Republic of Zimbabwe

MINISTRY OF WATER RESOURCES AND DEVELOPMENT

THE NATIONAL MASTER PLAN FOR
RURAL WATER SUPPLY AND SANITATION

Inception Report

REVISED CHAPTER 10

JANUARY 1984
INTERCONSULT A/S

10.0 PROPOSED EXTENTION OF THE STUDY

10.1 Electronic Data Processing (EDP) - Requirements within the Water and Sanitation Sectors

10.1.1 Introduction

Reference is made to the Contract, appendix B, clause 7.1, where it is stated that computer services for the NMWP are to be further discussed.

After having become more familiar with the computer services in Zimbabwe, the Consultant would like to propose that possible consulting services in the field of data processing should not be limited to the NMWP only. Zimbabwe is fairly well equipped with hardware that could be utilized to establish a data bank, and to carry out extensive analysis in the water sector. The requirements would be that reliable basic data are collected, put on computer tape and the necessary programmes worked out.

As a first step it is recommended that a feasibility study be carried out to determine the EDP - requirements within the water and sanitation sectors.

The Consultnat is prepared to undertake this feasibility study for EDP - requirements within a short period of time as the decision on our recommendation in this respect may influence the agreed reporting system.

In the following we have described the creation of a WATER AND SANITATION RESOURCES DATA BANK and the Terms of Reference for a Feasibility Study.

10.1.2 Water Resources Data Bank

General

One of the main objectives for this proposed extension of the National Master Plan Project is the creation of a Water Resources Data Bank.

The rationale for the creation of such a Data Bank is based on the realization that the ambitious goals of the Government within the Water Development Sector will require a solid foundation of relevant data for correct planning to best achieve the set targets.

The Water Resources Data Bank will ultimately contain readily accessible computerized information on Hydrology, Hydrogeology, Water Quality, Water Apportionment and Existing Water Supply and Sanitation Projects.

A number of computer programmes will be prepared to enable data from several of the above mentioned general areas of information to be interlinked and processed, thus combining the data into meaningful forms for planning purposes.

The first and also the most energy and time consuming task in the establishment of a data bank is the gathering of reliable raw data from various sources, the subsequent checking of the data and the filling in of missing information from other sources. Sometimes gaps of data may require synthesizing to arrive at reliable sets of records that can be consolidated into a useful format.

The gathering, checking and consolidation of data dealing with water permits is believed to be fairly straightforward, as this information is methodically recorded and filed.

As far as hydrological information is concerned the actual gathering of data will be relatively easy as the data are already on cards.

With respect to existing hydrogeological data much of this is of limited reliability. A substantial proportion of the available data is therefore not of sufficient quality to form the basis for the hydrogeological aspects of the water resources data bank.

Existing water quality data is also problematic to gather and incorporate in the data bank due to the lack of an organized recording and filing system.

The setting up of a task force to extract and evaluate the existing data in terms of reliability, source and position, and to organize the data selected is warrented.

HYDROLOGY

Rainfall, Organization of data

The collection and processing of rainfall data is carried out by the Department of Meteorological Services, Ministry of Transport. Data from all rainfall stations (approx. 2500) has been put on magnetic tape.

However, up to 1979 only monthly values are available. From the year 1979 - 1980 daily values have been punched. The rainfall-year begins on the 1st July and ends 30th June.

Of the approximately 2500 stations approximately 1100 are still operational. More than 30 years of records are available for about 800 stations.

It would be desireable to have all rainfall data available on tape on a daily basis. This task is basically a question of punching, and we believe this will be carried out by the Meteorological Services without expatriate assistance.

Rainfall output

Programmes for listing of the rainfall station network, programmes for print outs of monthly summaries and a few additional programmes are available.

To obtain full benefit of the rainfall data in the rainfall-runoff studies the following programmes would be desireable.

a) Point Rainfall:
b) Annual and monthly means and Standard deviation from mean.
c) Frequency distributions giving 50, 75, 80, 90 and 95% probability of exceedance.
d) Reliability of rainfall during wet seasons given as amount of rainfall to be expected with a certainty of 2, 5, 10,....90, 95, 98% probability of exceedance during a period of 10, 20, 30, 60 or 90 consecutive days.
e) Bumbel or other distribution of maximum point rainfalls for 1, 2, 3, 4, 5, 6 or 7 consecutive days. (This can be done only on records with no missing data).
f) Soil Moisture Balance, Marginal Areas.
g) A model which simulates the available soil moisture on a daily basis for a given soil type and a given crop with described varying water demand during the growing season.
h) The model should produce frequency distributions of crop yield for the rainy season, given for instance as:- 100% crop yield 60% of the years, 50% crop yield 75% of the years.
i) Area Rainfall:
j) Combining rainfall from individual stations to area rainfall over any area with digitized borders.

Runoff, General

The most basic information required in water resources planning is information on stream flow.

Most gauge height records collected by the Hydrological Department have been converted to discharges and punched on cards. Until the data are transferred to tape it will not be possible to carry out comprehensive analysis for a large number of stations. The Hydrological Department is in the process of transferring the data to tape.

For the analysis needed for the NMWP it is of greatest importance that the data transfer is speeded up.

We have had separate discussions with the Hydrological Department on this matter. At present it has not been confirmed whether our services will be required for this purpose, or if the Hydrological Department will obtain assistance from other sources.

The total number of discharge stations on the rivers is in the order of 650, of which approximately 360 are automatic recorder stations. The coverage of stations, therefore, seems to be adequate in most areas.

It is not known to what extent the data are continuous and complete. To fill in gaps it would be convenient to obtain a rainfall-runoff model.

Rainfall Runoff Model

A model used for daily discharge synthesis consists of two major components. One component is the storm runoff, i.e. rainfall excess, and the other the base flow.

The primary input to the model is daily point rainfall. The rainfall is then converted into storm runoff through a process in which antecedent precipitation, climatic region, soil type, land use and vegetative cover are taken into consideration.

The storm runoff is adjusted for base flow through recession curve analysis, and where spring flow is of importance further adjustments are made.

The primary result from the model is daily "point runoff". The point runoff is then combined into daily sub-basin wide runoff. Next step combines sub-basin flow into stream flow from any wanted larger catchment area or as runoff from any area with digitized borders.

Runoff-Output

Below follows a description of some suggested programs/outputs based on daily runoff input.

- Annual and monthly means and standard deviations from mean.
- Frequency distributions giving 50, 75, 80, 90, 95 and 98% probability of exceedance.

- Storage yield indices; storage required to guarantee a given sustained flow with a given acceptable probability of failure.

