suggest the same price they are unlikely to conflict seriously. Consequently at all times a two step tariff policy has considerable merit.

The consultants' policy recommendations quantified in Section will combine these approaches to reconcile the conflicting objectives of a tariff structure.

It is recommended that, where it is considered appropriate to charge for water on a quantity used basis, rates be composed of a fixed basic charge together with unit rates for additional consumption. The effective unit rate for the first part of consumption will be lower than the rate for the additional consumption. The objective is to meet social criteria and is in effect a two part tariff. The first part is a fixed basic sum in order to simplify the billing process and to guarantee a certain minimum income from every consumer every month. It is recommended that a discriminatory pricing approach based on different categories of consumers be adopted with regard to this minimum charge.

Although the recommended tariff structure satisfies social criteria it does not fully accord with either economic or financial criteria. The recommended price for additional use will, during the 1980's, be above marginal cost, i.e. it will not be "efficient" since it will restrict use of the facilities to below optimum use. Furthermore it will only partially meet financial criteria. But as has been discussed above it is impossible to fully satisfy all criteria and it is considered that the recommended policy represents the best compromise.

D.W.A. has in theory, been following a similar policy for some years. Consequently the consultants endorse the present theoretical policy in principle where it is appropriate to charge for consumption on a quantity used basis. However they question both the prices currently charged and the level of use at which the price increases.

It is considered that the quantity of water ($35m^3$) which D.W.A. allows consumers at the low initial rate is too large. In some countries 6-8 m^3/household/month represents the low price cut off point. If D.W.A. was to allow the average 5 member household 500 litres/day at the low rate, consumers would be able to use the full low cost housing design figure of 100 litres/person/day before being charged higher rates. Since it is considered that this quantity is quite generous enough, it is proposed that the cut off point between the low initial rate and higher water charges should be 15 m^3/household/month.

6.7 Flat Rate Charges.

The previous section explained the background to pricing policy when it is appropriate to charge for water on a quantity consumed basis. However this is not always the case and the question of whether or not to meter to enable water to be charged for on the basis of consumption is discussed in Chapter 8. This section provides a background to charging on a flat rate basis.

Flat rate charges are administratively simple and avoid all the costs associated with metering. However they are sometimes criticised since the same water rate for all consumers means that they are harder on the poor while the rich use more water. Metering on the other hand, is fair to low use consumers. However even when metering is adopted it is usually necessary to have a minimum charge which can be as high as, or represent a very significant percentage of the flat rate charge. Furthermore if it is decided that all or certain groups of consumers should be charged flat monthly water rates there are a number of alternative criteria on which the charge can be based to minimise inequity. Firstly it could depend on the ferrule of the consumers tap with additional charges for additional taps. This possibility has some merit and is easy to apply, though it could encourage tampering. Secondly it could be based on some form of property value. Although the correlation between the rates based on this criterion and the quantity of water consumed will be poor it would be no worse than the correlation when rates are based on size of ferrule. In addition it may be a reasonable equitable method of pricing since rates may crudely be related to ability to pay.

If the Government decides that flat rate charges are appropriate for the township supplies the consultants recommend a pricing method which combines these approaches. The basic charge should be related to the housing category (a) informal (b) low cost (c) medium cost and (d) high

cost. The low basic rates for categories (a) and (b) should only allow for one tap, with additional charges for extra taps.

Flat rate charges encourage consumption and also lead to increased wastage since there is no incentive for consumers to save water. Experience from other countries suggests that low cost housing consumers who are metered may only use half the volume of water that they would have used if they were charged on a flat rate basis.

Consequently if flat rates are charged for any groups of consumers consideration should be given to water wastage controls. The simplest would be small orifices to limit the quantity of water that a household could draw. Block meters could be used as control devices whereby if the consumption of a small consumer area exceeded a certain amount all consumers within that supply area would be subject to a surcharge. More expensive alternatives would include house tanks with small orifices and float valves.

The importance of detering excessive consumption depends on the relationship between the quantity demanded by consumers and the capacity of the supply. For some time after a scheme is constructed or augmented, when there is considerable spare capacity, the encouragement of consumption accords with an economic efficiency criterion since the benefits arising from the supply would be maximised for a very limited marginal cost. These low marginal costs also mean that wastage is not an important factor. But as the supply approaches capacity flat rate charges conflict with an economic criterion since marginal costs are increasing to reflect the cost of augmentation. Consumers are not discouraged from using as much water as they can even though they might be deriving only very minor benefits from their marginal usage. At the same time other consumers may be unable to obtain sufficient water for usage with higher benefits. When demand is close to, or has reached capacity, the cost of wastage is extremely high, i.e. the opportunity cost of that water is high. Consequently when a supply is close to capacity flat rate charges may become inappropriate even though they were the best policy some years earlier.

Flat rate charges may not meet the financial targets but they do not necessarily conflict with financial criteria. Since it may be possible for the authority to extract as much from consumers by means of flat rate charges as by another pricing method.

6.8 Uniform Rates.

Whatever criteria are used to determine the appropriate water pricing policy in Western Province it would be possible to base rates upon the financial/economic characteristics of every individual township water supply or to adopt a uniform policy for all the schemes. It is recommended that, with major one exception, a uniform rating structure is adopted. This, of course, means that although the basic pricing policy recommended by the consultants encompasses the idea that rates should be related to costs and the actual rate structure will depend upon the cost structure of the overall programme, the water rates within an individual township may not be so closely related to the costs of the water supply. Consequently the efficiency criterion which strictly requires that different prices are charged at different supplies depending on the marginal costs of the supply will be contravened in some townships. The following factors influenced the recommendation:

(a) it is administratively simple and practical.

(b) it is equitable that consumers in different towns with similar levels of income pay identical water rates.

(c) the cost data, even at this stage are not sufficiently precise to justify a policy which would depend on reasonably accurate cost figures for both construction and operation.

(d) a uniform rate can be set to match whatever economic criteria is appropriate for the eight townships as a whole.

(e) a uniform rate need not seriously contravene economic criteria since although the cost structures of the different township supplies are different all their marginal costs are low in comparison to their average costs.

The one exception to this uniform pricing policy mentioned above relates the fact that metering and charging on a quantity consumed basis is recommended for Lukulu and Namushakende, but that flat rate charges are recommended in the other townships. Hence there will be two, but only two rate structures for the eight supplies.

6.9 Inflation.

In examining the question of water rates the phenomenon of inflation must not be ignored. Frequently Governments allow water rates to fall behind inflation. This may occur because Government tries to use publicly provided services as one of the instruments in "the fight against inflation". However the more usual reason for failing to keep water rates in line with inflation is that Governments lack the political determination to back unpopular measures. If rates do get out of line with inflation they will also be out of line with Government's policy goals provided that rates were rationally determined in the first place. Consequently if Government implements a water pricing policy in Western Province that is based on a certain rationale it is important that the water rates are regularly revised in order to maintain the real value of the rates originally determined. There is nothing wrong in principle with subsidisation and as is discussed in this report subsidisation of the township water supplies is considered both necessary and appropriate. However subsidies should be planned and sanctioned with the knowledge of their extent and implications, and not arise by default by failing to increase prices in line with inflation.

In order to determine the optimal period before water rates are revised it is necessary to trade off the need to keep them in line with inflation with practicality and political considerations. The first consideration would suggest very frequent increases but the latter suggest tempering enthusiasm for constant increases. It is proposed that increases every two years would be suitable for the water supplies in Western Province. They may also need to be revised, though much less often, for incremental cost changes. Consequently when the two yearly inflation increase is being investigated, the planners should also examine whether marginal cost alterations justify additional changes in the rates.

All rate recommendations made in this report are expressed in 1980 prices unless it is explicitly stated otherwise. Therefore the reader can estimate the recommended rates for any particular year by applying the probable inflation from 1980 to the base figures.

7 ABILITY AND WILLINGNESS TO PAY FOR WATER.

7.1 Introduction.

In formulating a water rating policy which will work, consideration must be given to the willingness of consumers to pay for piped water. Willingness to pay is a combination of the ability to pay, and of the perceived need for the water that is being sold.

7.2 The Perceived Need for Water.

However much people want water they will be limited by their ability to pay but the perceived need for water in some areas of the world may mean that people are willing to pay a high proportion of their cash income. On the other hand if people have high incomes but believe that their existing natural sources are as good as they require they will not be willing to pay anything for water.

In most of the supply areas of the project there are alternative sources of water but none are comparable with the township supplies, consequently there is likely to be a genuine willingness to pay for clean water. However since other sources do exist their willingness to pay will be much lower than if they were in a desparate situation.

7.3 Ability to Pay.

It is important to estimate the ability of consumers to pay for water since it is desirable that the rate levels do not exclude the lowest income consumers from being able to consume a certain minimum amount of water.

In estimating the ability of consumers to pay for water two factors must be considered. Firstly the income of the population and secondly the proportion of this which could be spent on water. It is always difficult in situations, such as that which exists in Western Zambia, to calculate the real incomes of people where part of that income (agricultural crops, fish, etc.) is consumed directly. Furthermore income data from the townships being studied is very sketchy, not up to date and sometimes non existent. However an attempt was made to collect whatever information was available and this has been utilised to prepare approximate estimates of income.

During the first field visit, the investigation of present income levels and ability to pay for water was restricted to discussions with Township/Rural Council and D.W.A. personnel living in the townships of Western Province. There was a high degree of uniformity in the answers but it must be noted that they are not based on a scientific investigation using sound statistical methods.

The estimates are summarised in Table 7.1.

Table 7.1

Estimates of the Township Residents' Incomes and Ability to Pay for Water.

	Average income K/month	Ability to pay for water K/month
High cost housing residents	250+	10+
Medium cost housing residents	200-250	10
Low cost housing residents	100-150	3-5
Informal housing residents	40-80*	1-2**

* It was reported that the poorest families, with no member in employment have an income of at least K30-40 per month.

** The general feeling was that almost all peri-urban families could afford K1 per month. The problem is the tradition of non payment.

7.4 Employment.

Limited economic activity in the townships of Western Province (agriculture fishing, trading, construction,transportation, and very small manufacturing activities) means that Government services represent by far the largest source of employment. Nevertheless unemployment is not high and in the townships most people are gainfully employed. Even those families living in informal housing often have one member in cash employment. Otherwise they would have to return home. Officers in some townships e.g. Kalabo claimed that the population is more fully employed in the smaller towns than in Mongu and there is less unemployment in Mongu than in Lusaka.

An analysis of the employment situation in 1969/70 described in the Township Development Plans shows that in the townships of Western Province excluding Mongu, on average 50% of males over 15 years were employed, that 20% were unemployed and that 30% were neither i.e. they were students over 15 years, old, sick, etc. Hence over 70% of males over 15 years available for employment had jobs. Furthermore Ostlandskonsult's report shows that in a medium/low cost sample area male employment was almost 100%. The 1969/70 survey showed that only 4% of women were employed but the vast majority were not available for work and only 3% could be described as unemployed. There were considerable variations from town to town but bearing in mind the quality of the data an examination of differences between townships was not justified.

It can be said that there was, by the standards of urban areas in the developing world, a reasonably high level of employment. The level of employment is not necessarily as high today as it was ten years ago. Nevertheless in conjunction with statements by various officers interviewed in the townships that the unemployment situation in the townships of Western Province has not deteriorated sharply in the last few years, it suggests that the majority of families have at least one member with a regular monthly cash income. Even in the poorer areas i.e. informal housing areas it is estimated that 35%-50% of households have a regular wage earner.

The figures are not inconsistent with estimates by Government officials that at least three families in four have a regular source of cash income. The Township Development Plans further show that approximately 50% of those employed are working for the Government/ Public Service, and 35% of all households have a secure Government salary.

The reasonably high level of employment is also demonstrated by the experience of Nakambala Sugar Estate. When that organisation undertook their March, 1981, recruitment exercise in Western Province they only managed to obtain 824 workers when they had job opportunities for 1000 people. The workers are paid around K60 per month and are also provided with free food and accommodation. Thus workers should be able to return home after their 4 month stint with K200 in the pockets. Even though the work can be hard and the men are away from

homes for four months K200 would be a reasonably attractive proposition if there was a high level of unemployment in Western Province.

In addition to the reasonable level of employment many families even in the townships especially in the informal housing areas are involved in economic activities other than their main cash income job. For example, many families are involved to varying extents in fishing for subsistence.

Consequently there are few families in the townships suffering desparate financial hardship and the experience of Nakambala estate shows that although most people are poor there is no desparate shortage of cash. Thus most people could afford to pay something for the water supply.

7.5 Incomes in Mongu.

Table 7.2 presents income data for Mongu and Kasama, (which were grouped together in the survey), from the 1974/5 Household Budget Survey. The second column shows the same income groups, as are presented in the first column for 1974/5, for 1980/1 on the assumption of an annual 10% increase in incomes since 1975.

Table 7.2

Income Distribution of Households in Mongu and Kasama.

Monthly income group 1974/5 (K/month)	Monthly income group 1980/1 assuming an increase of 10% p.a. (K/month)	Percentage distribution of households (%)	Cumulative percentage distribution of households (%)
0-20	0-35	9.5	9.5
20-40	35-71	17.0	26.5
40-60	71-106	17.5	44.0
60-80	106-142	16.0	60.0
80-100	142-177	6.5	66.5
100-120	177-212	8.5	75.0
120-140	212-248	9.0	84.0
140-160	248-283	3.0	87.0
160-180	283-319	1.5	88.5
180-200	319-354	1.5	90.0
200-250	354-443	4.5	94.5
250+	443+	5.5	100.0

Before one can use the data in Table 7.2 a number of reservations must be stated. Firstly the sample on which the survey was based was not large, 192 in Mongu and 192 in Kasama, nevertheless a 6% sample in Mongu is acceptable. The fact that the published data does not allow one to separate Mongu and Kasama figures is more serious. Thirdly the assumption of an annual increase of 10% during 1975-80 is merely an informed guess. Fourthly although the figures are based on Mongu it is believed that there are no large differences between Mongu and the other townships. However given these reservations the data suggests that the consultants' first estimates were reasonable.

