SOCIAL IMPACT ASSESSMENT OF THE UPGRADING OF THE OLUSHANDJA DAM IN NORTHERN NAMIBIA

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Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Philosophy in Environmental Science

June, 1995

ACKNOWLEDGEMENTS

I extend my thanks to all those who have contributed their time and effort to this dissertation, but particularly:

Janet Barker, my supervisor, for her very thorough feedback and guidance.

Jon, my fiancé, for assisting with proofreading and for his endless reassurance and confidence in me.

Greg and Tanya, my housemates, for all their support and encouragement.

My fellow classmates for their friendship and camaraderie.

The financial assistance of the Centre for Science Development (HSRC, South Africa) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not to be attributed to the Centre for Science Development.

EXECUTIVE SUMMARY

INTRODUCTION

This report has three main functions:

* to fulfil the requirements for the degree of Master of Philosophy in Environmental Science;
* to present the social impact assessment (SIA) of the upgrading of the Olushandja Dam;
* to review the environmental impact assessment (EIA) and the SIA presented in this report, in the light of current environmental and social impact theory.

PROJECT DESCRIPTION

The Olushandja Dam, which is situated in the Omusati region in northern Namibia, serves as a balancing and storage dam for water supplied from the Calueque Dam, on the Cunene River. Olushandja Dam forms an important component of the bulk water supply network. The Namibian Department of Water Affairs (DWA), the proponent of the project, aims to upgrade the Olushandja Dam, with the objective of increasing the surety of water supply to the regions of northern Namibia.

The upgrading of the Olushandja Dam involves the repair of the north wall pump station and the installation of two pumps, with a combined pumping capacity of $3.2m^3/s$. A complete set of stand-by pumps will also be provided to optimise the surety of supply. The impact of upgrading the dam will be in terms of management, rather than construction or development, as the construction related to the upgrading will be minor. A sound management strategy is required to maximise the benefits of an assured water supply, while minimising the negative effects on the communities living in close proximity to the dam.

TERMS OF REFERENCE

The objectives of the SIA are to investigate and evaluate the social effects of the upgrading project on the surrounding communities. The terms of reference for the SIA, comprise of the following three study objectives:

→ The dam has influenced the health profile of the area, as there are a number of water related diseases such as bilharzia, malaria, and gastritis associated with the dam.

→ The grazing lands were affected by the construction of the dam, as the grasses, which are adapted to grow in the ephemeral *oshanas* do not grow in a perennial water body.

→ The dam has disrupted the mobility and movement patterns of the people in the study are. Peoples' access to facilities and services is obstructed and it also interferes with the interaction between family and friends located on the opposite side of the dam.

Major impacts associated with the Alternative Management Scenarios

The three management scenarios assessed in this study were as follows:

* *Scenario 1*: Maintaining the present water level of the dam. The present capacity of the dam is 30% and the water level is at 1104,6 m.a.s.l.
* *Scenario 2:* Fluctuating the water level between full capacity (1106 m.a.s.l) and dead storage level (5% capacity at 1103,7 m.a.s.l).
* *Scenario 3:* The no dam scenario.

The most significant impacts associated with each of these three scenarios are summarised in the decision-making framework on page vii. The green shading indicates impacts of high positive significance, while impacts of high negative significance are shaded red.

Preferred management scenario

On the basis of the decision-making framework and the evaluation according to the criteria of equity, efficiency and sustainability, Scenario 1 was selected as the preferred management strategy for the Olushandja Dam.

RECOMMENDATIONS

The following recommendations are proposed for the management of the Olushandja Dam:

▸ The dam should be maintained at its present water level (30% capacity at 1104,6 m.a.s.l). The recommendations proposed below, should be applied as part of an environmental management plan for the Olushandja Dam.

- The feasibility of constructing a bridge across the dam should be investigated. The investigation should involve the local people, so that the most desirable solution is found. In the interim, an alternative means of transport around or across the dam, should be provided by DWA in conjunction with the Ministry of Transport.