- Flow duration data.
- Low flows for 1, 5, 10 and 30 day periods.
- Flood flows for various return periods.
- Programmes for plotting of graphs showing the results from the above analysis.

Water Apportionment

The consultant believes that the gathering, coding and checking of data can most conveniently be based on river cards, filed by catchments.

Apart from the amount of water abstracted, information of the permit holder etc., it is extremely important that the map references for each abstraction are coded accurately. Accurate details of the map references will enable print outs of the permits in any digitized area to be obtained. As the map references have not been written on the cards, these have to be obtained from the 1:50,000 scale maps where all permits are marked.

HYDROGEOLOGY

Recently some major groundwater exploration and development projects have been implemented. Similar projects may be implemented in the near future.

It would be advantageous if hydrogeological information gathered during the current programmes and any new investigations could be incorporated into the NMWP. To accomplish this all the information gathered on the various projects needs to be collected in a standardized manner such that the data collection is similar quality.

The Terms of Reference for the NMWP makes specific mention of the need for the establishment of routine procedures, and we consider the collection of hydrogeological data to be of primary importance to the formulation of any future development plan.

From the information we have gathered so far, and from discussion with both Government and Consulting personnel, it is clear that the quality of the existing hydrogeological data is poor. Although there are considerable data available as computer print outs it would appear that these are of a qualitative nature only and are not ameanable to form the basis of a revised computer based storage system for the following reasons:

- The data are obtained from drillers records of poor accuracy, with limited field control.

- The grid references are inaccurate.

- The yield data given are based on short tests of unknown nature. They cannot be used for quantitative appraisal of water resources (only qualitative).

- No distinction is made between a dry hole and a successful hole with an unreported yield.

In order to avoid loss of information on current and future projects we therefore recommend that standardized procedures and schedules for the reliable recording of drilling and hydrogeological data be prepared without delay.

To prepare such procedures and schedules a study of the optimum format and essential information to be collected is required.

Such data will include information as relevant relating to the borehole and/or well (position, construction details, drilling technique used) geology intersected, hydrogeological data (depth of weathering, significant fractures) hydraulic

data (tested yield, including type of test carried out and raw test data), and groundwater quality (physical and chemical constituants).

It is obviously important that the implementation of the routine collection and recording of these data and standardized format be made a requirement of all drilling contractors and consultants by the Ministry of Water Resources and Development.

All information collected must be filed in a suitable manual retrieval system. This system will form the basis for the development of the computer based storage and retrieval system.

The development of a computer based hydrogeological data bank and storage retrieval system is essential in view of the large amount of information that will be obtained both during the implementation of the NMWP and other groundwater investigation or development programmes. Once reliable data are available in the water resources data bank the preparation of suitable programmes will allow these data to be manipulated in an advantageous manner to assist in the further development of locally available groundwater resources.

Such programmes will enable ready retrieval of for example, average drilling depths in any particular area or geology, average borehole/well yield in any particular area or geology, positions of existing boreholes/wells in any area, the most suitable borehole/shallow well construction in an area of interest, groundwater quality in any particular area or geology, and delineation of areas of good or poor quality groundwater. Other outputs obtainable from the computer programmes should include diagramatic borehole logs, and suitable hydrochemical plotting (Schoeller, Piper etc)

Water Quality

The NMWP will include the collection of water samples from rivers, lakes and boreholes. According to the Contract more than 500 samples comprising several water quality parameters will be required. It is important to include this Water Quality Data into the Water Resources Databank, particularly as the existing information on groundwater is scanty.

Inventory of existing Water Supply and Sanitation Facilities

According to the Contract, Appendix B, clause 1, an organized inventory of existing Water Supplies and Sanitation facilities should be provided. For this purpose, the Consultant has planned to use his own EDP-facilities.

However, it is a requirement to transfer all these charts to a Water Resources Data Bank.

Water apportionment - Output

Apart from the programmes required to establish the data files a selection of programmes should be written to make it possible to extract and print permit information according to certain defined selection criteria or combination of criteria such as:

- Drainage area or any other digitized area
- Purpose of extraction
- Flow abstractions within a given range
- Date of granting of permit
- Date of expiry of permit

Other Applications

Within the broad Terms of Reference of the NMWP a data storage and retrieval system has a number of additional applications that are useful to the MWRD and other bodies such as the MOH and Decade National Action Committee, for example:

a) General library and information catalogue, especially when combined with micro film storage. This may also be interfaced with the International Water Decade information system.

b) Development of an intersectoral/interministerial data and information base,for example with MOH and CSO.

c) Recording of details and progress of interministerial programmes within the sector.

10.1.3 Terms of Reference for a Feasibility Study Regarding the EDP-Requirements within the Water and Sanitation Sectors

1. Status of electronic data processing (EDP) in Zimbabwe.

Obtain reliable information about existing EDP activities with emphasis on governmental affairs. Specifically survey the following:

- Established EDP - Services and their obligations e.g. the Ministry of Health, Village Health Worker reporting system. CSO.

- Experience, know-how, human resources, hardware and software within these services. The extent of support and following-up offered by the suppliers.

- The situation with respect to any plans or direction for the National, Governmental and/or Departmental EDP-Development and usage.

- Additional relevant information.

2. Analyse the need for EDP as related to the NMWP.

It is necessary to conduct a thorough analysis of how EDP can efficiently contribute to the realization of the

intentions set out in the Terms of Reference for the NMWP. Such an analysis shall be carried out in close cooperation with the relevant authorities and interested-parties. The final goal should be the creation of a Data Bank.

3. Evaluation of Relevant Hard and Software.

   Relating to item 2 above, determine the design parameters for the EDP-system. Evaluate the existing Governmental EDP-systems and identify necessary supplements in order to fulfill the design parameters.

4. Analysis of the Hard and Software markets in Zimbabwe.

   Presupposing that new acquisitions are required, detailed information about the following shall be obtained:

   - Is adequate hardware offered by companies well established in Zimbabwe.

   - If not, what can be done to induce other companies?

   - How well suited is software offered by the hardware suppliers? If not satisfactory, are there other sources national or international, of relevant software (the relevance to be judged on basis of applicability, safety and ease-of-use).

5. System and Program-Development.

   If the design parameters cannot be met by systems which are already in house or easily available, system and programme development will be required.

6. Training.

Training may be necessary in these two areas:

- EDP in general

- Special introduction to purchased systems and equipment.

The extent of such training should be evaluated and discussed with the authorities in Zimbabwe. Suppliers of hard and software may be useful in this context.

7. A review of the data, information collection and recording systems and procedures.

This will be carried out in order to ensure that reliable data is presented for processing.