The average income in 1974/5 in the semi/urban sample areas (Mongu and Kasama) was K87 cash and K5 value of own produce consumed making K92 in total. However the median incomes was about K68. During the last six years incomes have increased significantly in cash terms but have probably lagged behind inflation. If it is assumed that incomes have increased by 10% p.a. the current median income would be around K120. The corresponding mean income would be just over K160.

If one assumes that the lowest 50% are living in informal housing, the next 38% in low cost housing and the top 12% in high cost housing (these figures are based on the percentages presently living in the different housing catagories), those living in informal housing have incomes in the k0-120 range, in low cost housing K120-300 and in middle/high cost housing K300+. Table 7.2 also shows that the corresponding median incomes would be K70, K180 and K300+. Clearly the assumption of placing all informal housing residents as the bottom 50%, and the low cost residents as the middle 50-88% is somewhat spurious. But nevertheless it is suggested that the results are meaningful in that they indicate that the consultants' initial estimates shown in section 7.3 can be used as minimum income estimates. Table 7.3 compares the initial median income estimates with those based on projecting the 1974/5 survey results.

Table 7.3

Median Incomes.

	Field work estimate	Estimate based on projecting 1974/5 survey	Guess-timated total income	Guess-timated cash income
Informal housing residents	40-80	70	70	50
Low cost residents	100-150	180	120	110
Medium cost residents	200-250	300+	250	240
High cost residents	250+	300+	300+	300+

The first two columns have been utilised to guesstimate current median incomes for the different housing catagories. The figures are shown in the third columns of Table 7.3. Since these figures represent total incomes a subsistence estimate must be subtracted to derive cash incomes. There is little information available on which to base this estimate and figures of K20 for informal housing households and K10 for other catagories are simply assumed. The resulting figures are shown in the last column of Table 7.3.

7.6 Rural Incomes.

Incomes in Western Province have always been well below the national average. The First National Development Plan estimated that the average Western Province per capita income was around 20% of the national average figure. A recent report* estimated that the average per capita income was only K53 p.a., a family income of around K320 p.a.

However, this type of overall figure is not very meaningful in the context of the present study since it does not differentiate between the rural and township populations. It is probable that the current rural figure is close to the 1979 overall figure since the rural figure in 1979 would have been lower than the overall figure, but will have increased over the last two years.

There is no good up-to-date data on rural incomes but one can examine certain sources of income, for example cattle. The cattle population of the province is around 400,000 and the overall off-take is about

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* Report of the Western Province Agricultural Development Project. FAO - ADB 1979.

7%, i.e. 28,000 head. At a current average price of K150 per animal this would produce an income of K4.2 mill or approximately K10 per head of the rural population. Since this is one of the major sources of rural income in the province the figure demonstrates that rural incomes derived from within the area must be low. The largest source of rural cash income is seasonal labour in Mongu, Lusaka and the Copperbelt and in other places such as the Nakambala Sugar Estate. Other sources include sale of surplus maize, milk, fruit and fish, beer brewing, timber and crafts. However the difficulties of imputing money values to subsistence and the uncertainity of all figures make any estimates extremely precarious and the figure of K320 per family per annum mentioned above is probably of the right order of magnitude in the rural areas. The 1974/5 budget survey in which rural provincial differences cannot be seen, showed that the mean monthly rural household income including subsistence was K29 and the median monthly rural household income was K20. If it is assumed that these have increased at 10% p.a. the current monthly mean and median rural household incomes would be K35 and K53 respectively. Since it is known that rural incomes in Western Province are well below national rural incomes a figure of K25-30 for Western Province i.e. one consistent with the above figure of K320 p.a. would seem to be of the right order of magnitude.

The 1974-5 survey showed that approximately half of all rural income is represented by the value of own production consumed. Thus the Western Province median rural household cash income is estimated at around K150 per annum.

7.7 Cash Availability for Water.

The proportion of income that consumers can afford to spend on water has no objective answer. Clearly it will vary from group to group. Often the poorer cannot only afford less in absolute terms but also in percentage terms. As a household's income increases there is a marked decrease in total household expenditure as a percentage of its income and in its expenditure on food as a percentage of total expenditure, i.e. there is more money to spare for non essentials such as piped water, (although water is the most vital necessity, piped water is not). For example the 1974/5 Zambian budget survey showed that the poorest urban groups spent over 80% of their income

on food and that this percentage steadily fell as income increased so that the wealthiest groups spent less than 20% of their income on food. The proportion that a particular group can afford for water will depend on its income, its needs, and the costs of those basic essential needs. Although generalizations are always dangerous a figure of 5% of cash income is often quoted as the acceptable ceiling and this will be adopted in this study as the absolute maximum that consumers should be asked to pay. However it is generally considered more appropriate for rates to be 1-2% of cash income and the implications of these figures are also considered below.

A further indicator of ability to pay that is sometimes utilised is the consumers' expenditure on alcohol and tobacco. The 1974/5 household budget survey showed that almost all income groups spent around 5% of their income on alcohol and tobacco. This suggests that asking households to pay up to 5% of income for piped water is not totally unreasonable, even though most of the income of the lower income groups is spent on basic necessities.

Table 7.4 presents the ability of the different catagories of consumers to pay for water when figures of 1%, 2% and 5% of income are applied.

Table 7.4

Ability to Pay for Water.

	Fieldwork estimates K/month	Ability to pay as a % of estimated median cash income.		
		1% K/month	2% K/month	5% K/month
Informal housing residents	1-2	0.5	1.0	2.5
Low cost housing residents	3-5	1.1	2.2	5.5
Medium cost housing "	10	2.4	4.8	12.0
High cost housing "	10+	3.0+	6.0+	15.0+
Rural inhabitants	-	0.125	0.25	0.625

The similarity between the fieldwork estimates of the maximum acceptable rates and the figure of 5% is quite noticeable. It suggests that the maximum rates that should be levied are close to the fieldwork estimates. However if 2% is considered desirable the maximum monthly rates for informal, low cost and medium cost housing should be K1, K2 and K5 respectively. It can be seen that whatever criterion is used the

ability of the rural people to pay water rates is very low.

If informal housing residents consume the design figure of 40 litres per capita per day and if an average family size of 5 is assumed, the 5% criterion would suggest a maximum price of 42n per m^3 and the 2% criterion would suggest a maximum price of 17n per m^3.

If low cost residents consume the design figure of 100 litres per day and if an average family size of 5 is assumed, the 5% criterion would suggest a maximum price of 36n per m^3. The 2% criterion would indicate a maximum price of 15n per m^3.

If medium cost residents consume the design figure of 250 litres per day and if an average family size of 5 is assumed the 5% criterion would suggest a maximum price of 32n per m^3. The 2% criterion would indicate a price of 13n per m^3.

The 5% and 2% criteria applied to the high cost residents would indicate prices significantly higher than 32n per m^3 and 13n per m^3.

This background suggests that an acceptable range for the price of water, solely from the ability to pay point of view, is between 15n and 35n per m^3.

7.8 Quantification of Willingness to Pay.

Quantifying willingness to pay is a very difficult problem. Consumers themselves may not really know how much they are willing to pay until they are forced to go without. Secondly their present estimation of their own willingness to pay may be conditioned by the existing rate structure. Thus in the light of the existing limited information it is extremely difficult to quantify willingness to pay with much hope of being accurate. It can only be reasonably estimated by undertaking a major fieldwork exercise. Thus as far as the townships are concerned it will simply be assumed to coincide with consumers' ability to pay. However even the first fieldtrip showed that the willingness of rural consumers to pay for shallow wells and well points is very low. In addition to their low willingness to pay they do not perceive a high need for the improved supplies and are therefore not willing to pay anything more than token amounts. This is not to say that they do not appreciate the new supplies, it is simply that they often prefer to use their existing sources unless the new supplies are free or virtually free.

8. METERING.

8.1 Introduction.

A policy of wholesale metering involves capital, maintenance and administration costs on which the return when dealing with low income/low use consumers may not justify the cost. It may be better not to meter such consumers but to charge flat monthly rates. Consequently the question of metering is inextricably tied up with the structure of water rates. If a particular category of consumers is to be charged flat water rates there is no point in installing water meters at every connection. Conversely if pricing policy dictates that water rates shall be based on the quantity of water consumed, meters are necessary. However even if it is intended to charge on the basis on quantity used, i.e. to implement wholesale metering, in the long run it may still be worthwhile delaying the costs involved in metering if there is considerable spare capacity in the system.

Water supply authorities often favour metering since they concentrate their attention on the costs of not metering.

If consumers are not metered they have no incentive to prevent wastage and the idea that water is free can be perpetuated since the marginal cost of using or wasting it is zero. It may also be felt that it is unfair not to meter since one does not distinguish between the high and low users and the wealthier consumers are likely to be among the higher users.

However any supporters of metering must consider the costs of metering and examine all their own assumptions. For example, although metering will generally lead to consumers being more careful to restrict their usage and to prevent wastage, this will not always be true. For example some employers pay their employees water bills. Usually the size of the bill does not affect the consumer's income and other perks. Consequently the usage/wastage of consumers who have their bills paid on their behalf is unlikely to be effected by metering unless the unit charges are sufficiently high that employers become more conscious of the size of their employees water bills.

8.2 Present Policy and Attitudes to Metering.

Over the last few years senior officials of the DWA have on more than one occasion stated that it is now Government policy that all individual connections for all categories of consumer should be metered. However in practice a completely opposite policy is being followed in Western Province, virtually all consumers are charged a fixed monthly water rate irrespective of their usage in a given month, although a few large consumers are charged higher fixed rates than the average consumer.

Nevertheless during the consultants' discussions both DWA and council officials supported metering. It was reported that one council has been trying to order water meters directly. It appears that councils believe that metering would result in increased revenues but that they have given little thought to the full costs involved in metering.

8.3 Metering - Present Situation.

At present a high percentage of house connections are metered. Table 8.1 presents some very approximate figures, since the data obtained from different sources within DWA often conflicts.

Table 8.1

Meters and Unmetered Connections.

Township	Individual Connections		Percentage
	Metered	Unmetered	Metered
Kalabo	84	111	43.1%
Kaoma	140	62	69.3%
Lukulu	30	59	33.7%
Mongu	697	74	90.4%
Namushakende	23	14	62.6%
Senanga	60	120	33.3%
Sesheke	85	145	37.0%
Total	1119	585	65.7%

Even if the above figures are not particularly accurate it can be seen that a high proportion of house connections are metered. Overall nearly 2 out of 3 individual connections are metered although the overall percentage is highly influenced by the large number of meters in Mongu.

A large number of meters are not working. In Mongu the council officer responsible for water billing estimated that only 126 meters were working (18%). An investigation by the consultants showed that even some of the meters identified as working were obviously not working properly and reading accurately. In Kaoma a local officer claimed that 86 out of 140 were working (61%) but a closer examination of the records showed that this was an over-optimistic estimation.

Many of the meters are only clogged with dirt so that a very basic maintenance system would have ensured that they would still be working. There appears to be no maintenance system whatsoever and the repair facilities and spare parts are inadequate, although in some towns there are large numbers of meters in store. In Kalabo there are more meters in store (100) than there are installed on connections. There is no mechanism for any action to be taken when meters stop functioning. Meter readers may record the fact in their records but nothing else is done. Consequently there are large numbers of meters which are known to be faulty but no efforts are made to repair them. Consumers do not report the malfunction for two reasons (i) they know that nothing will be done (ii) they have no incentive to report it since their water bill will remain unaltered whether their meter is working or not.

Some meters record in metric units and others record in British units. There is still some confusion among the meter reading and clerical staff as to what the number that they write down really means. In addition simple meter reading mistakes are made even when the units are understood. Since the numbers are not used for billing purposes it does not really matter at present.

Consequently the whole metering situation at present is rather futile; (i) as mentioned above the majority of meters are not working (ii) even though they are not working properly some meters recording obviously incorrect consumption data are still being read (iii) although working meters are still read, consumers are not billed on a quantity used basis i.e. the readings are disregarded for billing purposes, (iv) even though meters are currently not fulfilling any function either for billing or for planning, new connections are still being fitted with meters in Mongu and some other centres. It was reported in Kalabo that a few existing meters were replaced last year.

The existence of meters also creates a ridiculous situation of inequality. Consumers with meters are generally charged a flat rate of K4 while consumers without meters are charged a flat rate of K5. Although there is nothing wrong in theory with metered low use consumers paying less than unmetered consumers, under present circumstances when no billing is done on a quantity used basis and faulty meters are not repaired it is a farce and naturally upsets unmetered consumers.

8.4 Future Requirements for Metering.

If in the future consumers are to be charged on a quantity consumed basis it is essential; (a) that meters are kept in good working order, (b) that meters are standardised in metric units to simplify the meter reading process, (c) that meter readers are more effective. It is unlikely that the calibre of meter readers could be improved in the near future but improved training will improve their performance and reduce mistakes. If it is necessary in the short term to continue to use different types of meters the classification of every meter must be made clear to everyone and the meter readers must be able to recognise the units immediately, (d) that meter readers report faulty meters for immediate inspection. It is possible that an effective metering system could induce some consumers to tamper with their meters Meter readers must be alert to this possibility and report any suspicions so that meters which have been tampered with are fixed immediately and are given higher priority than purely technical meter failures. In this way the guilty consumers will not profit from their misdemeanours. (e) that there is an effective maintenance system with sufficient trained men and spare parts. This will require the establishment of a maintenance team solely for inspecting and repairing meters. Even if a real effort is made in the future to maintain meters properly,meter maintenance will continue to represent a major problem which will only be solved if sufficient resources are always devoted to it. (f) that special attention is paid to the larger consumers. Since a faulty meter could quickly lead to a significant loss of revenue from a large consumer and to considerable wastage it is important that such meters receive repair priority. Also if as is proposed below most meters are only read once in 3 months, these meters should still be read monthly.