- To ensure that the fish resources of the Olushandja Dam are not over-exploited, an appropriate management plan should be developed. This should be done through the joint consultation of relevant government departments, traditional and political authorities within the area and the local fishermen.

- Preceding the implementation of a fishing management plan, an educational programme should be initiated to advise the local people of the need for the management of the fish resources, and of the guidelines of the management plan.

- The endemic aquatic and wetland associated floral species should be maintained. This could be achieved by establishing a sanctuary for rare and endemic species. This would require the collaboration of DWA and the Department of Nature Conservation.

- The establishment of any form of conservancy, should be accompanied by an educational programme to advise people of the aims of the conservancy and of the role that they can play in conserving these resources. Furthermore, negotiations between local people and the relevant government departments should be initiated, with the aim of ensuring that the conservancies would be mutually beneficial.

- The following aspects require further investigation:
  - the conservation value of the birdlife associated with Olushandja Dam;
  - the economic potential of the Pila occidentalis species (freshwater snail) and the acceptability of eating this snail, to the local people, should be investigated; and,
  - the potential effects of the proposed commercialisation of the bulk water supply function of DWA, on peoples' land rights and rights to water use from the Olushandja Dam.

Table 4: Decision-Making Framework: Comparative Evaluation of Scenarios 1,2 and 3

* The significance ratings for each impact, with and without mitigation/optimisation, is presented for all three scenarios.
* For Scenario 2, when the significance rating relates to full capacity or dead storage level, this is indicated. No indication of a specific water level means that the rating refers to a fluctuating water level.

*** Positive impacts of high significance are shaded green; Negative impacts of high significance are shaded red.**

Interest Group	Impact Statement	Scenario 1 Present Level	Scenario 2 Fluctuating Levels	Scenario 3 No Dam Option
		30% Capacity (1104 m.a.s.l)	**Between Full Capacity (1106 m.a.s.l) and Dead Storage Level (1103,7 m.a.s.l)**	**No Dam**
Elao and Epalela market gardens; 30 households that will be inundated; residents and fisherman of Epalela; people living in areas in which people resettle.	*IMPACT 1: The various management scenarios could affect the local settlement patterns and may also have an influence on the sub-regional settlement distribution (as a result of people relocating due to a rise in the water level or due to the decommissioning of the dam).*	**No impact**	At full capacity: *Without mitigation:* **MODERATE negative** *With mitigation:* **LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
DWA; 30 households that will be inundated; market gardens; communities that buy produce grown by the market gardens.	*IMPACT 2: If the dam was filled to its full capacity it would result in the inundation of 30 homesteads and the Epalela and Elao market gardens.*	**No impact**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to HIGH negative**	**No impact**
Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local and regional settlements.	*IMPACT 3: A decline in the fish resources of the dam will have a negative effect on the fishing activities associated with the dam, which may in turn alter the economic profile of the area.*	*Without optimisation:* **MODERATE positive** *With optimisation:* **HIGH positive**	Full Capacity *Without optimisation:* **MODERATE positive** *With optimisation:* **HIGH positive**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
			Dead Storage Level *Without mitigation:* **MODERATE to HIGH negative** *With mitigation:* **Uncertain**	
People employed at Epalela and Elao; local and regional communities who buy produce grown by the gardens.	*IMPACT 4: The Elao and Epalela market gardens, which are situated on the immediate banks of the dam, are directly dependant on the dam for irrigation. A rise in the water level will result in the inundation of the gardens while the decommissioning of the dam could affect their access to water.*	*Without optimisation:* **HIGH positive** *With Optimisation:* **HIGH positive**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **Uncertain**
30 households where agricultural land would be inundated.	*IMPACT 5: A rise in the water level of the dam will result in the inundation of productive land used for subsistence agriculture.*	**No impact**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
Households who utilise the dam for drinking, household and livestock purposes; health services in the area.	*IMPACT 9: Various freshwater snails are found in the dam. The management scenarios may affect the distribution of the freshwater snails, which will have an associated impact on the incidence of snail-borne diseases such as bilharzia in humans and liverfluke in cattle.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	**No impact**
People who are dependant on the dam for drinking water; health services in the area.	*IMPACT 10: The poor quality water in Olushandja Dam has a negative impact on the health of the people who drink the water, causing diseases such as diarrhoea and gastritis.*	*Without mitigation:* **HIGH negative** *With mitigation:* **LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **LOW negative**	**No impact**
Households who require access to the other side of the dam, but particularly households on the eastern side of the dam.	*IMPACT 11: The presence of the dam obstructs access to community services and facilities.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
People who have family or friends on the opposite side of the dam; communities on opposite sides of the dam.	*IMPACT 12: The presence of the dam interferes with inter- and intra-community contact.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
DWA; regional users of the water supply network; Etunda Irrigation Project.	*IMPACT 14: The various management scenarios will provide different degrees of surety of water supply to the regions of northern Namibia.*	*Without optimisation:* **MODERATE to HIGH positive** *No optimisation:*	*Without optimisation:* **HIGH positive** *No optimisation:*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
DWA, SWAWEK.	*IMPACT 16: The rate of evaporation from the dam decreases its overall efficiency.*	*Without mitigation:* **HIGH negative** *With mitigation:* **HIGH negative**	Full Capacity *Without mitigation:* **HIGH negative** *No mitigation*	**No impact**
Department of Nature Conservation; DWA; people who utilise the dam who may be affected by the establishment of conservancies.	*IMPACT 17: Changing the water level or decommissioning the dam could result, respectively, in a decline or a loss of natural resources of conservation value.*	*Without optimisation:* **LOW to MODERATE positive** *With optimisation:* **HIGH positive**	*Without optimisation:* **LOW positive** *With optimisation:* **MODERATE positive**	*Without mitigation:* **MODERATE to HIGH negative** *No mitigation*