10.1.4 Plan of Action

This feasibility study is supposed to be undertaken by two highly qualified EDP-experts, one specialized on software and one on hardware.

The total man-months required is estimated to 4.

Depending on when the decision is taken to commence, the mobilization may ultimately take 2 months.

10.1.5 Budget

a) Remuneration of Personnel

Personnel	Man-Months	Rate per month NOK	Total NOK
Software Expert	2½	70,000	175,000
Hardware Expert	1½	70,000	105,000
Sum a	4		280,000

b) International Travelling

Lump sum b.	NOK 37,000

c) Overseas Allowances

Personnel	Days	Daily Rate NOK	Total NOK
Software expert	75	487,50	36562,50
Hardware expert	45	487,50	21937,50
Sum c	120	487,50	58500,00

d) Local Travelling in Zimbabwe

4800 km at NOK2,00	NOK 9600,00

SUMMARY BUDGET

a)	Remuneration of Personnel	NOK 280,000
b)	International Travelling	NOK 37,000
c)	Overseas Allowance	NOK 58,500
d)	Local Travelling	NOK 9,600
	TOTAL SUM	NOK 385,100
	Contingencies 10%	NOK 38,500
		NOK 423,600
	GRAND TOTAL	NOK 424,000

10.2 Cooperation and Support to the (International Drinking Water and Sanitation Decade National Action Committee)

10.2.1 General

In concurrence with the aims and procedural guidelines suggested by the United Nations, the Government of Zimbabwe established a Water Decade National Action Committe (NAC) towards the end of 1982. A technical support committee and three standing sub-committees dealing with:-

a) Baseline Data Collection
b) Health Education
c) Community Participation

were set up at the same time.

At its inception the functions of the NAC were seen to be:

"(i) Arrange for review of the current sector situation and national resources available for the sector;

(ii) set tentative goals and targets for the Decade for this sector;

(iii) identify potentials and quantum of additional resources that can be generated from the communities;

(iv) formulate policy with regard to population groups to be served and decide on tentative levels of service;

(v) identify constraints and means of
  (a) overcoming them, or
  (b) minimizing their impact;

(vi) enunciate concrete policy guidance for
  (a) programme development,
  (b) criteria for identifying priority projects, and
  (c) project formulation;

(vii) designate departments or ministries for preparing national programmes on the basis of policy guidance given;

(viii) identify projects or components thereof for which external resources (technical and financial) may be required;

(ix) designate an officer who will liaise with the UNDP Resident Representative on behalf of the NAC;

(x) arrange for a plan of action to be prepared for the various activities decided upon with target dates and approve the plan of action; and

(xi) monitor progress and take corrective action as necessary. "

The NAC is clearly an important instrument for establishing policy and interministerial cooperation, especially in view of the multi-ministerial composition of its membership. However, the NAC does not have any executive powers and UNDP (in Zimbabwe) are limited in their support of NAC by their own staffing constraints.

The NAC's operating budget is drawn from the limited funds of individual ministerial budgets and its administration falls upon the shoulders of Government officers already fully employed by their own duties.

The NMWP will recommend ways and means of strengthening the role of NAC. It is therefore recommended that the Terms of Reference for the NMWP be expanded to enable the master planning team to work in close cooperation with NAC and that one of the first objectives be to draft a 'Decade Action Plan'.

Furthermore we would recommend the following actions be taken;-

a) The appointment of a full time 'secretariat' person. This would ease administration especially when NAC assumes the role of identifying projects and external resources.
b) Specific administration and operating funds should be sought and a budget established.
c) UNDP should be encouraged to assume a more active role by senior Government officials especially in bilateral donar coordination.

10.2.2 Proposed Cooperation between Interconsult and the National Action Committee

The activities of the NAC and the NMWP consultant are so closely inter-related that it is essential to establish good cooperation and communications between the two bodies in order to prevent duplication and overlap of activities and also to enhance the complementary activities of the two bodies; (especially as the NMWP Steering Committee has been newly established as the forth NAC sub committee). For example:

i) the NAC sub committee 'Baseline Data Collection' has instigated a national survey of water supply and sanitation facilities parallel to this the consultant undertaking a national survey together with an evaluation of existing water supply and sanitation facilities.

ii) the NAC sub committee on health education is preparing educational media for use in Zimbabwe whereas the consultant is reviewing existing educational media and delivery systems and will prepare raw strategies.

iii) the NAC sub committee on community participation is investigating means of community mobilisation whereas the consultant is examining existing institutional and community structures in order to make recommendations on implementation methods.

In order to achieve good cooperation and communications it has been agreed by Government that representatives from the consultant should be present and provide inputs to the varous committees.

The consultant would also, to some extent act on a resource to the NAC by providing printing and typing facilities etc., as the NAC has no operational budget.

In addition to the above the UNDP is preparing to establish in the near future a technical support team, the purpose is to draw together a pool of experts from multi and bilateral agencies present in the country who could be called upon to advise the NAC on any technical issues or problems that may be identified. It is also proposed that the consultant should provide from time to time as required, experts for the technical support team.

The additional man/days required for this cooperation and support are detailed below.

10.2.3 The Water Decade National Action Plan

One of the principle decade strategies recommended by the UN is that each country should draft a Decade Action Plan, in Zimbabwe, this is seen to be a long outstanding task that urgently requires undertaking.

The WHO guide to preparation of National Action Plans summarises the eight questions that such a plan should answer:-

i) What are the needs?
ii) Which needs shall we be able to meet and when?
iii) How should we meet them?
iv) Who is to do what?
v) How can we strengthen the health impact?
vi) What resources must be developed?
vii) When will the steps be taken?
viii) How do we ensure progress?

The Terms of Reference for the NMWP is such that the plan will answer the majority of the questions posed by the WHO guideline. However, the record function of such a plan is to translate the answers (or data) into persuasive action by coordination of activities throughout the sector, identifying funding sources etc.

It is proposed that after the NMWP has been finalised and accepted by Government a second brief document or manual 'The National Action Plan' be written jointly with the NAC. The manual would draw planning, financing and coordinating data from the NMWP but present them in a critical path format against a fixed time scale.

10.2.4 An Intermediate National Action Plan

Four of ten decade years have passed by and another year or so will pass before the NMWP is finalised. It is essential that a temporary or intermediate plan of action or programme for the NAC and its sub committees be immediately drafted to ensure that the next year is best utilized by avoiding duplication of effort by the NAC and the consultant.

It is proposed that an intermediate action plan or programme be drafted through a joint effort between the NAC and the consultant as soon as possible.