If a decision to meter is made prior to the construction of a supply the designers may be able to save distribution pipe costs by using smaller diameter pipes when it is believed that metering will significantly reduce consumption. However in Western Province the designers have paid no attention to the effect that metering will have on consumption and most of the designs are now complete. There is no sign that they will be modified in any way by a decision to meter, or not to meter. Hence the main capital cost saving of metering will only occur when the supplies are approaching capacity and when the reduced consumption brought about by metering permits delays of future augmentations. However if the supply networks are extended to new areas before demand approaches capacity, metering may allow pipe distribution costs to be saved, if it is shown in the next few years that metering does reduce consumption. In this case metering may be more valuable in new supply areas.

Conceptually the decision as to whether or not to meter a group of consumers can be based on a cost benefit analysis. The costs of metering are (i) the purchase and installation of the meters, (ii) the subsequent costs of maintenance and (iii) the reading and billing costs. In addition the reduction in consumption brought about by metering may reduce the level of benefits achieved. Metering may also result in a loss of head and slightly increase pumping costs.

The major benefits brought about by metering are (i) a saving in operation and maintenance costs if the metering reduces wastage and induces low usage , (ii) a subsequent saving in capital costs since lower demand will permit delays in implementing future augmentations (iii) cost saving in distribution pipes in new supply areas. There is also a minor benefit in that loss detection from the distribution system may be facilitated.

Theoretically the metering decision should be made by comparing the present values of the costs and benefits. Unfortunately existing data makes it almost impossible to forecast the probable fall in consumption that metering would bring about in Western Province. Consequently the approach that is adopted is to calculate what reduction in consumption would be sufficient to justify metering, and then to judge whether such a reduction is likely.

The capital costs of purchasing and installing meters for house connections will be as follows:-

1)	15 mm water meter	K52.00
2)	Fittings and values	K25.00
3)	Meter manholes or chambers	K15.00
4)	Labour charges	K 7.50
	Total capital cost of installation	K90.00

It is assumed that the meters have an expected life of 8 years and that they will have to be removed for cleaning, testing, adjusting and where necessary reconditioning every two years i.e. 3 times during their lives. It is assumed that the cost of this biannual maintenance will be twice the labour cost of installation i.e. K15. The costs of meter reading, based on a meter reader visiting 900 meters per month* and earning K1,500 per annum is K1.67 per meter per annum. Section 11.4 shows that the additional billing costs of a metered connection compared to an unmetered connection are K0.51 per annum. Hence the meter reading/additional billing costs = K2.18 per annum. The present value cost of meter purchase installation and maintenance = K90 + K33.33 = K123.33 where it is assumed that maintenance takes place at the end of years 2, 4 and 6 and that the discount rate is 8%. Consequently the annual cost of meter installation and maintenance, assuming an 8 year life is K21.5. Thus the total annual cost of metering = K21.5 + K2.18 = K23.68, say K24 per annum.

Section 5.9 showed that in most townships the short run marginal cost of water will be under 2 ngwee. Thus in order to justify the annual cost of metering of K24 it will be necessary to save at least 1200 m^3 per connection per annum or 3.3 m^3 per connection per day or 600 litres per person per day. Clearly wholesale metering is not justified using this approach.

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* Discussions with the DWA and council officers in the different townships revealed large differences in the estimates of the number of meters that a meter reader could read in one day. In addition there are significant differences in today's rates of meter reading between the different townships. As a result of their investigations the consultants estimate that a meter reader should be able to visit and read 40 meters per day on average. Although this figure is easily achievable the productivity of the meter readers falls short of this figure in some towns today. For example Mongu council employs three meter readers to cover less than 800 meters, the majority of which are not even working. However ZESCO reported that they have one meter reader in Mongu who reads 784 meters in five days i.e. 150/day. Thus the target of 900/month or 40/day is extremely modest.

The marginal costs in Lukulu and Namushakende are however much higher than the marginal costs in the other towns. The necessary savings in those towns are estimated as approximately 150 and 110 litres per person per day respectively. These figures make it worthwhile to seriously consider widespread metering, since they only represent 60% and 44% of medium/high cost residents' consumption. It is very possible that flat rate charges would induce extra usage/wastage of this magnitude.

Thus although metering in Lukulu and Namushakende may be justified immediately the only purpose of metering in the other towns would be to avoid needing to incur the costs of augmentations sooner than is really necessary. Unfortunately the consultants do not have any good data on the longer run marginal costs. But the Ostlandskonsult reports suggest that the cost of augmentations in 1988 (in 1980 prices) will be between 30% and 50% of the cost of Phase I. Consequently the longer run marginal costs will be very significantly higher than the short run marginal cost.

The annual cost of metering in Mongu in 1988 will be approximately K200,000 in 1980 prices. The cost of the augmentation will be approximately K1,500,000 in 1980 prices. Unfortunately any estimates of how much sooner the augmentation would be required would be based on unproven assumptions and any conclusions would be rather spurious. Furthermore the costs of metering and augmentation do not make the answer obvious. However if metering is not implemented demand will probably be up against a supply constraint before 1988. Since it is unlikely that any augmentations to the new scheme, which is not yet under construction, will be implemented before 1988, the cost of not metering will include problems of water shortage. It may therefore be sensible to adopt a policy of widespread metering during the 1980's. Such a policy will also enable the tariff structure to be used as a tool in delaying the need for augmentations into the 1990's if implementation capacity/development funds are limited.

Unfortunately the truth of the matter is that the consultants do not know whether widespread metering is the best policy. Furthermore it is unlikely that any rational decision could be made for some years until more data is available. However it is recommended that all consumers in Namushakende and Lukulu are metered. Due to the high marginal costs of water in these towns it is improbable that this will be a wasted cost even within the context of those towns supplies alone. Furthermore a comparison of the consumption in those towns in the period 1981-5 with consumption elsewhere, together with better data on the cost of augmentations, will permit

a sensible decision to be made regarding metering in the other townships. It must be appreciated that this decision should not only be based on a cost trade off but also on whether the authorities with limited capabilities can handle the technical and administrative burden that will be imposed by a policy of wholesale metering. (c.f. section 2.4).

It is also recommended that only large consumers in the other townships are metered immediately, but that the authorities keep an open mind as to whether wholesale metering will be adopted in those townships from the mid 1980's.

It is further recommended that one town where wholesale metering is inappropriate in the immediate future, for example Kalabo or Kaoma, should be selected for a pilot programme that would help determine whether a non metering/flat rate policy in low cost housing areas would be suitable even in the very long term. The programme would include wastage control measures, small orifices, block metering etc. It should be aimed at producing information on consumption and consumer reaction and data on the costs of alternatives to metering.

It is also proposed that even where metering is restricted to major consumers, meters should be installed on a representative sample of all connections since this should provide consumption and loss data necessary for operation and planning purposes. Accurate production meters and meters strategically located on the distribution network should also be installed. The latter will enable the authority to quickly identify excessive consumption by non metered consumers.

9. COMMUNAL POINT RATING POLICY RECOMMENDATION.

9.1 General Recommendation.

The policy of providing free water from communal points is recommended for the following reasons:

(i) it is considered appropriate that the minimum water supply service provided by commual points should be regarded as a social service, rather than as a public utility,

(ii) consumers only obtain a low level of services, they only take limited quantities of water which they have to carry home,

(iii) until supplies are close to capacity, marginal costs will be low and thus free water accords with an economic efficiency criterion,

(iv) the consumers ability to pay is very limited,

(v) free water supplies allow the Government to subsidise the poorer sections of the community,

(vi) in those areas where other, if very unsatisfactory, sources are available,only free water may persuade some people to use the communal tap instead of the poorer quality source. This may be especially true of the informal housing areas outside the township boundaries.

(vii) there is an external benefit arising from township water supplies since there is a public health risk if consumers use alternative polluted sources.

(viii) the policy would save the high cost of collecting rates from standpipes.

(ix) the revenue lost will only represent a small percentage of total revenue and costs.

The arguments against providing free water from communal points generally include:-

(i) there is a risk of greater wastage, but this is not true if communal point consumers are charged on a flat rate basis.

(ii) a greater financial burden falls on other consumers, or on Government finances. However as is discussed below it is believed that the Zambian Government will be unsuccessful in achieving a high level of rate collection even if it tries to collect rates from communal point consumers. Consequently this argument against free water can be dismissed.

9.2 Specific Recommendations.

It is recommended that water from communal water points in the townships be provided freely to all consumers other than (a) Government, (including council) employees and (b) any others renting houses from the councils. This policy is not totally satisfactory but does have a number of advantages discussed below. The three main criticisms to which it is subject are:-

(i) it is inequitable that Government/council employees should pay while others do not,

(ii) even the poorer urban people have better access to a range of services than the rural population. If they receive them free it would be unfair to the population living outside the townships.

(iii) it reduces the level of rate collection and the financial viability of the water supplies.

It would be clearly inequitable for senior Government employees to have to pay water bills if senior employees of other organisations did not have to pay but all such persons will presumably have their own house connections.

However it is considered less unfair for junior Government employees and any other people living in council houses to have to pay for using communal points while other consumers obtain free water. Firstly the Government employees are often living subsidised accommodation and are paying a lower rent than many other consumers living in similar standard accommodation. Recent studies have shown that the Government currently provides considerable subsidies either directly or indirectly to the public housing sector. Secondly they have a higher level of job security than other people. Unfortunately nothing in life is completely fair and the consultants proposal is not too inequitable. It has the merit that some finance would be collected for communal point use and as is pointed out below this is likely to be the greater part of the money that could realistically be collected.

It is admitted that the policy may not be equitable vis à vis the rural population since the urban population is already privileged as regards the provision of services. However this report also recommends free water in the rural areas. Furthermore free water for the poorer sections of the community means that the policy is fair within the townships.

It is suggested that it will be extremely difficult to collect rates from most communal point users unless a collector is stationed at every point and consumers are charged on a quantity used basis. However this strategy has no real merit, since it is unlikely that the average collector would do much more than cover his salary, if communal point users were charged

rates similar to low use individual connection owners. The major effect would be to reduce consumption. The pattern of use would also become more irregular since some consumers may use alternative sources at times and many may use less water than is desirable. Consequently the benefits of the communal points would be reduced. Furthermore due to this low and irregular use revenue will be much less than anticipated. Thus it is better that water is free since the financial viability of the supplies would not be increased by charging on a quantity consumed basis. In addition free water would lighten the administrative burden and increase the achieved benefits.

In some countries the authority allows private individuals to operate water kiosks. The only advantage of this method is that the authority is certain of some income. However this will be insignificant compared to costs and income from individual connections. Furthermore since it is difficult to control the prices charged by the vendors the result would be to reduce consumption to below the level that would be achieved if the authority employed revenue collectors at communal points, and is therefore even less desirable.

It is sometimes claimed that supervised communal points are required to deter vandals. However vandalism is not restricted to the working hours and if vandalism does occur the problem is better tackled in other ways. For example if dissatisfaction stems from an unreliable service the answer is to improve the service.

The alternative method of charging communal point users for their water is to levy a monthly fee. This could be charged on a per person or on a per household basis and there is a case for and against both possibilities. The most straightforward method of collection would be to have a water authority employee visit every house in all areas served by communal points that does not have its own connection. Unfortunately experience from most supplies in Zambia shows that although consumers utilise the supplies, they often resist paying monthly rates. For example Lusaka has only been collecting about 50% of the revenue that if should have done from communal points. Since collection in some areas dominated by Government employees is around 90%,collection must have been very low in some other areas. If some people refuse to pay and are seen to get away with it most consumers will soon decide to follow suit. The authority has two choices in this situation, to accept that they have to supply water freely or to disconnect communal taps. The latter action has two major disadvantages; (i) disconnection of a tap will only be fair if all consumers using that tap have refused to pay, otherwise those who have been paying will be made to suffer along with those who have not;

(ii) the water authorities objective of supplying potable water to the entire population within the supply area will obviously not be met if the authority itself denies access to a part of the population. Furthermore if individual isolated standpipes in very localised areas of non payment are closed, the affected consumers will simply draw from another communal point in the vicinity or they may even take less desirable action such as opening hydrants.

In a number of towns attempts were made to solve the problem via the Party (UNIP). Unfortunately this raised other problems and did not solve the original one. The system was that the section chairman was responsible for collecting the monthly rates from the 25 houses within his section. This money was passed to the ward and branch levels and finally to the water authority. Receipt books were issued to ward and section leaders but the overall performance often remained poor. Sometimes leaders only gave people receipts if they demanded them forcefully, and often money disappeared into individual pockets before being handed over to the water authority. Often it would be impossible to tell whether the money had been collected or simply not handed in. A story in the Zambia Daily Mail of 16th April, 1981, highlighted one specific example of this problem. It concerned 16 outgoing ward councillors of the City Council of Lusaka who have not accounted for K633,609 allegedly collected by them for water bills from residents of squatter compounds. "The council did not receive any significant remittances from the wards despite efforts at various levels and reports to the appropriate committees and the Council, from time to time, to have collection accounted for" the report adds. The whole thing is a national problem that is even more difficult to solve in the provinces since the most competent manpower is concentrated in Lusaka and the other larger towns. In addition the very same leaders who in discussion with the local authority agree to why the supply must be financially viable, and why the people must pay, and who say they will exhort their constituents to pay, go back to their sections and for personal political gain tell a completely different story and say that their people do not have to pay for the water. The consultants gave serious consideration to developing a payment system using the Party machinery. However the examination of past evidence showed that the involvement of the Party did not improve the water rate non payment situation and it is considered that its future involvement would bring no greater success than in the past. The best means by which a higher rate of collection could be achieved would be an intensive education campaign aimed at the average communal point consumer. This might involve sending explanatory letters to every home, the use of the radio and television, the briefing of newspaper editors, etc. The basic

message would be that the local authorities require considerable sums of money every year to operate and maintain the water supplies and that even though communal point charges are low they are needed if the authority is to continue to run the supply efficiently and provide water to all areas of the townships. Nevertheless the basic problem of enforcement discussed above would remain and it is doubtful if a high rate of collection could be maintained. It is likely that if a high level of payment was achieved over a long period social sanctions could be developed so that pressure could be successfully brought to bear on rate payment evaders. However it is not believed that this situation will occur and although initial concentrated efforts may be successful, the rate of non-payment would again soon increase and it will prove impossible to successfully collect rates from communal point users over a long period. This applies to low cost housing residents and even more forcefully to people living in informal housing. Thus the authority would again be faced by the choice between providing free water or closing the supply in certain areas. The consultants recommend that free water is the least undesirable course of action.