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GLOSSARY

Cuca shop	a small informal general store
Efundja	a large flood in the *oshana* system
Egumbo	homestead
Hand dug wells	relatively deep shafts with more or less vertical walls that are dug by hand down to the water table. Water is retrieved from the bottom of the shaft using buckets on ropes and a windlass or other mechanical devices
Land use mapping	a participatory rural appraisal (PRA) method, which encourages people to draw their village or household in relation to important points in their environment
Mahangu	pearl millet
Ohambo	transhumance practice whereby livestock (principally cattle), are taken to cattle posts for dry season grazing
Oshanas	local name for the system of interconnected ephemeral drainage channels that flow through northern Namibia
Potable water	water which is suitable for drinking

ABBREVIATIONS

m.a.s.l	Metres above sea level
CATAD	Centre for Advanced Training in Agricultural Development
DDGIC	Dutch Directorate General of International Cooperation
DEA	Department of Environment Affairs, South Africa
DEA, Namibia	Directorate of Environment Affairs, Namibia
DPA	Discontinuous Perched Aquifer
DWA	Department of Water Affairs
EA	Environmental Assessment
EEU	Environmental Evaluation Unit, University of Cape Town
EIA	Environmental Impact Assessment
I&APs	Interested and affected parties

IEM	Integrated Environmental Management
ha	Hectares
km	Kilometres
m^3	Metres cubed
m^3/s	Cubic metres per second
MSA	Main Shallow Aquifer
N$	Namibian dollars
NPC	National Planning Commission
p	Page
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
SIA	Social Impact Assessment
SWAWEK	South West African Water and Electricity Commission
UCT	University of Cape Town

CHAPTER 1
INTRODUCTION

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INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This report has three main functions. Firstly, it is an academic report written in partial fulfilment of the requirements for the degree of Master of Philosophy in Environmental Science. The content of the report must demonstrate the competence of the writer in undertaking work in the field of environmental and social impact assessment.