The additional man/days required for the drafting of the National Action Plans are detailed below.

10.2.5 Summary of Additional Man-Month

1. Cooperation between Interconsult and the NAC

				Man-Months
i)	NAC	Project Manager	1 days/month x 16 =	½
		Senior Engineer	1 days/month x 16 =	½
ii)	Baseline	Data Collection		
		Senior Engineer	2 days/month x 10 =	3/4
iii)	Community Participation			
		Sociologist	2 days/month x 16 =	1
iv)	Health Education			
		Public Health Engineer	2 days/month x 16 =	1
v)	NMWP Steering Committee			
		Project Manager	2 days/month x 16 =	1
		Senior Engineer	2 days/month x 16 =	1
vi)	UNDP Technical Support Team			
		Senior Engineer	2 days/month x 16 =	1

2. National Action Plan

Project Manager	1½ man months
Senior Water Engineer	1½ man months
Public Health Engineer	1½ man months
Economist	1½ man months
Sociologist	1½ man months

3. Intermediate National Action Plan

Project Manager	1/4 man months
Senior Water Engineer	1/4 man months
Public Health Engineer	1/4 man months
Economist	1/4 man months
Sociologist	1/4 man months

10.2.6 Cost Estimates

a) Remuneration of Personnel

Personnel	Man-Months	Rate per month NOK	Total NOK
Project Manager	3 1/4	76,500	248,625
Sen. Water Engineer	5	68,600	343,000
Public Health Engineer	2 3/4	75,000	206,250
Economist	1 3/4	50,000	87,500
Sociologist	2 3/4	35,000	96,250
Sum a.	15½		981,625

b) International Travelling

Lump sum b. NOK 37,000

c) Overseas Allowances, Housing and Field Allowances

Personnel	Days	Daily Rate NOK	TOTAL NOK
Expatriate Personnel	210	487,50	102,375
Local Personnel	84	300,00	25,200
Sum c.			127,575

d) Local Travelling in Zimbabwe

9,000km at NOK2.-	NOK18,000

e) Office Expenses

Secretarial Services for NAC	NOK 20,000
Copying documents, reports for NAC	NOK 60,000
Sum e.	NOK 80,000

f) Miscellaneous

Workshops, seminars on behalf of NAC.	
Lump sum	NOK100,000

SUMMARY BUDGET

a)	Remuneration of personnel	NOK 981,625
b)	International travelling	NOK 37,000
c)	Overseas allowance, housing and field allowances	NOK 127,575
d)	Local travelling	NOK 18,000
e)	Office expense	NOK 80,000
f)	Miscellaneous	NOK 100,000
	TOTAL SUM	NOK1,344,200
	Contingencies 10%	NOK 134,420
		1,478,620
	GRAND TOTAL	NOK1,479,000

10.3 The Inclusion of Peri-Urban Areas in the Study

10.3.1 General

The Terms of Reference for the NMWP are presently restricted to rural areas. However, we have been made aware of the potential future problems in planning for and providing water supply and sanitation facilities in peri-urban areas in the light of projected urban migration levels.

Squatter areas in one respect are very much a rural sector problem in that the majority of squatter settlements are adjacent to but outside municipal boundaries and responsibility and fall into the district council administration. In reality the responsibility for the squatter communities is taken by the Ministry of Local Government and Town Planning (MLG&TP) on behalf of the district councils.

The Problem

An examination of Zimbabwes population trends indicates an average total growth rate of 3,3%, one of the highest in the world, however, consideration of the percentage of total population living in urban areas, some 23% indicate that Zimbabwe is under urbanised in comparison to other similar countries.

It is significant to note that the rate of urban growth is increasing dramatically, from 6.7% per year in 1981 to 13.6% in 1982. Zimbabwe is on the brink of rapid urban growth.

By comparing Zimbabwe with other countries of similar economic development and structure it has been estimated that an urban population level of 40% of the country total may be expected. This would project an urban migration of some 1.3 million people. Inevitably a large proportion of these people will settle in informal unplanned and unserviced areas especially as urban employment opportunities are limited and they would be unable to afford formal low cost housing even if they were available.

The Present Situation

Although the authorities in the past have prohibited unplanned settlements,the increasing rate of urban migration accelerated by the insecurity of rural areas during the guerilla war has resulted in a large increase in squatter communities.

For example there were two settlements in Harare
a) Chirambahuyo, where population in 1980 was some 50 000. The Government adopted a strategy of providing communal water and sanitation facilities at strategic points and allocating permanent/formal housing to residents. The Government demolished the temporary shelter as residents left to avoid reoccupation Chirambahuyo was virtually demolished by 1982.
b) Epworth in comparison has been in existence for a number of years, originally as mission farm containing a number of villages. Over time more and more people have settled in the area which now has a population of some 30 000 people, living in unplanned housing with no formal services or facilities.

The Government has adopted an alternative policy for Epworth, an upgrading project is being planned although implementation funding is not fully identified.

It is interesting to note that many ex residents of the demolished squatter areas have found their way to Epworth.

Although squatting has occured mainly in Harare, it is by no means confined to the capital, it is a national urban problem where extent has yet to be surveyed.

Future Policy

Considering the National Housing Programme building rate, the policy of squatter upgrading rather than demolition may well be adopted in future especially if successful upgrading projects such as Epworth can be demonstrated. One of the major concerns of Government is that squatters are settling in the least physically suitable areas and at some distance

from existing infrastucture or indeed settling on privately owned land. A major planning need is to be able to direct urban migrants into suitable areas that can be serviced and to encourage them by building appropriate structures.

10.3.2 Proposed Study

It is proposed that the terms of reference for the NMWP be extended to include peri-urban areas. This would enable a clear and rational policy for water supply and sanitation to be established together with short and long term development plans fully integrated into the National Rural Water Supply and Sanitation Master Plan.

The terms of reference for the peri-urban study would be the same as for the other sectors but with emphasis on the following tasks:

1. To identify and evaluate the extent and level of service in existing peri-urban areas.
2. To identify areas which could be readily developed and serviced by water and sanitation into which urban migrants could be directed for informal housing, transit or reception areas and/or sites and service of ultra low cost housing areas.
3. To recommend policy as to level of service and appropriate technology, giving special regard and consideration to upgradability of technologies and standards.
4. To recommend strategies for implementation or water supply and sanitation implementation both for upgrading and new areas giving special regard to community participation and self help.

The tasks listed above would be carried out in close co-operation with the Ministry of Local Government and Town Planning and the Ministry of Housing who have expressed interest and willingness to co-operate in the study.