It is often claimed that a free communal point policy will increase usage and especially wastage. This is true if a free policy is being compared with charging for water from communal points on a quantity used basis. Thus a free water policy does mean that a certain amount of wastage (allowed for in the design) has to be accepted but this can be reduced by various means, such as 'waste-not' taps. But as was discussed above, charging on a quantity used basis has little merit in Western Province. Furthermore free water should not lead to any greater usage or wastage than a low flat rate charge would, since consumers in both cases would be paying zero marginal cost for actual usage/wastage.

There are no doubts about it being practical, administratively simple, acceptable to consumers and politically attractive. Its major drawback is the loss to the water supply authority that it could entail. However if as is proposed above, those consumers who are Government or council employees, or who occupy a council house, are charged, the real loss would not be all that great since the amount that would be collected from the other consumers would in practice be very limited.

It is appreciated that this recommendation is not optimum but it means that the local authorities can concentrate on more meaningful activities that could increase the rate performance from individual connections with

much less effort than would be required to raise revenue from communal points. In other words given the existing situation,attempts to enforce rate payment from communal water points would at best be an inefficient use of resources, (better devoted to other aspects of rate collection or to other areas of the water supply operation), and at worst would be a complete waste of money and effort.

The financial significance of the recommendation which is estimated in Section 11.8 will be dependent upon (i) the percentages of consumers in a town who utilise a communal point and those who have their own connection and (ii) on the percentage of communal point users who are employed by Government and the council, or who live in council houses. In Addis Ababa (Browne 1974) it was found that although a high proportion of consumers relied on communal points a 10% increase in the price paid by consumers with their own connections would make up the financial loss that would have ensued from providing communal point users with free water. The very small price increase required to cover the potential loss was due to the fact that although individual connection owners constitute a minority of consumers they utilised a high proportion of the water consumed.

9.3 The Effect of a Free Communal Water Point Policy on Recurrent Unit Costs.

Table 9.1 presents the unit operational costs of water. The first column shows the costs in terms of total water consumed, the second column shows the costs in terms of water consumed from individual connections and the third column shows the costs in terms of water that is consumed by people who should pay for it, i.e. individual connection consumers plus one third of communal point users. It can be seen that the recommended policy increases the production costs of water that is paid for by just over 20% compared to a situation where all water is paid for. If all communal point consumers were allowed free access, the costs of production of water that is sold would increase by a further 13%.

Table 9.1

Unit Operation and Maintenance Costs.

Township	Operation and Maintenance Costs in 1980. Cost (ngwee per m^3) of water consumed	Cost (ngwee per m^3) of water consumed from individual connections	Cost (ngwee per m^3) of water used by consumers who pay for water.
Kalabo	18.1	26.5	22.9
Kaoma	29.6	40.1	35.8
Limulungu	24.5	34.9	30.6
Lukulu	50.9	87.9	70.6
Mongu	12.3	17.2	15.2
Namushakende	46.4	51.5	49.7
Senanga	22.9	32.8	28.6
Sesheke	31.2	38.9	36.1
Overall	20.3	28.2	24.9

10. CONNECTION FEE POLICY.

Consumption typically multiplies by a factor of five when a family acquires its own connection. This results in very significant health and other social benefits and it is proven that the benefits arising from house connections are much greater than those from communal points. Furthermore the larger the number of individual connections, the higher the revenue collection. Consequently there is often a strong case for encouraging individual connection, and it is argued that house connection fees should be low enough so as not to exclude most low income consumers from connecting.

D.W.A.'s present connection fee policy is that the charge should cover the cost of connection. The current connection fee is K100 plus the cost of pipes in excess of one length. It is composed as follows:-

15 or 20 mm water meter	K 50
One 6 meter length of G.I. pipe	K 15
Fittings and valves	K 20
Meter manhole or chamber	K 10
Labour charge	K 5
Total	K100.

Although this fee is not low enough to encourage all low cost housing residents to request connection, neither it is so high that most low cost housing residents could not afford it, since K100 represents just under one month's income for the majority of low cost housing families. At present since D.W.A. is sometimes unable to satisfy requests for connections for a considerable period, it can be argued that the present level of fees does not present a financial problem to many potential consumers. For example, at the time of the consultants' visit to Namushakende it was reported that a few people had been waiting several months for connections. It is hoped that the resources being devoted to the township supplies in Western Province will result in connections being available to potential consumers on demand. The consultants have therefore given serious consideration to the possibility of lowering, i.e. subsidising the connection fee.

In examining this question the following factors were taken into account:-

(a) the encouragement of individual connections is a "good thing" since more connections will both increase the benefits of the supply to the population and increase the revenue to the authority. Once most consumers become used to the luxury of their own connection they will not be willing to do without it, and will continue to pay monthly rates quite willingly. The encouragement is only necessary to overcome any initial resistence to investing in a connection.

(b) an increase in the number of connections can sometimes lower the average connection costs. Although the cost of connecting the first individual in a particular area may be high the subsequent cost of connecting his neighbours will be much lower.

(c) any subsidised fees must be large enough to deter any frivolous requests for connections which would have to be disconnected soon afterwards due to non payment of water rates. Section 11.1 shows that it is estimated that most low cost housing residents will be expected to pay K5 per month in 1980 prices. It is suggested that a connection fee representing one year's water rates should have the effect of restricting new connections to those who will be able to afford water rates.

Thus a fee of K60 in 1980 prices i.e. approximately K90 in 1982 prices is recommended for low cost houses only.

It is therefore proposed that low cost housing residents be charged K60 in 1980 prices i.e. K90 in 1982, while high and medium cost housing residents should be charged K100 in 1980 prices i.e. K140 in 1982. The authorities should appreciate that subsidising the connection of low cost housing residents will not necessarily cost them money, other than in the very short term. This, of course, pre-supposes that the water authorities improve their billing and rate collection performances.

It is also felt that it is equitable that the connection fee paid by an individual is dependent upon the distance that he lives from the nearest branch line. There is no social reason why people who accidentally live nearer a branch line should be rewarded with lower connection fees. But due to financial limitations and to the fact medium and high class housing residents have a higher ability to pay and will connect anyway, it is suggested that charges for this group of

consumers be left unaltered other than for increases in line with inflation. However it is proposed that where new connections are provided to low cost houses, where only one tap is provided, and where the service line is a maximum of 10 mm that consumers should only pay the connection fee of K60 irrespective of how many lengths of pipe are used. If any consumer who takes advantage of this facility subsequently increases the number of his taps so that he is receiving more than the very basic house connection service, he must refund the subsidy. Where abnormally long connection lines would be required it would be necessary to consider every case on its merits. The authority would have to decide whether to heavily subsidise the connection or whether to turn down the request unless the consumer pays for the cost of the connection. An important factor would be whether or not there were other potential consumers in the vicinity. If there were it may be appropriate to extend a minor branch line into the area.

It is sometimes recommended that low income consumers should be encouraged to acquire connections by means of some kind of hire purchase arrangement. The consultants dismissed this proposal as a possibility for Western Province since it would be too difficult to administer effectively. Furthermore if some staff members were capable of implementing such a scheme their abilities could be better used in other aspects of rate collection. Finally a subsidised connection fee of K60 for low cost housing consumers should obviate the need for easy term payment.

Even if a connection fee of K60 was introduced for low income consumers it does not necessarily mean that the subsidy would be permanent. It would be possible to recoup it as part of the water rates so that new consumers pay higher rates until their fees were paid off. However this is in effect a hire purchase arrangement and is subject to the criticism mentioned above. Alternatively water rates could be based on the total costs of the schemes including minor distribution and connection costs. However since the rates in Western Province will not cover more than a fraction of the basic capital costs it is probable that the subsidy would be a permanent one in Western Province. Nevertheless the subsidisation of connection fees may not necessarily increase the total subsidy to the water schemes because the marginal revenues from the increased number of connections will exceed the marginal operating costs.

Some private tenants cannot afford to take the risk of paying for a connection since they could lose their investment if they were to be evicted. In order to encourage connection it is proposed that tenants who have paid for their own connection be refunded the cost whenever they can show that they are made to leave their dwelling. In this case the next resident or landlord must pay the connection fee before the house is reconnected.

It is probable that there will be many new connections installed in the next few years without meters. It is recommended that the fee for these connections should be the same as for those without meters. This will enable D.W.A. to generate a limited amount of additional income and will be equitable since the decision of whether or not to meter a certain consumer, area or township will not be made by the consumer. Consequently if different connection fees were to be levied based on whether or not a meter was installed, it would be a matter of luck for a consumer whether or not he lived in a township in which all consumers were metered.

The corollary to this recommendation is that whenever it becomes appropriate to meter a particular town, meters should be installed free of charge. If on the other hand lower connection fees were charged for non metered consumers it might be necessary to charge consumers for a meter when it was later installed. Consumer opposition to this would be understandable since they might feel that they were being charged for nothing, or even worse, to allow the authority to subsequently increase their monthly rates.

The costs of, and revenue from, connections is excluded from the overall financial analyses since it is assumed that they will be roughly equal.

11 RECOMMENDED TARIFFS AND THEIR FINANCIAL IMPLICATIONS.

11.1 Recommended Prices.

As a result of the findings concerning:-

(i) ability and willingness to pay described in Chapter 7.
(ii) costs described in Chapter 5.
(iii) metering described in Chapter 8.
(iv) communal point pricing policy recommended in Chapter 9.
(v) pricing theory described in Chapter 6.

The following price structure is recommended:-

1. Communal Water Points.

   (a) communal point consumers who are employed by Government or councils or who occupy council houses should be charged a fixed fee of K1 per month.

   (b) all other communal point consumers should not be charged.

2. Individual Connection in Lukulu and Namushakende.

   All consumers should be metered and be charged K2 per month for their first 15 m^3/month and 50n per m^3 for any additional consumption.

3. Individual Connections in the Other Six Townships.

   Only the very largest consumers should be metered and all others should be charged flat monthly rates as follows:-

Low cost housing households	K 5 per month (K4 for consumers with only one tap).
Medium cost housing households	K10 per month
High cost housing households	K15 per month
All non domestic consumers	K15 per month.

   Major consumers should be charged flat rates ranging from K20 to K200 per month with an additional charge for consumption of 10n per m^3.

This proposed tariff structure accords with social criteria since:-

(a) very low rates are charged for all communal point consumers. Most government and council employees who use communal water

points earn between K100 and K150 per month after the recent wage increases. Thus if inflation between 1980 and 1981 is taken as 20% per annum the current recommended rate would be K1.20 per month or approximately 1% of the average income of consumers who must pay.

(b) the rates for basic consumption in Lukulu and Namushakende and the low cost housing charge elsewhere can be afforded by most low cost housing families.

The proposed tariff structure accords with the economic criterion in that the price of additional consumption and marginal costs are both low. The one major exception is that the high rate recommended in Lukulu and Namushakende for additional use will unduly deter consumption. However this represents a compromise with the financial criterion, since even the high recommended price will do no more than cover the costs of operation and maintenance.

The proposed rate structure accords with the financial criterion of meeting, or at least covering, a very significant proportion of operation and maintenance costs.

The recommended policy represents a compromise between principles and the need to facilitate implementation/administration. It is based largely on the fact that the existing committment to build the supplies means that both the short and medium run marginal costs will be low. However in about 6-7 years time as the supplies are approaching capacity, there will be a greater need to deter consumption and especially wastage. Thus greater attention will have to be paid to longer run marginal costs, though the costs of most of the augmentations required in 1988 or thereabouts will not be high.

While the recommended prices imply substantial capital subsidies they will still appear high from the view-point of many consumers. It is strongly recommended that the actual demand for water at these prices should be carefully monitored to ensure that a realistic pricing policy is being followed.

11.2 Projected Revenue.

The population/demand forecasts presented in Chapter 3 have been combined with the price recommendations of Section 11.1 to estimate future revenues. Table 11.1 presents the projected revenues from individual connections. The following assumptions were made in calculating the revenue figures:-

High/medium cost households in the six towns where rates are levied on a flat rate basis pay K11 per month on average, i.e. the ratio of persons living in high cost housing to those living in middle cost housing is 1:4.

High/medium cost households in Lukulu and Namushakende pay K13.25 per month on average, i.e. consumption is 250 litres per capita.

Most low cost households in the six towns pay K5 per month, but a few pay the concessionary rate of K4. Low cost households in Lukulu and Namushakende pay K2 per month on average, i.e. they consume 100 litres per capita.

The actual revenue collection is 95% of the revenue that should be collected.

The collection of revenue from non domestic consumers entails assumptions on the fixed basic fees of major consumers and the number of consumers under the "Industry" category. The consultants tried a number of "reasonable" assumptionsand found that the overall revenue was not sensitive to this series of assumptions.

The consultants initially estimated the revenues for 1980 and 1995 and interpolated the figures for 1982, 1985 and 1988 on the assumption of a linear increase in revenues.

Table 11.1

Estimated Revenue from Individual Connections.
(K/annum).