10.3.3 Cost Estimates

a) Remuneration

	Personnel	Man-Months	Rate per Man-month NOK	TOTAL NOK
*	Project Manager	½	76,500	38,250
	Physical Planner	3	50,000	150,000
*	Public Health Eng.	4	55,000	220,000
*	Sen. Water Engineer	4	65,000	260,000
	Sociologist	4	35,000	140,000
*	Economist	4	55,000	220,000
	Statistician	3	25,000	75,000
*	Hydrogeologist	2	50,000	100,000
	Enumerators (x 10)	20	1,500	30,000
	Sum a.			1,233,250

* Expatriate personnel

b) International Travelling

Lump sum b. NOK 92,500

c) Overseas Allowances, Housing and Field Allowances

Personnel	Days	Daily Rate NOK	TOTAL NOK
Expatriate personnel	435	487,50	212,062
Local personnel	780	300,00	234,000
			NOK 446,062

d) Local Travelling

80,000 km at NOK 2,00 = NOK 160,000

e) Office Expenditure

Copying, postage etc NOK 70,000

SUMMARY BUDGET

a)	Remuneration	NOK	1,233,250
b)	International travelling	NOK	92,500
c)	Overseas allowance	NOK	446,062
d)	Local travelling	NOK	160,000
e)	Office expenditure	NOK	70,000
	TOTAL SUM	NOK	2,001,812
	Contingencies 10%	NOK	200,181
		NOK	2,201,993
	GRAND TOTAL	NOK	2,202,000

10.4 Proposed Extension of Terms of Reference to include Commercial Farming Areas and Mines

10.4.1 Background

Zimbabwe has inherited a diverse system of land apportionment. The population of 7,5 million is roughly divided as follows:

	% Land	% Population
Urban Areas	1	21
Communal Areas	42	56
Small-scale Purchase Areas	3	2
Commercial Farming Areas	31	21
Forestry, Parks and Wild Life	16	-
National Land	7	-
	100	100

The present Terms of Reference (TOR) for the NMWP covering rural areas make special mention of communal areas and resettlement areas. These two land apportionment areas were identified by the Government of Zimbabwe as priority areas for development after independence and the initial TOR reflect these priorities.

The percentages are rough approximations adapted from the 1969 Census. This categorization takes no account of Resettlement areas which are largely derived from Commercial Farming Areas.

The Commercial farming lands cover an extensive rural area not mentioned in TOR for the NMWP. This land apportionment region covers roughly a third of the land area of Zimbabwe and contains approximately 1,7 million people, predominantly farm labourers and their families. Prior to independence this land area was exclusively restricted to european farmers and the highest proportion of land grades I and II occur within this region. The commercial farms range in size from the large ranches in Matabeleland to smaller field-crop and mixed farms in Mashonaland.

The farm worker population and their dependants for the most part live in compact mud and thatch housing clusters or 'compounds' on individual farms. A consequence of the war was that the compounds were densified and few compounds have subsequently become more dispersed. The conditions for farm labourers are among the worst in Zimbabwe; incomes are at the minimum wage of $52 per month, though short term contract workers who are an increasing section of the farm worker population may receive less than this, workers have no wide-spread organization representing their interests; a high proportion are immigrants from neighbouring countries; and environmental conditions are generally poor.

There is little available information on the environmental status of farm worker compounds, but a study of the health status of farm workers in central Mashonaland a year after independance found that 67% of households had no sanitation whatsoever, 18% used river water as their primary water source and 74% used communal water points.

A follow up study at the beginning of 1983 after a primary health care programme focussing on environmental health, reduced the number of households without sanitation to 31% (but a control study of non-project farms still showed that 83% of households had no facilities), and the number of project households still using river water as their primary source to 2%.

The inadequacy of water, sanitation and other facilities are reflected in the health status of farm workers. Sixty five percent of children under 5 in the 1981 study were found to have chronic malnutrition, and 40% of the same children were found to have wasting, or acute malnutrition, 58% of children under 5 were found to have had diarrhoea in the last four weeks on non-project farms in the 1983 study. Many of the principle health problems on farms such as malaria, diarrhoeal diseases and schistosomiasis are related to inadequate environmental facilities on farms.

It is proposed that the TOR be extended to include commercial farming areas. It is further proposed that mines as rural centres with a high population existing and potentially high level of water use, also be included in the extension. The reasons for this proposal are as follows:-

- Commercial farms account for about a fifth of the population on a third of the land area.
- Commercial farms contain the poorest and least priv ledged sectors of Zimbabwe society.
- Mines and farm labourers and their families appear to have a very low level of water and sanitation provision.
- Indications are that mine and farm labourers and their families have the highest incidence and prevalence of water and excreta-related diseases.

- Government is restructuring the historical divisions of land and population. In the future administrative structures in the commercial farming areas are likely to be similar to those in communal areas. The National Water Plan should take cognizance of the extensive and the neglected population on the commercial farms and in mine worker compounds.
- In the interests of integrated planning and optimum use of water resources, decisions in sectoral planning need to take account of water demand in all land apportionment areas and all potential benefits of increased provision. The exclusion of commercial farming areas would severely weaken the usefulness of Zimbabwe's NMWP.

However, the extension of the Study to commercial farming areas will greatly enlarge the workload and the time frame of the NMWP.

- The extension would need to cover just a third of the country's land area, and a fifth of its population.
- Data on existing water and sanitation provision on commercial farms has not been recorded and would have to be entirely gathered from field work. Information on population, social factors, health structures and other categories of data necessary for the NMWP would also have to be gathered in field surveys.
- At present the Government of Zimbabwe access to the farms is legally restricted. Access should be obtained with the support of the Commercial Farmes Union and the consent of individual farmers, but this will entail further delays in data colleciton.

10.4.2 Study Objectives

The objectives of extending the NMWP to Commercial Farming and Mining areas are:-

- To extend coverage of the national inventory of existing water resources and water and sanitation facilities to include Commercial Farming areas and Mines.

- To formulate standard schemes and strategies for water and sanitation provision in Commercial Farming and Mining areas to take account of both the farming and mining needs and provision for farm and mine labourers and their dependents.

- To provide a data base in commercial farming and mining areas to facilitate integrated rural development planning to address sectoral provision for differing needs in the full range of land apportionment areas.

10.4.3 Study Organization

The Work Plan is represented at Fig. The study will be carried out over a 8 month period to overlap with the existing time frame of the NMWP.

The study will include:-

- mobilization
- review of existing information on water management and provision on commercial farms and mines
- collection of new and supplementary data
- processing and analysis of data
- reporting.