Township	1980	1982	1985	1988	1995
Kalabo	50,500	60,100	74,500	88,800	122,400
Kaoma	54,600	66,300	83,800	101,300	142,200
Limulungu	33,700	41,100	52,100	63,200	89,000
Lukulu	12,200	13,500	15,500	17,500	22,200
Mongu	233,700	278,100	344,800	411,500	567,000
Namushakende	13,600	16,400	20,700	24,900	34,800
Senanga	42,600	51,300	64,300	77,400	107,800
Sesheke	37,600	42,100	48,900	55,700	71,600
Total	478,500	568,900	704,600	840,300	1,157,000

Table 11.2 presents the projected revenues from communal water points on the assumption that revenue is actually collected from every third family which uses the communal water points, i.e. from those people who work for Government or councils, or who rent a council house. It can be seen that revenue from communal points only represents about 8% of the revenue from individual connections. Thus despite the fact that approximately 60% of all consumers,and just over 50% of consumers who live within the townships' boundaries,use communal points the revenue for communal points is relatively important. Even if rates were collected from all users of communal water points the resultant revenue would only represent 24% of the revenue from individual connections.

Table 11.2

Estimated Revenue from Communal Water Points.
(K/annum).

Township	1980	1982	1985	1988	1995
Kalabo	5,300	6,400	8,000	9,600	13,300
Kaoma	3,900	4,700	5,900	7,000	9,700
Limulungu	2,600	3,300	4,200	5,200	7,300
Lukulu	1,900	2,200	2,500	2,900	3,800
Mongu	18,200	21,600	26,800	32,000	44,200
Namushakende	400	500	600	800	1,100
Senanga	3,700	4,500	5,800	7,100	10,200
Sesheke	2,100	2,300	2,800	3,200	4,200
Total	38,100	45,500	56,600	67,800	93,800

Table 11.3 presents the total gross revenue from the township water supplies i.e. it is the addition of revenue from individual connections (Table 11.1) and revenue from communal water points (Table 11.2).

Table 11.3

Estimated Total Gross Revenue from the Township Water Supplies (K/annum)

Township	1980	1982	1985	1988	1995
Kalabo	55,800	66,500	82,500	98,400	135,700
Kaoma	58,500	71,000	89,700	108,300	151,900
Limulungu	36,300	44,400	56,300	68,400	96,300
Lukulu	14,100	15,700	18,000	20,400	26,000
Mongu	251,900	299,700	371,600	443,500	611,200
Namushakende	14,000	16,900	21,300	25,700	35,900
Senanga	46,300	55,800	70,100	84,500	118,000
Sesheke	39,700	44,400	51,700	58,900	75,800
Total	516,600	614,400	761,200	908,100	1,250,800

11.3 Unit Revenues

Table 11.4 presents unit revenues per m^3 of water produced. These represent overall averages for the period 1980-95, but there is very little change from year to year. It can be seen that the overall income is n18.8 per m^3 of water produced.

Table 11.4

Unit Revenues.

Township	Average revenue (ngwee per m^3 of water produced)	Average revenue from individual connections only (ngwee per m^3 of water produced).
Kalabo	16.8	15.3
Kaoma	19.9	18.6
Limulungu	19.7	18.2
Lukulu	15.9	13.8
Mongu	19.2	17.8
Namushakende	16.4	16.0
Senanga	18.3	16.8
Sesheke	19.8	18.8
Overall	18.8	17.4

11.4.1Unit Costs.

ZESCO reported that billing 784 consumers in Mongu takes 8 man days i.e. one man can prepare approximately 100 bills per day. This number of bills is not achieved by the present water billing staff. For example, Mongu town council employs two billing clerks for approximately 1,000 consumers. Since the councils are less efficient it will be assumed that one clerk will prepare 50 bills for metered connections per day, or 80 for unmetered consumers, where there is no arithmetic to perform. If it is assumed that the annual cost of a billing clerk is K1,500 per annum, then the costs of billing are:-

Metered connection	K1,500 ÷ 50 x 22 working days	= K1.36 per annum
Unmetered "	K1,500 ÷ 80 x 22 " "	= K0.85 per annum.

If it is further assumed that the rate collections costs, (taking the money, issuing receipts, etc.), equals the cost of billing a metered connection,the total costs of billing/collecting rates are:

Metered connection	=	K1.36 + K1.36	=	K2.72
Unmetered "	=	K0.85 + K1.36	=	K2.21

Section 8.5 showed that the annual cost of meter reading is K1.67. However it would be possible to read the majority of meters once in three months and to base monthly bills on the most recently calculated 3 month consumption average. Some meters,(for example, those of major consumers), would have to be read every month but the reduction of meter reading could reduce meter reading costs by just over 50% to an average cost of K0.80 per annum.

Thus the total costs of meter reading, billing and collection are likely to average:-

Metered connection	=	K3.50 per annum.
Unmetered connection	=	K2.20 per annum.

If it is assumed that all consumers in Lukulu and Namushakende are metered but that only 5-10% of consumers in the other townships are metered the average costs per consumer would be:-

Lukulu and Namushakende	=	K3.50 per connection
Other townships	=	K2.30 per connection.

Based on these figures it is guesstimated that the costs of collection for a household which pays for communal point access is K1.50 per annum.

11.4.2 Total Costs of Collection and Metering.

Table 11.5 presents the total costs of collection and metering. They were calculated as follows:-

(i) It is not known exactly how many non domestic consumers there will be. However it is estimated that there will be less than 10% of the number of domestic consumers. Consequently the costs of collection from domestic connections have been increased to K3.75 per annum in Lukulu and Namushakende and to K2.50 in the other towns so that the total costs of collection estimated by multiplying these figures by the appropriate numbers of domestic consumers are assumed to include the costs of collection from non domestic consumers.

(ii) The capital and maintenance costs of metering are assumed to be K21.5 as estimated in Section 8.5.

(iii) The cost of collection from communal water points is taken as K1.50 per family per annum.

Table 11.5

Costs of Rate Collection and Metering.
(K/annum)

	1980				1995			
Township	Cost of collection from individual connections	Cost of metering	Cost of collection from communal water points	Total cost of collection & metering	Cost of collection from indivi-daul connections	Cost of metering	Cost of collection from commun-al water points	Total cost of collection & metering
Kalabo	1,400		660	2,060	3,860		1,669	5,529
Kaoma	1,750		493	2,243	4,945		1,208	6,153
Limulungu	1,200		333	1,533	3,310		919	4,229
Lukulu	488	2,795	239	3,522	975	5,590	478	7,043
Mongu	7,260		2,271	9,531	19,075		5,522	24,597
Namushakende	1,028	5,891	50	6,969	2,828	16,211	138	19,177
Senanga	1,300		460	1,760	3,590		1,270	4,860
Sesheke	1,200		260	1,460	2,400		520	2,920
Total	15,626	8,686	4,766	29,078	40,983	21,801	11,724	74,508

It can be seen from Table 11.5 that the total cost of collection and metering in 1980 is just over K29,000 and that this cost is split roughly 70/30 between collection and metering. The cost of collection in 1995 is just under K75,000 with a similar division between the costs of collection and metering.

Table 11.6 presents the interpolated costs of collection and metering for 1982, 1985 and 1988.

Table 11.6

Total Costs of Rate Collection and Metering (K/annum)

Township	1980	1982	1985	1988	1995
Kalabo	2,060	2,523	3,216	3,910	5,529
Kaoma	2,243	2,764	3,546	4,328	6,153
Limulungu	1,533	1,892	2,432	2,971	4,229
Lukulu	3,522	3,991	4,696	5,400	7,043
Mongu	9,531	11,540	14,553	17,566	24,597
Namushakende	6,969	8,597	11,038	13,480	19,177
Senanga	1,760	2,173	2,793	3,413	4,860
Sesheke	1,460	1,655	1,947	2,239	2,920
Total	29,078	35,135	44,221	53,307	74,508

11.5 Net Revenues.

Table 11.7 presents the annual revenues from the township supplies net of the costs of collection and metering. It can be seen that total net revenue increases from just under K500,000 in 1980 to over K1,000,000 by 1988.

Table 11.7

Net Revenues from the Township Water Supplies. (K/annum)

Township	1980	1982	1985	1988	1995
Kalabo	53,700	64,000	79,300	94,500	130,200
Kaoma	56,300	68,200	86,100	104,000	145,700
Limulungu	34,800	42,500	53,900	65,400	92,100
Lukulu	10,600	11,700	13,300	15,000	19,000
Mongu	242,400	288,200	357,000	425,900	586,600
Namushakende	7,000	8,300	10,300	12,200	16,700
Senanga	44,500	53,600	67,300	81,100	113,100
Sesheke	38,200	42,700	49,800	56,700	72,900
Total	487,500	579,200	717,000	854,800	1,176,300

11.6 Projected Financial Performance of the Township Water Supplies.

11.6.1 Analysis in 1980 Prices.

Prior to presenting the financial implications of the recommended pricing policy it is felt that the fact that all costs and revenues are expressed in 1980 prices should be reiterated.

11.6.2 Projected Overall Financial Performance of the Township Water Supplies.

Table 11.8 presents the projected overall financial implications of the proposed tariff policy, and the financial performance of the township water supplies, i.e. the figures in Table 11.8 equal the revenues from Table 11.7 less the total costs of the supplies, (including capital costs), from Tables 5.20.1 - 5.20.4.

Table 11.8

Projected Overall Financial Performance.

(K/annum)

Township	Revenue less Total Costs			
	1980	1982	1985	1988
Kalabo	-119,870	-110,276	- 98,535	- 84,395
Kaoma	-208,207	-197,224	-183,199	-166,674
Limulungu	-142,619	-135,551	-126,349	-115,798
Lukulu	- 84,166	- 83,874	- 87,236	- 86,748
Mongu	-260,143	-218,289	-161,657	- 98,675
Namushakende	- 85,351	- 85,980	- 88,122	- 89,115
Senanga	- 66,378	- 57,917	- 48,927	- 36,086
Sesheke	-114,705	-110,499	-107,591	-101,135
Total	-1,081,439	-999,610	-901,616	-778,626

It can be seen that throughout the period 1980-88 the recommended prices for water result in a continuing deficit in every township, although in six of the townships the deficit is being reduced. It is of course difficult to interpret the significance of the figures in Table 11.8 without reference to the actual costs. Hence Table 11.9 shows the proportion of total costs that are covered by revenues.

Table 11.9

Proportion of Total Costs Covered by Revenue.

Township	Proportion of Total Costs Covered by Revenue (%)			
	1980	1982	1985	1988
Kalabo	30.9	36.7	44.6	52.8
Kaoma	21.3	25.7	31.2	38.4
Limulungu	19.6	23.9	29.9	36.1
Lukulu	11.2	12.2	13.2	14.7
Mongu	48.2	56.9	68.8	81.2
Namushakende	7.6	8.8	10.5	12.0
Senanga	40.1	48.1	57.9	69.2
Sesheke	25.0	27.9	31.6	35.9
Overall	31.1	36.7	44.3	52.3

It can be seen that revenue meets only 31% of total costs in 1980, but that the percentage increases to 52% by 1988. During the entire period 1980-88 revenue meets approximately 40% of all costs. However there are very large differences between the different townships. In Mongu revenue covers nearly half of all costs in 1980 and over 80% of all costs by 1988. During the entire period 1980-88 revenue in Mongu covers over 60% of all costs. In the other townships the corresponding figures are: Senanga well over 50%, Kalabo just over 40%, Sesheke 30%, Kaoma just under 30% and Limulungu 27%. In both Lukulu and Namushakende revenue only covers a small proportion of total costs, just over 12% in the former and under 10% in the latter.

Hence the subsidy that will be provided by the Government and the donor will on average represent about 60% of all the costs of constructing and operating the supplies, but in Lukulu and Namushakende it will be of the order of 90%. Therefore the programme is only financially viable if the government and/or the donor is/are willing to provide this high level of subsidy.

11.6.3 Projected Recurrent Financial Performance of the Township Water Supplies.

Although the projected revenues from the township water supplies only cover 40% of all costs on average, they do meet the financial objective of covering the costs of operation and maintenance. Table 11.10 presents the projected recurrent financial performance, i.e. the figures in

Table 11.10 represent revenues less the costs of operation and maintenance.

Table 11.10

Projected Recurrent Financial Performance.

(K/annum)

Township	Revenue less Operation and Maintenance Costs.			
	1980	1982	1985	1988
Kalabo	822	10,416	22,157	36,297
Kaoma	-20,905	- 9,922	4,103	20,628
Limulungu	- 5,121	1,947	11,149	21,700
Lukulu	-28,148	-27,856	-31,218	-30,730
Mongu	99,388	141,242	197,874	260,856
Namushakende	-27,195	-27,824	-29,966	-30,959
Senanga	- 6,287	2,174	11,164	24,005
Sesheke	-16,929	-12,723	- 9,815	- 3,359
Total	- 4,375	77,454	175,448	298,438

It can be seen that at the beginning of the period revenues just fail to cover operation and maintenance costs,but by 1981 a recurrent financial surplus is generated. This surplus increases steadily until it reaches almost K300,000 per annum by 1988. Hence it is possible for the recommended pricing policy to more than meet DWA's present, and the consultants recommended, financial objective for the overall programme.

Nevertheless there are very significant differences between townships. The revenues in Mongu and Kalabo cover their costs of operation and maintenance throughout the period. In six of the towns revenue fails to meet the recurrent costs at the beginning of the period,but in three of them, it soon covers the costs of operation and maintenance,and in Sesheke it almost covers these costs. However in Lukulu and Namushakende continuing recurrent deficits appear to be inevitable. Furthermore it seems as if they will not decrease over time.

Section 5.4.1 argued that the overmanning in DWA was likely to lead to the cost of the township water supply staff being over K50,000 p.a. higher than is really necessary. This is very high additional cost in the context of the present operations. However when the new supplies are operating the significance of this over-manning cost will be reduced. By 1985 it will represent less than one-third, and by 1988 approximately one-sixth of the projected recurrent financial surplus.

11.6.4 Comparison of Projected Revenues with Variable Costs.

Overall variable costs only represent 10.8% of revenue throughout the period 1980-88, but again the figure varies dramatically between townships. The approximate percentages of revenue required to cover the variable costs in the different townships throughout the period 1980-88 are as follows:-

Kalabo	6.9%	
Kaoma	7.8%	
Limulungu	8.2%	
Lukulu	62.0%	increasing to 65%
Mongu	8.7%	
Namushakende	124.0%	increasing to 134%
Senanga	6.9%	
Sesheke	6.4%	
Overall	10.8%	

It can be seen that at most supplies only a small proportion of the projected revenue is required to cover the variable costs. However at Lukulu the variable costs represent over 60% of revenue, and at Namushakende revenue even fails to cover the variable costs.

11.7 Variations of the Financial Projections.

It is possible that the financial performance will not be as good as that projected in the previous sections and those projections can be considered as the optimistic forecasts, though they are certainly achievable.

This section presents a more pessimistic forecast. There are a number of reasons why the revenue may not achieve the levels assumed earlier in this Chapter. The main one is that, at present, a considerable proportion of low cost houses do not have their own connections and it is far from certain that the assumption that all low cost houses will have their own connections in the future will be realised.

(i) some consumers in low cost housing may continue to use communal points rather than pay the connection fee and significant monthly water rates.

(ii) the assumption of 100% connections is dependent upon a considerable investment in secondary reticulation that has not been budgeted for. Present plans often only include the use of existing secondary reticulation (Lukulu and Namushakende are exceptions). No one has looked into the number of future consumers who will live near to, and far from existing supply lines. Unfortunately there are no existing cost figures for the consultants to include the cost of secondary reticulation in their cost/revenue projections. A reasonable alternative is to assume that a significant proportion of potential consumers will not be connected.

Therefore the revenue implications of lower rates of uptake of individual connections by low cost housing residents will be examined.

The second reason why revenue may not reach the levels assumed earlier is that the rate of revenue collection could fall well below the assumed figure of 95%.

The third reason why revenue may not reach the levels assumed earlier is that consumption could fall below the estimated per capita figures. However the recommended pricing policy will result in revenue being largely independent of per capita usage, other than at the two smallest supplies.

Calculations by the consultants show that if only 50% of low cost housing residents connect in 1980 that overall revenue net of variable costs will be approximately K108,000 lower, and that if only 25% of low cost housing residents connect overall net revenue will be approximately K162,000 lower. The corresponding figures for 1995 are K310,000 and K465,000. Table 11.11 presents the interpolated losses of net revenue for 1982, 1985 and 1988. Table 11.12 presents the original and revised projected financial performances.

Table 11.11

Reduction in Net Revenue if Some Low Cost Housing Residents do not take up Individual Connections.

(K/annum)

	1980	1982	1985	1988
Reduction in net revenue if only 50% of low cost housing residents have individual connections	108,000	135,000	175,000	216,000
Reduction in net revenue if only 25% of low cost housing residents have individual connections	162,000	202,000	263,000	324,000

Table 11.12

Comparison of the Original and Revised Financial Performances.

(K/annum)

	1980	1982	1985	1988
Original shortfall of revenue compared to total costs	1,081,439	999,610	901,616	778,626
Revised shortfall of revenue compared to total costs if only 50% of low cost housing residents have individual connections	1,189,439	1,134,610	1,076,616	994,626
Change in deficit	+ 10%	+13.5%	+19.4%	+27.7%
Revised shortfall of revenue compared to costs if only 25% of low cost housing residents have individual connections	1,243,439	1,201,610	1,164,616	1,102,626
Change in deficit	+ 15%	+20.2%	+29.2%	41.6%
Original excess of revenue over the costs of operation and maintenance	- 4,375	77,454	175,448	298,438
Revised excess of revenue over the costs of operation and maintenance if only 50% of low cost housing residents have individual connections	-112,375	- 57,546	448	82,438
Ditto but 25%	-166,375	-124,546	-87,552	-25,562

The reduction in the uptake of individual connections by low cost housing residents to 50% and the resultant loss in revenues increases the original deficit by 10% in 1980 and by over 27% in 1988. The corresponding percentage increases in the overall deficit, if only 25% of low cost housing residents take up individual connections, are 15% in 1980 and over 41% in 1988.

Whereas in the original projection revenue met approximately 40% of all costs during the period 1980-88 the reduction in the uptake of individual connections by low cost housing residents to 50% reduces the overall contribution of revenue to meeting all costs to around 31%, and the reduction in the uptake of individual connections by low cost housing residents to 25% reduces the overall contribution of revenue to meeting all costs to around 26%.

However the effect of the reduced uptake of individual connections on the recurrent financial performance is even more dramatic. Whereas in the original projection revenue more than covered the costs of operation and maintenance the reduction of the uptake of individual connections by low cost housing residents to 50% means that the revenue does not meet the costs of operation and maintenance until 1985 and that over the period 1980-88, total revenues fail to match the total costs of operation and maintenance. Furthermore if the uptake of individual connections by low cost housing residents is only 25% revenues fail to meet the costs of operation and maintenance for the entire period and the overall deficit for the period 1980-88 approaches K900,000.

Thus whereas in the original projection revenue met the financial target of covering all the costs of operation and maintenance, the reduction of the uptake of individual connection of low cost housing residents means that the target is not met when the uptake is reduced to 50% and that revenue comes nowhere near meeting the financial objective when the uptake is reduced to 25%.

The financial performance of the township water supplies is also sensitive to other factors, for example the rate of successful revenue collection.

11.8 The Financial Effect of a Free Communal Water Point Policy.

Table 11.13

Financial Effect of a Free C.W.P. Policy

	1980	1995
Total estimated revenue from individual connections (K/annum)	478,500	1,157,000
Total estimated revenue from township supplies when water is supplied free to two thirds of communal point consumers (K/annum)	516,600	1,250,800
Total estimated revenue from township water supplies if all communal point consumers were to be charged K1/family/month (K/annum)	592,800	1,438,400
Revenue lost as a result of the free CWP policy (K/annum)	76,200	187,600
Revenue lost as a result of the free CWP policy expressed as a % of estimated potential revenue	12.9%	13.0%
Revenue lost as a result of the free CWP policy expressed as a % of estimated revenue	14.8%	15.0%
Revenue lost expressed as a % of revenue from individual connections.	15.9%	16.2%

Table 11.13 presents the effects of supplying water free to two thirds of communal point consumers i.e. to those who are neither employed by Government or councils nor occupy a council house.

It can be seen that only approximately 13% of total potential revenue is lost or that if this revenue was to be collected revenue would only be 15% higher. Furthermore an overall increase in the rates of individual connection consumers of only 16% would pay for the free water.

If all communal point consumers (i.e. including Government employees, etc), were not charged for water, the above figures would increase by approximately 50%.

In this case just over 19% of total potential revenue would be lost and an increase in the rate of individual connection consumers of 24% would pay for the completely free communal point policy.

12 REVENUE COLLECTION.

12.1 Introduction.

This section concentrates on non payment for private connections. The major problem of collecting water rates from communal points is discussed in Section 9.2

12.2 The Experience of Lusaka.

Even in Lusaka where the council is more efficient and more powerful than smaller authorities in the provinces a debt problem occurs. At one stage the Lusaka City Council was owed over K14 million of which nearly K6 million was for water. The Government including parastatals was responsible for over K3 million of the total debt. However by giving special attention to the problem the situation was improved.

A unit was set up to deal with the problem. The first step was to sort out the debts into various categories (a) those which obviously had to be written off. Many of these debts had been passing routinely through the billing process for 15 years with no hope of payment, simply clogging up the administrative process. (b) those which efforts would be made to collect but which were considered unsuitable for constant repetitive billing were removed from the mainstream of the routine billing process. (c) those which remained in the mainstream. The result of this action was to remove a pointless administrative burden and to minimise the work of the regular billing process.

The second step was to improve debt collection management. For example the debt collection staff constantly complained about computer break-downs but an investigation showed that the only real problem was a lack of liaison between the debt collection and computer staff. Many consumers did not accept their meter readings and bills,and were correct not to do so. Consequently a unit was set up to deal with complaints, and the necessary action was usually very simple. When some order had been achieved the debtors were ranked in order of the size of their debts and a senior staff member personally contacted very senior management in the largest debtor organisations. This soon resulted in significant financial results. Sometimes senior management was unaware of their debts and ordered immediate payment. In other cases where immediate success was not achieved threats of disconnection proved to be a valuable weapon. In addition members of the debt collection unit

visited some consumers. In some cases it was discovered that debtors had never even been billed. Finally other measures were taken to minimise the debt problem for the future. For example, billing was retimed so that consumers would receive their bills when they had money. Consequently it can be seen that even in the case of a relatively efficient council,debts are partly the fault of the authority itself.

It is recommended that the councils in Western Province clear the decks of their present debt problem before the new supplies are operational. The appropriate strategy will not necessarily be identical to that followed by Lusaka but should follow the same general outline. Above all else it must be accompanied by a firm policy of disconnection for non payment of water rates.

12.3 Reliability.

Most of the township supplies currently provide a rather unreliable service to consumers. In some towns the people only receive water intermittently during the day and the quantity supplied is often less than that required,causing serious shortages. There are a number of reasons, in addition to capacity constraints, for this situation:

(a) breakdowns that are not repaired immediately due to lack of spare parts, transport, etc.

(b) lack of recurrent expenditure for diesel, oil , etc. The limited diesel supply sometimes restricts the number of pumping hours during a day.

There are also other minor contributory factors. For example, the D.W.A. officer in one town claimed that some of the diesel sent for the water supply was taken for use by other Government departments.

This state of affairs causes concern but for a tariff study the main focus is on the facts that:

(a) if water is charged for on a quantity used basis unreliability will cause a significant reduction in revenue whereas the extra costs involved in supplying the extra water would be small.

(b) if flat rate fees are charged as at present, consumers will naturally complain at paying for a service which they are only

receiving in part. This will result in a resistence to paying water rates and a reduction in revenue. Furthermore it puts low level D.W.A. employees, in a difficult position. The revenue collector in Kalabo asked the consultants what he should do when people refused to pay. "I tell them to pay first and then complain, but the second time they do not understand". Clearly the only satisfactory answer is to improve the reliability of the supplies.

Reliability should be improved when the new supplies are implemented. However maximum reliability will also require that sufficient recurrent finance is always available to pay for the variable costs. It would be a most unsatisfactory state of affairs if the present situation of limited pumping hours was to continue because the water authority had, for example, to limit its monthly electricity bills.

In theory it would be desirable to tie water rates to reliability in some way. For example, to reduce a consumer's monthly bill by 10% for every day that water was unavailable. In practice this would be very difficult under any circumstances and given the likely level of management efficiency, impossible.

12.4 Disconnection.

At present the disconnection deterrent is not used effectively. Although consumers are sometimes disconnected there is no strict enforcement of disconnection for all debtors. This is in part due to the possible political implications, but is largely due to the inefficiency of councils in supplying D.W.A. officers with lists of offenders.

It is vital that a strict disconnection policy for non payment of water rates be uniformly enforced. If a high level of rate collection is not achieved no rating policy will be successful. Recent history shows that it is easy to collect water rates if a policy of disconnection is followed. In every township where the consultants discussed the question the story was the same. Whenever consumers' water is disconnected they rush to pay their outstanding bills and their reconnection fees. In 1980 virtually every disconnection in Mongu, Kalabo and Namushekende, (totalling around 80 in the three townships), was reconnected very quickly. The consumers found the money without any major delays and came to pay almost immediately.

Furthermore this type of situation is not unique to water supplies. Even though rents are easier to collect than water rates, some of the townships' housing accounts face the problem of non payment of rents by tenants. But when house eviction notices are issued tenants rush to pay. Last year ZESCO (Mongu) had 748 consumers and disconnected 162. It is known that over 50 consumers moved away, so a maximum of 110 remained. The figure is possibly much lower. 96 consumers of those were reconnected, and almost all of these went and paid immediately after disconnection.

At present the forms supplied to applicants for new connections state that the authority has the right to disconnect 14 days after a demand for payment in writing has been presented, but some consumers do not pay for several months.

ZESCO is more successful in collecting their rates than the water authorities are. This is partly explained by their higher level of efficiency. However a more rigorous policy of disconnection is also a contributory factory. They have even been known to disconnect Government departments.

12.5 Proposed Procedure.

It is proposed that consumers are disconnected if they do not pay their bills within two months of their dispatch. According to the present regulations the authority has the right to disconnect after 14 days so this proposal is not harsh to consumers. The recommended timing is as follows:-

During the first 10 days of "month two" meter readings are made of consumption for "month one".

The bills for "month one" are sent out during the middle of "month two" stating that they should be paid within 30 days.

When the bills for "month two" are sent out during the middle of month three they will point out to consumers who still owe their "month one" bill that they are liable to be disconnected if they have not paid within 30 days, i.e. by about the 20th of month four .

Actual disconnection takes place in the two days prior to the major pay day in month four.

Thus consumers will be disconnected if they have not paid for their water within two months and a few days of being billed.

It is proposed that the only warning that consumers should receive will be that included on their following month's bill. Once a pattern of disconnection has been established and consumers expect non payment within this time period to lead to disconnection additional warnings should not be necessary. They would add to administrative costs and represent a waste of resources.

12.6 Timing of Bills and Disconnections.

It is suggested that bills are sent to consumers during the third week of the month so that they have received them before pay day at the end of the month. This will increase the probability that bills are paid quickly.

In addition it is proposed that disconnections are concentrated in a two day period around pay day so that consumers not only want to rush to pay their outstanding bills and the reconnection fee, but are also able to do so. Disconnection is undesirable from everyone's point of view, so the authority must make every effort to minimise disruptions to consumers' connections whilst at the same time encouraging them to pay their debts.

12.7 Government Institutions.

A major problem that must be examined by the Government and followed up by serious action is that of non payment for water by Government departments. Wherever the consultants went they heard the same story of defaulting by Government departments, the army, police, etc. If the Government believes that such groups should have free water a policy statement should be issued to this effect. If on the other hand it is decided that all consumers should be treated identically and that all departments/institutions must pay, rate payment must be seriously enforced. Moreover it would be desirable that Government departments set a good,rather than a poor example. However a common problem is that some of these debtors especially in the isolation of Western Province are more powerful than water authority officials who risk getting themselves into trouble if they vigourously pursue those duties which another arm of Government has appointed them to perform. Although Lusaka City Council in their debt collection exercise managed to get a debt of several hundred thousand kwacha paid by the army it

would be more difficult for officials in the townships of Western Province to get paid, or even to threaten disconnection.