10.4.4 Brief Description of Methodology

Existing information is well developed in some aspects (e.g. inventory of the dam construction, water provision for mining engineering) but incomplete or out-of-date in several others (borehole inventory in commercial farming areas, water and sanitation provision for farming and mine workers). The primary sources for the review of existing information would be Agritex's farm files, the records of the MWED and the Ministry of Mines (MOM) and miscellaneous reports and studies held by the MOH, MWRD, MOA, MOM, the Commercial Farmers Union (CFU) and the Chamber of Mines (COM).

The collection of new data would be by 3 methods:

1. Questionnaire distributed through CFU to commercial farmers.

2. Questionnaire distributed through the COM to managers.

3. Field studies in a small selection of farms and mines.

A detailed protocol for the questionnaire and field studies will be developed during the initial phase of the study.

Analysis of the questionnaire will be by computer.

10.4.5 Cost Estimate

a) Remuneration of Personnel

	Personnel	Man-month	Rate per month NOK	TOTAL NOK
*	Study Coordinator	9	60,000	540,000
	Statistician/computer programmer	5	25,000	125,000
*	Water Engineer	5½	45,000	247,500
	Economist	2½	25,000	62,500
*	Hydrogeologist	1½	45,000	67,500
	Enumerators	12	1,500	18.000
	Computer Data Entry Personnel	4	1,500	6,000
	Sum a.	39½		1,066,500

* Expatriate personnel

b) International Travelling

Lump sum b. NOK 150,000

c) Overseas Allowances, Housing and Field Allowances

Personnel	Days	Daily Rate NOK	TOTAL NOK
Expatriate Personnel	480	487,50	234,000
Local Personnel	360	300,00	108,000
Sum c.			342,000

d) Local Travelling

25,000 km at NOK 3,- NOK 75,000

e) Office Expenses

Copying questionnaires, postage, etc.	NOK 170,000
Secretarial Services	NOK 85,000
	NOK 255,000

SUMMARY BUDGET

a)	Remuneration of personnel	NOK	1,066,500
b)	International travelling	NOK	150,000
c)	Overseas allowances	NOK	342,000
d)	Local travelling	NOK	75,000
e)	Office expenses	NOK	255,000
	TOTAL SUM	NOK	1,888,500
	Contingencies 10%	NOK	188,850
			2,077,350
	GRAND TOTAL	NOK	2,077,000

10.5 Testpumping of Shallow Wells

10.5.1 Plan of Operation

During the data collection phase and the early stages of the desk study it has become apparent that a certain emphasis is being placed by the MWRD and MOH on the use of shallow wells as an alternative to boreholes for rural water supplies.

At present no provision is made in the hydrogeological programme for the field pump testing of selected wells to gather information to enable optimum design parameters to be formulated. It is proposed therefore that the Terms of Reference be extended to include the short term controlled testing of approximately 50 - 60 shallow wells such that the near surface horizons of various water bearing lithologies are sampled. The tests will be run for 3 - 6 hours.

Water samples will be collected at the beginning and end of the test to check the groundwater quality and to monitor any changes in quality under pumping.

Since the results of the testing of shallow wells are particularly susceptible to seasonal changes in water level, it is advisable that the testing be carried out towards the end of the dry season. It is therefore recommended that this testing should overlap with the latter part of the borehole testing programme and be undertaken from July to end September 1984.

It is estimated that approximately 3 man-months of field work will be required for this testing followed by 1,5 man-months for data interpretation.

The field testing will be run under controlled conditions according to standard specifications prepared by the principle hydrogeologist. It is proposed that the testing be the responsibility of a locally recruited field assistant/ technician working under these specifications.

The equipment required to undertake the testing is given below.

- a small electrical submersible pump with capacity 0,3 to 0,5 1/sec from a depth not exceeding $\pm$ 15m.
- a lightweight portable generator with suitable power output.
- ancillary equipment (water level meter, resistivity meter, pH meter).
- 4 wheeled drive vehicle for the field survey. It is estimated that approximately 20 000 km will be required.

10.5.2 Cost Estimate

a) Remuneration if Personnel

Personnel	Man-months	Rate per month NOK	TOTAL NOK
Expatriate Staff	1½	43,800	65,700
Local Engineer	3	25,000	75,000
Test pumping team, Field Assistant	9	1,640	14,760
Sum a.			155,460

b) International Travelling

None

c) Overseas Allowances, Housing and Field Allowances

Personnel	Days	Daily Rate NOK	TOTAL NOK
Expatriate personnel	45	487,50	21,937,50
Local personnel	360	300,00	108,000,00
Sum c.			129,937,50
			130,000,00

d) Local Travelling

4 wheel drive

20,000 km at NOK 3,- NOK 60,000

e) Rent of Equipment

Rent of Equipment	3 x 8000	=	NOK 24,000
Field lab.	3 x 2000	=	NOK 6,000
Sum e.			NOK 30,000

SUMMARY BUDGET

a.	Remuneration of personnel	NOK 155,400
b.	International travelling:	NOK --
c.	Overseas allowances, housing and field allowances	NOK 130,000
d.	Local travelling	NOK 60,000
e.	Rent of equipment	NOK 30,000
	TOTAL SUM	NOK 375,460
	Contingencies 10%	NOK 37,546
		413,006
	GRAND TOTAL	NOK 413,000

10.6 Seminars

It is proposed that members of the study team should organize and present regular seminars on various aspects of water resource planning and policy formulation. Such seminars would be aimed at meeting two main objectives.

Firstly they would contain a multi-disciplinary training element wherein participants would be informed on a number of questions central to water supply development. In particular it is intended that participants should gain an insight into issues which are outside their own professional backgrounds, for example engineers would be exposed to the views of economists and sociologists.

The second objective would be to enable the Consultants to receive feedback from a wide audience on policy issues which are central to the National Master Plan.

The seminars or workshops will mostly take place in Harare and will last for ½ - 1 day.

The cost per participants is estimated to $20 including the rent of conference rooms, tea, coffee and lunch.

The number of participants will be limited to about 25 and the number of these short seminars will be about 10.

In addition to these short seminars we see the need for a 3 day workshop outside Harare. The main cost for this workshop will be transport and accommodation which amounts to $175 per participant. The number of participants will be limited to about 60.

In order to organize these very important seminars and workshops we require an allocation of NOK 110,000.

COSTS:

½ - 1 day seminars.