Although it is a general story that Government is a poor payer there are significant differences between different departments/institutions and between different locations. Sometimes they are simply rather slow to pay but do so eventually. In the majority of cases the officials concerned are helpful but simply do not have the funds.

It should also be noted that D.W.A. has also been guilty of being in debt to other Government departments for considerable periods. It has been suggested that they are receiving electricity still because NORAD has paid the bills.

This problem of non or slow payment for water by Government is not unique to Zambia. It would be worth considering the possibility of working out a system so that all departments pay directly to the Treasury which simply subtracts their debts to other Government departments from their expenditure allocations. Theoretically there is only an accounting problem to deal with, the solution to which could help to sort out the whole network of indebtedness between different Government departments. Of course, in one sense the problem doesn't really matter unless it distorts Government spending priorities and/or disguises resource allocations. However from the point of view of the efficient financial operation of the water supplies it is a matter of importance.

12.8 Act of Parliament.

It was suggested to the consultants during their field trip discussions that disconnection of water subsequent to non payment of rates should be supported by an Act of Parliament. It was pointed out that house eviction is supported in this way, and that this is one of the reasons why rent collection is easier than water rate collection. Although such an Act would not always solve the water authority officials' problem, for example in his discussions of disconnection with a local army or police commander it could frequently make the efficient performance of his duties with regard to disconnection easier.

12.9 Reconnection Fee.

It is proposed that the present reconnection fee of K5 be raised significantly. The reconnection fee has two functions: (a) to cover the costs of reconnection, and (b) to act as a deterent. Since disconnections are caused by consumers there is no reason why reconnection fees should not be used as a source of income. Consequently it is recommended that the fee should be dramatically increased to K25. At the same time the increase must be widely publicised so as to deter consumers from needing to be reconnected. Even this apparently high fee is no more than that currently charged by ZESCO to its consumers for reconnection.

12.10 Deposits.

It would be possible to back up the policy of disconnecting debtors by a deposit system. This would entail every consumer having to make a deposit with the water authority to cover any subsequent non payment of rates. The size of the deposit could perhaps be equal to a consumer's estimated quarterly bill. Whenever a consumer has to be disconnected the authority would simply be able to subtract the amount owed from the deposit. The consumer could be refunded the difference if he had moved and would have to make up the deposit in full if he wished to be reconnected.

The proposal has some merit but is not recommended. Recent history has shown that disconnection is a sufficient incentive to make debtors come running to pay their outstanding bills. All that is required is a more efficient and possibly more ruthless system of disconnection. If this was fully enforced there would be no need for deposits. The only losses that could be incurred by the water undertaking would be those arising from people who move leaving unpaid bills. It is considered that the administration costs involved in a deposit system to cover this loss would not be justified.

12.11 Revenue Collection and Procedures.

The question of whether revenue should be collected by councils or by D.W.A. was discussed in Section 2.8 , but whichever organisation is responsible the requirements are the same. There is nothing inherently wrong with the present system of billing and revenue collection. All that is required is an increase in "clerical

efficiency", with regard to both billing and revenue collection. In addition it is desirable that the supplies are reliable so that consumers are satisfied with the service and are very willing to pay for it. Finally as discussed above it is necessary that a strict policy of disconnection is enforced, otherwise junior staff involved in collecting revenue will be severely handicapped.

It is important that an efficient revenue collection system is accompanied by the following of laid down financial procedures for passing the money on, whether this be to the council's water fund with any surplus being passed on to its general fund, or to the Ministry of Finance. At present there is no procedure being universally followed by the councils for passing on the money that they have collected as D.W.A.'s agents. If it is decided that water rates should be submitted to the Ministry of Finance it does not matter whether this is done through D.W.A. or through the machinery of local government. What does matter is that a fixed procedure is followed and that D.W.A. knows exactly how much is being collected in water rates. If the rates are to be passed into the councils' funds as is suggested by the decentralisation intentions, it is vital that proper accounting procedures are followed. If the income from rates simply gets lost in other council money it may be impossible to tell how much money is being raised from the water rates. In this case rational pricing policies, and future planning and evaluation of the township water supplies' performances would have to be based on guesswork.

13. MAINTENANCE OF RURAL WATER SUPPLIES.

13.1 Shallow Wells.

The shallow well programme has been planned with the objective of minimising the required maintenance of the wells and pumps. Consequently buckets with chains rather than handpumps will be installed. If the bucket system is successful the costs of installing and maintaining about 200 handpumps should be saved. Nevertheless even with the proposed wells certain problems can be foreseen.

They will include:
- cracked covers
- theft of buckets and chains
- contamination of wells and surrounding areas.

Measures to combat these causes are not always successful, and depend on the cooperation of the local population.

Regular well maintenance checks should include:
- Regular inspection and repair of the wells
- Regular examination of the chemical and bacteriological quality of the water.

It is recommended that the maintenance of the shallow wells should be carried out by a maintenance unit which will visit and completely check every well twice a year. It is estimated that one team will be able to maintain the 200 wells proposed in the current programme.

The major responsibility for maintaining the wells should rest with the local community. A village may appoint an individual to look after the well.

The duties should be:
- to construct and maintain a fence around the well to keep cattle away.
- to prevent anyone from using the area inside the fence as a working place (e.g. for washing) or as a childrens playground.

13.2 Well Points.

A well point is a shallow cased borehole equipped with a pump. Handpumps should be sufficient for most of the well points in the programme.

The maintenance problems mentioned in section 13.1 on shallow wells will also occur at well points. There will also be a number of additional problems as follows:

- loosened anchor bolts
- broken pump rods and handles
- broken hinge point bolts
- silting of wells.

The well points should be visited and checked every six months and the maintenance programme should consist of the following activities.

- remove the pump unit, dissemble, check and if necessary repair the pump, pipe connection, etc.
- pump the well dry with a motor pump and remove all dirt, silt, etc.
- disinfect the well if required
- inform the village authorities and the persons responsible for the daily maintenance work of the problems that have occurred, what has been done to remedy them and what they should do to reduce the problems in the future.

It is assumed that one unit will cover on average 150 well points per year.

13.3 Dams.

Three dams to the east of Kaoma have been included in the programme. These are along the streams, Shishamba, Namilangi and Kabombwar.

The dams have been in operation for only a few months and it is too early to determine the required maintenance work precisely. However it is likely to include:

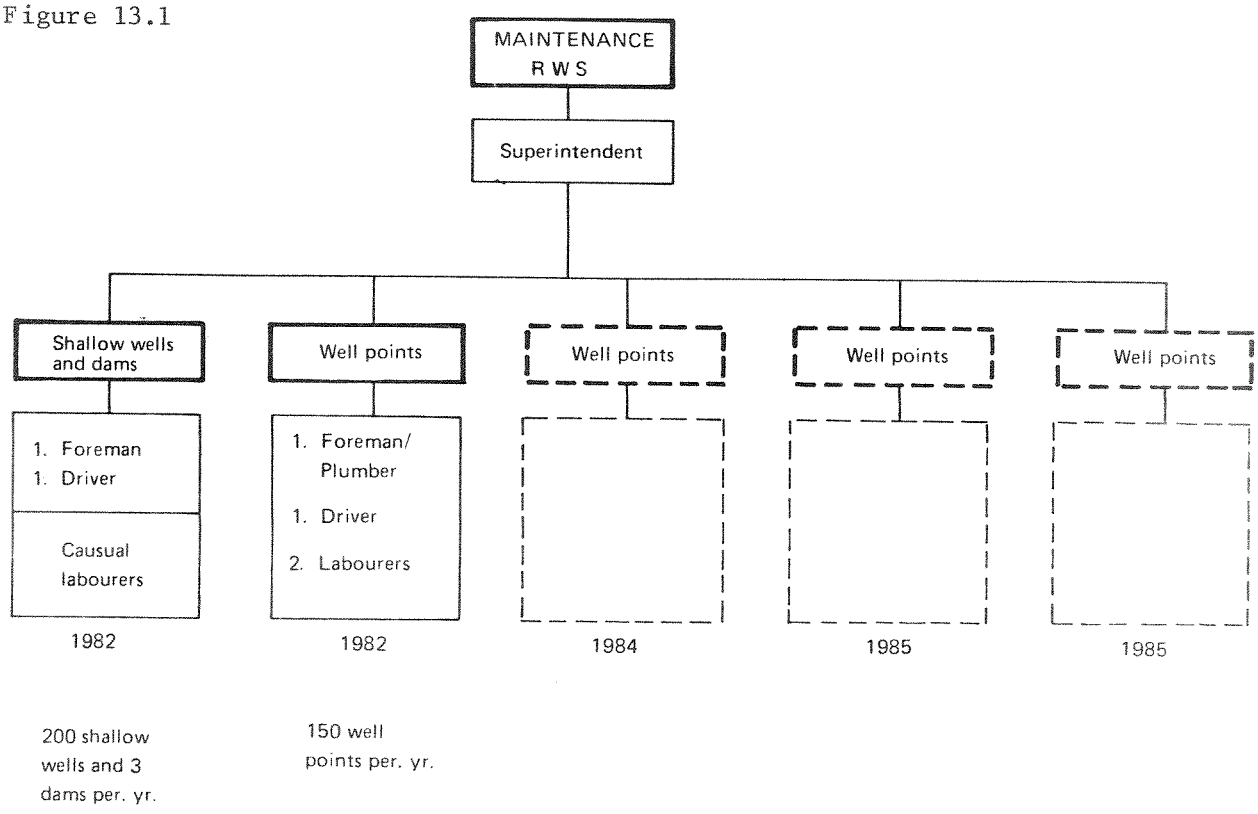
- desilting
- grasscutting
- protection of the crest
- cleaning the spillway
- prevention of soil erosion in the vicinity of the dam.

It is assumed that one weeks maintenance per dam per year is sufficient. The maintenance work will be done by casual labourers under the direction of the maintenance team responsible for shallow wells.

13.4 Manpower Requirements.

The proposed organisation is shown in the chart below:

Figure 13.1



13.5 Costs.

13.5.1 Labour Costs.

It is estimated that one maintenance unit for shallow wells and dams will be sufficient. However four teams will be required for maintaining well points. It is assumed that one such team will commence working in

1982 and that one additional team will be added every year until 1985. Table 13.1presents the labour costs of maintaining the rural water supplies.

Table 13.1

Labour Costs of Rural Water Supply Maintenance.

Unit	Category and number of staff	Annual labour cost 1982	Annual labour cost 1985
Officer in charge of all the rural water supply maintenance teams.	1 super-intendent	K5.304	K5.304
	1 driver	K1.500	K1.500
Maintenance unit, shallow wells and dams	1 foreman	K2.820	K2.820
	1 driver	K1.500	K1.500
	1 labourer	K 900	K 900
Maintenance unit, well points	1 foreman/ plumber	K2.820	K11.280
	1 driver	K1.500	K6.000
	2 labourers	K1.920	K7.680
Total		K18.264	K36.984

The costs of labour in Table 13.1 are based on the salary scale of December, 1980 and are expressed in 1980 costs. In practice since the 1980 wage/salary increase was significant, it is assumed that there will be no increase for two years i.e. until January, 1983. Although it is most unlikely that annual increases will be given from that time, for the purposes of this exercise it is assumed that annual increases will match those of inflation (20%). Thus the actual costs will be as follows:-

Year	Cost in 1980 prices (K)	Current cost allowing for inflation (K)
1982	18,264	18,264
1983	24,504	29,405
1984	30,744	44,271
1985	36,984	63,908

13.5.2 Transport Costs.

In 1982 three four-wheel drive Landrovers will be required. The average present life of Landrovers in the government service is

less than one year. The average life of vehicles on this project is expected to be extended to three to five years since the Landrovers will benefit from the new D.W.A. workshop in Mongu. A life of three years is assumed. Thus the vehicles would have to be replaced in 1985 at which time an additional three will also be required.

It is assumed that every vehicle will be driven, on average, 30,000 kms. per year in 1982, increasing to 40,000 kms. in 1983 and 50,000 kms. in 1984. In 1985 when six vehicles should be operating the average mileage will fall to 30,000 kms. per vehicle. The 1980 cost of a new Landrover was K18,000 and the mileage cost is estimated at K0.20 per kilometre. The costs of the necessary transport are as follows:-

Initial 1982 capital cost (in 1980 prices) of 3 Landrovers at K18,000 each = K54,000.

Annual capital cost, assuming a life of 3 years and a rate interest of 8% = K20,952.

Annual operation costs (in 1980 prices) = 3 x K0.20 x 30,000 kms = K18,000.

Capital cost in 1985 (in 1980 prices) of 6 Landrovers at K18,000 each = K108,000.

Annual capital cost assuming a life of 3 years at a rate of interest of 8% = K41,904.

Annual operation costs (in 1980 prices) = 6 x K0.20 x 30,000 kms. = K36,000.

Table13.2presentsthe transport costs associated with maintaining the rural water supplies.

Table 13.2

Transport Costs of the Rural Water Supply Maintenance Programme.

	Annual capital cost at 1980 prices	Annual operating cost at 1980 prices	Total annual cost at 1980 prices	Annual capital cost at current prices	Annual operating cost at current prices	Total annual cost at current prices
1982	K20,952	18,000	38,952	30,171	25,920	56,091
1983	K20,952	24,000	44,952	36,205	41,472	77,677
1984	K20,952	30,000	50,952	43,446	62,208	105,654
1985	K41,904	36,000	77,904	104,270	89,580	193,850

13.5.3 Material Costs.

The annual cost of materials at 1980 prices, will be of the order of K7 per shallow well and K14 per well point (including handpump). Hence the annual cost of materials in 1982 and 1985 at 1980 prices will be:-

	Shallow wells	Well points	Total (K)
1982	200 x K7 = K1,400	150 x K14 = K2,100	K3,500
1985	200 x K7 = K1,400	500 x K14 = K7,000	K8,400

On the assumption that 120, 120 and 110 additional well points will have to be maintained in 1983, 1984 and 1985 respectively, the material costs both in 1980 and current prices are shown in Table 13.3.