10.25.20	= $ 5,000 =	NOK 35,000
3 day workshop		
175 . 60	= $10,500 =	NOK 73,500
		NOK108,500
		NOK110,000

10.7 Project ONTAP (Our National Technical Awareness Programme for Improved Water and Sanitation in Zimbabwe)

10.7.1 Background/Health Education and Promotion

In the educational/promotional sector there are four major initiatives to be undertaken:-

i) A promotion campaign to persuade communities and individuals to provide for themselves (perhaps with assistance) good sanitary facilities.

ii) A demonstration/technical help campaign to show how to build and help communities construct the facilities.

iii) A health education programme to support and reinforce the above investments by ensuring proper use and associate hygiene practice.

iv) A promotion of village gardening with a view to improve the nutrition status of the rural population.

The Consultant will evaluate and make recommendations on effective methods, "media mixes", and programmes for delivering these messages. Emphasis will be placed on utilizing existing institutions and organizations within the country, for example the Ministry of Health, Ministry of Education and Community Development Organizations. Existing local social organizational structures should also be utilized (Village Headman, Community Development Committees etc.).

Commonly used aids that may be considered for these programmes are:-

- Audio Visual - TV, Radio, Newspapers, Cassettes, Films, Slides, etc.

- Adaption of Traditional Entertainments - folk theatres, puppet shows, story tellers etc.

As our Health Education Consultant completes part of the study (see iii) above), in mid May, Interconsult strongly recommend that the Consultant carry on to the implementation phase of this sub-section of the Study.

To implement a health education programme is very essential and should not be delayed until the NMWP is completed.

Below we are proposing Project ONTAP which should be an ongoing exercise for some time.

10.7.2 Project ONTAP

Although there have been significant advances in the development of appropriate technologies for rural health in the last decade, there is also a growing realisation that the success of such technologies depends on (a) their applicability and durability (b) their acceptance by the community and (c) the provision of supportive educational information regarding their application and relativeness to health. A recent examination of existing educational materials relevant to health technology in Zimbabwe, has revealed a fragmented approach with few available materials. It is proposed therefore that Project ONTAP (Our National Awareness Programme for Improved Water and Sanitation in Zimbabwe) be initiated in response to the need for development of educational materials in support of rural health technology in this country. It is envisaged that a thorough and systematic approach to the problem would in part, provide a solution to the fragmented approach to the development of educational materials which exists at this time. Project ONTAP would therefore provide a framework within which appropriate educational materials could be designed tested and finally disseminated through appropriate channels to the people.

10.7.3 Project Objectives

1. To CONVENE an "ONTAP Educational Unit" to work within the existing framework of the Master Plan Project. The 'Team' would compromise a Health Educator, and Artist and a Co-ordinator.

2. To DESIGN an appropriate educational "logo" say with the ONTAP (or similar) slogan to create decade awareness.

3. TO DEVELOP, EVALUATE AND DISSEMINATE appropriate T.A.P. (i.e. Technical, Awareness and Participatory) educational materials for varying target groups in Zimbabwe: viz

   (T) Technical Support Materials - i.e. simple informative explanatory aids to support recommended health technologies

   (A) Awareness materials - i.e. simple informative - motivational materials aimed to create awareness and motivate the people to adopt specific health practices (e.g. handwashing, latrine use. etc)

   (P) Participatory materials - i.e. drama scripts etc., which will aim at mobilisation of the community.

10.7.4 Methodology

Notwithstanding the contribution by an "ONTAP - Educational Unit", it is envisaged that much of the success of the proposed project, will depend upon close liaison with the Ministries of Health, Water Resources and Development, Education and Womens Affairs and Community Development, who should be encouraged to recognise the national importance of such a project. In addition to materials design, it is proposed that, prior to the large scale dissemination of prepared materials significant emphasis will be placed on evaluation procedure. Materials will therefore be tested at all stages of development, this necessitating the employment of Field Assistants for part of the Project.

10.7.5 Duration of an "ONTAP" Project

It is envisaged that such a project should be realistically planned initially to span a period of 24 months, which will allow for materials design, evaluation, re-design, final preparation and dissemination of a variety of appropriate educational materials. However, Project ONTAP will consist of two phases:

Phase 1 is supposed to take 9 months and will fall within the present NMWP period.

Phase 2 will take 15 months.

During phase 1, draft material will be produced. In phase 2 the materials will be tested and finalized.

10.7.6 Staffing

It is proposed that in addition to support from the Project Manager, and other members of the existing NMWP team, it will be necessary to employ the following personnel:

1. Full time Health Educator and Project Leader
2. Assistant Materials Producer
3. Artist (expected duration of $\pm$ 12 months
4. Research Assistants (x4) ($\pm$ 6 months) (phase 2)

10.7.7 Cost Estimates

a) Remuneration of Personnel

Personnel	Man-month	Rate per month NOK	TOTAL NOK
Project Leader and Health Educator	9	30,000	270,000
Assistant Materials	9	25,000	225,000
Producer	5	25,000	125,000
Artist	4	30,000	120.000
Sum a.			740,000

b) Field Allowances

Lump sum NOK 9,000

c) Local Travelling

2 wheel drive
8,000 km at NOK 2,- = NOK16,000

d) Materials

Lump sum NOK30,000

SUMMARY BUDGET

a.	Remuneration of Personnel	NOK 740,000
b.	Field Allowances	NOK 9,000
c.	Local Travelling	NOK 16,000
d.	Materials	NOK 30,000
	TOTAL SUM	NOK 795,000
	Contingencies 10%	NOK 7,900
	GRAND TOTAL	NOK 874,000

10.8 HEALTH IMPACT STUDY

10.8.1 Study Title

Case-control Study to examine the role of water and sanitation improvements in limiting the transmission of diarrhoeal disease in Zimbabwe.

Background

Zimbabwe is a tropical, largely agricultural, middle-income, recently independent African country with a population of 7.5 million. The country's water and sanitation sector is currently being reviewed and a National Master Water Plan (NMWP) developed under the direction of the Ministry of Water Resources and Development (MWRD) with assistance from the Norwegian Government. The consultant firm executing the NMWP are Interconsult A/S who have a multi-disciplinary team of consultants in the field over a 21 month period from July 1983.

The objective ofthe NMWP is to provide guidence to future programmes to enable sector resources to have optimum utilization. The thrust of the NMWP is directed to water and sanitation engineering, hydrogeological and hydrological aspects of water planning. The educational, sociological and economic aspects of sector planning are also receiving close consideration. Less emphasis is currently placed on examination of the health aspects of water and sanitation implementation. As part of the NMWP the consultant is carrying out a 3 month review of the Zimbabwean health profile but despite the relative strength of Zimbabwean research in the water and sanitation sector, no study has been undertaken in Zimbabwe to examine the health impact of water and sanitation interventions.

The purpose of extending the terms of reference of the NMWP to include such a study are:

1. To provide data on the health impact of water and sanitation provision to guide and justify continued investment in the sector.

2. To provide more detailed data on transmission routes of principle water and excreta-related diseases in Zimbabwe to enable sector planners to develop optimum combinations of water, sanitation and educational interventions to maximize health economic benefits.

Diarrhoeal diseases are a major cause of mortality and morbity among childre under 5 in Zimbabwe and probably constitute the most serious group of water and excreta ralated diseases in the country. National reportings of diarrhoeal and gastro-enteric diseases are not reliable but constitute a considerable proportion of all reportings. One community-based study found that 56% of households without water and sanitation provision reported a childhood diarrhoea in January 1983. The seasonal pattern of the incidence of diarrhoeas has not been clearly demonstrated but a seasonal pattern of peaking in the warm wet months from December through to April is well recognized.

10.8.2 Study Objectives

The study will investigate environmental and behavioural risk factors associated with severe diarrhoea in rural Zimbabwe. Variables to be investigated are:

1. Access to and usage of an improved domestic water source.
2. Access to and usage of a household latrine.
3. Household and community hygiene including the disposal of the solid waste and waste water, and an index of crowding.

4. Personal hygiene and excreta disposal practices including handwashing and the disposal of infants and childrens excreta.

10.8.3 Choice of Methodology

The methodology selected for the study is the case-control study. The predominent studies in health impact assessment in environmental health are cross-sectional or intervention studies. Problems with these methodologies have included the difficulties in controlling for all confounding variables affecting health, uncertainty in judging the optimum time lapse between environmental interventions and health benefits, lack of assessment of technology usage and hygiene and the substantial costs incurred by these methods.

The use of case-control methodologies in this type of study is universal in that case-control studies are classically used to investigate risk factors associated with epidemic situations. The principle difficulties with the use of case-control methodology in the assessment of diarrhoeal disease transmission are: the definition of cases and controls in a near endemic situation, the definition of periods of disease, and allowing for the possibility that a wide range of different risk factors operate in differing populations at differing times and in differing places.

The choice of methodology follows the recent recommendation of the "International Workshop on Measuring the Health Impact of Water and Sanitation Projects", held in Bangladesh in November 1983, and is justified by the following points: wet season peaking does provide a near epidemic situation; ongoing research on behavioural aspects of diarrhoeal disease transmission associated with an ongoing diarrhoeal incidence study does provide evidence of identifiable differences between cases and controls and of a possible though unverifiable association between diarrhoea incidence and water and sanitation interventions; and the methodology is relatively quick and inexpensive and would provide

essential information which might form the basis of a larger, more comprehensive, and expensive study if the conclusions of the present study were inconclusive.

10.8.4 The Study Area

The study will be mounted simultaneously at 2 rural hospitals serving a catchment area where there has been longstanding water and sanitation improvements affecting between 20 to 30% of the catchment population. Bindura General Hospital, Mashonaland East, has a total catchment of approximately 100,000 and serves a large population of farm workers. St. Theresa's Mission Hospital is situated in Chilimanzi Communal Area in the Midlands and serves a total catchment of approximately 60,000. Both hospitals are well established centres of medical care in their areas, have active primary health care programmes, would be willing to collaborate with the study and have facilities to support the study personnel.

10.8.5 General Description of Study Design

A more detailed description of the study design will be developed during the first phase of implementation to include detailed sampling procedures, data collection procedures, questionnaires and observational checklists, methods of analysing the data, identification of possible sources of error or bias and ethical considerations. Annex I contains a study schedule. The study will be implemented in 3 phases: I a preparatory phase including a pilot study, II the main study data collection, and III analysis and write up. The study period will extend over 9 months with the main study centered over wet season diarrhoea peak. In Phase I, study design details will be finalized, field staff recruited, and the questionnaire and procedures for behavioural observations developed. A full pilot study of a small scale sample will be undertaken through every stage of data collection and analysis prior to the commencement of the main study.

The main study, in Phase II, will consist of a sample survey of diarrhoea cases presenting to either of the study hospitals and 2 matched controls for each case drawn from individuals presenting at the hospital without diarrhoea and matched to their case by age, sex, socio-economic status and education. On presentation a study card will be developed for each case and each control and a monitoring system adopted for clear identification of cases and their controls. The first and the second will only be used should the first be dropped from the study. Controls will be eliminated if they are found (by self-reporting and follow-up interviews) to have an episode of diarrhoea in the study period in which case they will be dropped from the study. The sample size will be developed for each study site taking into account the size needed to demonstrate significant differences in the variables under study.

Once the data card has been administered each case control household will be visited, a questionnaire administered and an environmental examination undertaken. The questions will cover the range of environmental variables under consideration.

A smaller sub-sample of the main sample will be selected for a behavioural observation study. Household activities, water and sanitation usage and hygiene in the subsample will be monitored for two days by field enumerators.

The third phase of data analysis and write up will require 3 months. The data sheets will be pre-coded for easy transfer for analysis by computer. The analysis will be done by matched pairs and the results being presented in 2 x 2 table. Tests of statistical significance will be taken to identify associations between risk factors and diarrhoeal disease.

10.8.6 Cost Estimates

a) Remuneration of Personnel

Personnel	Man-month	Rate per month NOK	TOTAL NOK
Project Manager	1	76,500	76,500
Study Co-ordinator	9	50,000	450,000
Epidermiologist	3	75,000	225,000
Statistician	3	25,000	75,000
Social Anthropologist	3	35,000	105,000
Research Assistants	10	2,000	20,000
Field Enumerators	35	1,500	52,500
Data Entry Personnel	2	1,500	3,000
Sum a.	66		1,007,000

b) International Travelling

Lump sum b.	NOK 36,400

c) Overseas Allowances, Housing and Field Allowances

Personnel	Days	Daily Rate NOK	TOTAL NOK
Expatriate	390	487,56	190,125
Local Personnel	1590	300,00	477,000
Sum c.			667,125

d) Local Travelling

2 WD - 12,000 km at NOK 2,-	=	NOK 24,000
4 WD - 5,000 km at NOK 3,-	=	NOK 15,000
Sum d.		NOK 39,000

e) Office Expenses

Copying	NOK 12,000
Use of Computer & Software	NOK 30,000
Sum e.	NOK 42,000

SUMMARY BUDGET

a)	Remuneration of Personnel	NOK 1,007,000
b)	International Travelling	NOK 36,400
c)	Overseas Allowances	NOK 667,125
d)	Local Travelling	NOK 39,000
e)	Office Expenses	NOK 42,000
		NOK 1,791,525
GRANT TOTAL		NOK 1,792,000