Table 13.3

Material Costs of Rural Water Supply Maintenance

	Cost in 1980 prices (K)	Cost at current prices (K)
1982	3,500	5,040
1983	5,180	8,951
1984	6,860	14,225
1985	8,400	20,902

13.5.4 Total Maintenance Costs.

Tables 13.4and 13.5 present the total maintenance costs of the rural water supply programme for 1982-5 in 1980 and current prices respectively.

Table 13.4

Cost of Rural Water Supply Maintenance in 1980 Prices

	Cost of labour	Cost of transport	Cost of materials	Total cost
1982	18,264	38,952	3,500	60,716
1983	24,504	44,952	5,180	74,636
1984	30,744	50,952	6,860	88,556
1985	36,984	77,904	8,400	123,288

Table 13.5

Cost of Rural Water Supply Maintenance at Current Prices

	Cost of labour	Cost of transport	Cost of materials	Total cost
1982	18,264	56,091	5,040	79,395
1983	29,405	77,677	8,951	116,033
1984	44,271	105,654	14,225	164,150
1985	63,908	193,850	20,902	278,660

The average labour and material cost of maintaining a well point is double that of maintaining a shallow well. But since transport is the major cost it is difficult to estimate the different costs for shallow wells and well points. It can be seen that the overall average cost of maintaining both types of well in 1985 will be approximately K180 in 1980 prices or K400 at current prices. If it is assumed that the average rural supply is used by a population of 70 people the annual cost per consumer will be under K3 per head in 1980 prices and between K5 and K6 at current prices. It is particularly striking that approximately 60-70% of all costs are for transport. This might well lead to an investigation of whether or not a much cheaper form of transport, for example, 4-wheel drive Suzuki's could be appropriate, in place of one or some of the Landrovers.

Since it is recommended and considered probable that no revenue will be collected from these rural wells the entire cost will have to be borne by the Government.

14 RURAL WATER SUPPLY PRICING POLICY.

It is clear that the rural water supplies being constructed under the NORAD programme must be free. The main reason is that the consumers are not willing to pay for the improved supplies and if rates were levied there would be two possible outcomes:-

(a) the people continue to use the supplies but the authority finds that it is unable to collect rates.

(b) in the unlikely even of rate collection being successfully enforced the consumers would simply revert to using their traditional sources. Consequently the improved supplies would be unutilised and all investments would have been wasted.

Since supplies will either (a) be free in practice or (b) be unused, the only practical policy is to make them free from the start and the Government should have no expectations that revenue will ever be raised from these supplies. Although this policy is recommended primarily on practical grounds there are a number of additional reasons why they should be free. The argument is very similar to that put forward for free communal points in the townships.

(a) rural water supplies should be regarded as a social service and if they are worth constructing in the first place the financial criterion should play a secondary role.

(b) if the Government considers social criteria as an important determinent of policy it may elevate certain goods above the market price and there is a strong case for regarding rural water supplies as such a "merit want".

(c) the rural consumers in Western Province will only receive a low level of service from the improved supplies. In many cases the improvement over the existing water supply situation will only be very marginal and it is reasonable for the consumers to be unwilling to pay. They will only use small quantities of water and will still have to carry it home.

(d) the supplies are intended for the ordinary rural people who have a very limited ability to pay for water.

(e) Governments are always talking about redistributing income to the rural areas. Although free water supplies are not a very efficient way of achieving this goal they should have some redistributional effects.

(f) the marginal costs of the wells are low, both in the short and

longer terms. Even a large part of the operation and maintenance costs are fixed. Thus a free policy accords with an economic efficiency criterion.

(g) even if the people were willing to pay something for the improved supplies the administrative problems and collection difficulties may not justify the effort. The revenue collected may well be exceeded by the cost of collection, let alone cover the costs of operation and maintenance. For example if a supply was to be used by 15 families who each contribute K0.50 per month, the monthly collection would only total K7.50. If the water supply authority was to employ collectors on bicycles who spent one day per month at a supply point his monthly cost would be at least K100 per month or at least K4.50 per supply point, i.e. at least 60% of the revenue. Moreover it is possible that the costs could exceed K7.50 per supply point. Even if collection costs were covered it is unlikely that any profit would be made after all the clerical costs etc. were met. Thus the major argument against free water supplies, that the authority must meet certain financial targets has no relevance in this case. Another way to explain the problem is to say that the effective demand for water is so low that the demand schedule lies entirely below the marginal cost curve.

Thus if Government has limited funds for water it must restrict the number of supplies which it constructs rather than attempt to increase available funds by charging for rural water supplies.

Consequently the relevant question regarding the Western Province rural water supply programme that must be considered by the authorities and the donor, NORAD, does not relate to pricing but solely to benefits. Will the benefits expected from the rural water supplies justify the investments and the continuing costs of operation and maintenance bearing in mind that no revenue will be raised?

This leads on to further questions. Is the NORAD policy of financing rural water supplies in Western Province misguided? The grants given for the supplies will saddle the Zambian Government with the continuing costs of operation and maintenance for as long as the supplies are operating. NORAD personnel working on the project were convinced that many of the supplies that have been built have led to little change compared to the previously

existing water supply situation and that few, if any, real benefits have been achieved. The consultants were able to accept this view after visiting only a small sample of the wells constructed to date.

However it would be over-pessimistic to condemn the whole rural water supply situation out of hand. Probably there are sites where the construction of improved supplies would genuinely benefit the local community. A major fault of the programme to date has been the selection process. Every district has been allocated so many wells based on its population and the district councils have been responsible for the choices within their district. Thus the NORAD field staff cannot be blamed since it was agreed by NORAD that they should simply implement the decisions of the district council meetings.

Consequently there is an urgent need to improve scheme selection. If NORAD genuinely want to see their funds being better used it should propose to the Zambian Government that its own field staff are involved in the selection of future sites. It is all very well to allow the district council to select the sites, indeed it is preferable for donors not to be too involved in such decisions. However when the district councils have used political factors as the major selection criterion and have failed to do an adequate job it is necessary for the donor to become involved so as to ensure that their grants are not wasted. Any rational scheme selection must be based on accurate descriptions of the water supply situations of the proposed sites and on estimates of need, etc. Involvement of the NORAD field staff should make this possible.

15. EDUCATION.

Whatever pricing policy/tariff structure is adopted it must be properly explained to consumers so that they fully understand it. The information provided must include a clear statement of the facts, for example, the high costs of operating and maintaining the supplies, together with the rationale behind the policy, for example, the need for revenue at least to cover the cost of operation and maintenance.

Although it is important that consumers understand these simple facts of life it is vital that local officials do. The evidence is that today not all of them do fully understand. For example, in September 1979, the council secretary in Namushakende wrote expressing concern over the rate increase from K3 to K5 for individual connection consumers. However he totally ignored the cost side of the matter. Consequently the water authorities must ensure that local officials are educated in the need for,and rationale behind,water rates. Incidentally the above mentioned letter is also a reflection of the revenue collection performance. It was written one year after the price increase was first notified by circular and nine months after it should have been implemented.

It appears that part of the current revenue collection problem relates to a lack of education. Although the low rate of collection from communal water points is in part due to:

(a) the Government attempting to satisfy aspirations after Independence,

(b) minor politicians, even today, misleading the people about their obligations to pay for communal points,

(c) the tradition of non payment that has grown up,

the basic problem has been a lack of education and discussions about the need to pay for water. No efforts were made to discuss the matter with the people when schemes were first implemented. Later the authorities continued to ask for payment for the same service which people now regarded as free. They did not back up their efforts with any meaningful education campaigns.

It is recommended in Section 9.2 that communal water points should be free. If the Government does not feel that it is able to adopt this recommendation it is vital that a major education programme must be launched to convince the people that they must pay for communal point

access. The consultants doubt whether such a campaign would be successful, but what is certain is that a high level of rate payment for communal points will only be achieved after a successful education campaign in which the speakers are respected by the majority of the people.

Even before an education programme aimed at the people is started the issues involved must be explained to the leaders so that they support the campaign. Without this support there would be little point in implementing a campaign aimed at the ordinary people.

The support of leaders such as UNIPChairmen and M.P.'s is essential. In the past, politicians in Zambia, for example in Lusaka, during briefings by water authority officials, have agreed to urge the people to pay for the water but have then gone and told the consumers that they do not have to pay, in order to gain popularity for themselves.

The message that should be conveyed to the leaders is that the people must understand that they have to pay for the water since the alternative is a continually increasing burden on Treasury. Since Government will not be able to fully make up the deficit it will lead to a continuing deterioration in the supplies until they break down completely.

It is important that both the support of the leaders is obtained, and the major campaign is started, prior to the opening of the new schemes, and where possible prior to construction, so that a tradition of non payment is not carried forward. It may be appropriate that some or all of the meetings are organised by UNIP since party support is essential. The initial meetings must be backed up by a continued effort to get the basic message across. For example, it should be stressed at any ceremonies marking the opening of any new scheme.

If the water authority is really serious and has the genuine support of local leaders it should back up its campaigns by closing water points where consumers do not pay. However this will not be possible without the support of local leaders since closures would simply lead to a situation of chaos with invective between politicians and the water authorities.

Although the tricky question of payment for communal points has been used to illustrate the need for education, the authorities may need to get other messages across to consumers. For example, rather than allow consumers to focus their discontent of a two part tariff system on the higher rate, the authorities should emphasize that they are charging a low (sub-cost) rate for low consumption for social reasons. The most suitable means of communication with consumers may depend on what the message is, and on which group of consumers is the target. Possible methods will include meetings, posters, letters to individual consumers, and use of the media.

16. NATIONAL STUDY.

It is strongly recommended that this study be extended to cover the entire nation. Firstly there would be no point in carrying out this study unless it were eventually to be used as a planning input in the water tariff decision making process. However a policy for Western Province cannot be implemented in isolation from other provinces of Zambia. Even if this study clearly suggests certain alterations in the current water pricing policy it would not be politically wise or even possible to implement them in Western Province alone. If higher water prices were established in Western Province than elsewhere politicians from the province would naturally try to create an uproar to reverse the decision. If lower prices were established politicians elsewhere would be demanding equality with Western Province. This view was endorsed by a number of senior Government officials with whom the question was discussed in both Mongu and Lusaka, i.e. it is essential to develop a sound national water supply pricing policy. This does not necessarily mean that a uniform price would be established but any differences would be based on rational criteria and would not seriously contervene considerations such as equity. On the other hand it would not be wise to formulate a national policy and to recommend price changes based on the study of one province alone when there are significant physical, economic and social differences between them. Thus the implementation of changes in the level or structure of water rates in Western Province should therefore be based on recommendations of a national study, for which the present study would form an important starting base and an essential input.

A National Action Committee (N.A.C.) has already been established in Zambia for the International Drinking Water Supply and Sanitation Decade (IDWSSD) to formulate national water supply policies. Whether or not this committee with its strong health orientation is an organisation fit to determine economic issues such as pricing policy is a moot point. However its existence demonstrates Government's perception of the need to determine important water supply issues at the national level.

Finally it may not be possible to determine the optimum policy for a province without reference to other provinces. For example the national financial constraint's ramifications for an individual province considered in isolation may not be clear. Issues such as cross-subsidisation could only be considered on a within, rather than on a between province basis, etc. Whereas the present study has suggested that for reasons of practicality

water from communal points should be free, a firm answer to this problem cannot be given until it has been studied at the national level. Vital questions such as this should be part of a national study, i.e. the investigations to date should be expanded.

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APPENDIX 2/I

ESTABLISHMENT POSTS
DEPARTMENT OF WATER AFFAIRS

	Establishment		85 Main Scale Salary
	1979	1980	
S/3	1	1	Director
S/5	1	1	Deputy Director
S/6	2	2	Chief Water Engineer
S/7	-	9	Provincial Water Engineer
S/7	1	1	Principal Hydrologist
S/7	1	1	Senior Hydrogeologist
S/7	4	-	Chief Water Engineer
S/9	1	1	Chief Executive Officer
S/13/12	8	9	Executive Officer
S/13/12	1	1	Senior Store Officer
S/14	1	1	Junior Executive Officer
S/15	11	11	Clerical Officer
S/19/17	26	26	Junior Clerical Officer
S/21/16	18	18	Water Development Officer, Grade IV
S/21/18	1	1	Telephone Operator, Grade II
S/24	1	1	Orderly
			Seconded from Ministry of Finance (1)
S/14	1	1	Accounts Assistant
			19 Professional Staff
GPS/8	1	1	Chemist
GPS/8	4	4	Hydrogeologist
GPS/8	2	2	Hydrologist
GPS/8	20	11	Water Engineer
GPS/8	1	1	Mechanical Engineer
			141 Technical Staff
TS/9	1	1+2=3	Chief Engineering Assistant
TS/10	1	1	Chief Drilling Superintendent
TS/10	11	11+4=15	Senior Engineering Assistant
TS/11	8	8	Senior Mechanical Superintendent
TS/11	3	3	Senior Driller
TS/12	13	13	Water Development Officer, Grade I

Salary Scale	Establishment 1979	Establishment 1980	Post
TS/13/11	37	37	Engineering Assistant
TS/13/11	1	1	Mechanician
TS/13/12	6	6	Driller
TS/13/12	2	2	Mechanic
TS/13	19	19	Water Development Officer, Grade II
TS/15/14	2	2	Assistant Laboratory Technician
TS/15/14	32	32	Water Development Officer, Grade III
TS/15/14	5	5	Learner Driller
TS/15/14	2	2	Tracer
			5 Secretarial Staff
SS/2	1	1	Stenographer
SS/3	2	2	Typist
SS/4	2	2	Punch Card Operator