Secondly, the report presents a social impact assessment (SIA) of the upgrading of a component of a water transfer scheme in northern Namibia, namely, the Olushandja Dam. The proponent of the upgrading project is the Namibian Department of Water Affairs (DWA). The SIA is one of the components of the environmental impact assessment (EIA) commissioned by DWA for the upgrading project. The objective of this SIA is to fulfil the terms of reference specified by DWA for the SIA, (the terms of reference are discussed on p.2 and 3). This report, together with the SIA reports produced by the other Master of Philosophy students (see Appendix 1) undertaking this project, will be used to compile the main EIA report which will be given to the client (DWA). The EIA will contribute to the decisions made regarding the upgrading and management of the Olushandja Dam. This report will be written according to the requirements for a decision-making document.

Thirdly, the process and principles of the EIA of the upgrading project as well as the SIA presented in this report, will be reviewed in the light of current environmental and social impact theory.

1.2 PROJECT DESCRIPTION

The Olushandja Dam, which is situated in the Omusati region in northern Namibia, (refer to Fig. 1, contained in Appendix 2), forms part of a two-dam supply system comprising the Calueque Dam in Angola on the Cunene River and the Olushandja Dam in Namibia. Olushandja Dam serves as a balancing and storage dam for water supplied from the Calueque Dam on the Cunene River and is an important component of the bulk water supply to the

northern regions of Namibia (refer to Fig. 2, Appendix 2).

The demand for water in the northern regions of Namibia and the need to guarantee surety of water supply, are DWA's reasons for the upgrading of the Olushandja Dam. The objective of upgrading Olushandja Dam is to make provision for the maximum abstraction rate of $6m^3/s$ from the Cunene River. The upgrading of Olushandja Dam is coupled with plans to modify and improve the pumping facilities at Calueque as well as repair the incomplete and damaged components of the dam. However, this will take place at a later stage and is not the subject of this study. The upgrading of the Olushandja Dam is being funded by the Dutch Directorate General for International Co-operation (DDGIC). The DDGIC required that an EIA of the upgrading project is undertaken.

The upgrading of Olushandja Dam, which is currently in progress, involves the repair of the north wall pump station and the installation of two pumps with a combined pumping capacity of $3.2m^3/s$. A complete set of stand-by pumps will be also be supplied to optimise surety of supply. The south wall requires minimal repair work, although the outlet gates need to be serviced.

The impact of upgrading the dam will result from the implementation of various management options as opposed to construction or development. This is due to the necessary infrastructure already being in existence. Construction activity related to the upgrading is therefore minor. A sound management strategy is required in order to maximise the benefits of an assured water supply, while minimising the negative effects of fluctuating storage levels on the communities living in close proximity to the dam. The three alternative management strategies assessed in this report have been proposed by the writer, as the proponent has not as yet put forward a proposal regarding management strategies for the Olushandja Dam.

1.3 TERMS OF REFERENCE

The terms of reference, for the SIA of the upgrading of the Olushandja Dam, were compiled by the Department of Water Affairs in collaboration with the University Of Cape Town (UCT) study team (refer to Appendix 1). The terms of reference were stated as follows:

1.3.1 Study Objectives

To investigate, identify, evaluate and report on the social effects which the envisaged water supply upgrading project may have, as well as possible remedial measures and any necessary monitoring schedules.

1.3.2 Study Area

The study area should cover the immediate area adjacent to the Olushandja Dam. The extent of the study area is to be determined by the study team. Although the study will focus on the local area around the dam, the impacts should also be considered in a regional and national context. Refer to Fig. 3 (Appendix 2) for the study area.

1.3.3 Scope of the Study

The assessment should be threefold:

1. A comparison of the existing social groups or communities that have gradients of availability or access to water from the Olushandja Dam and other water supply infrastructure, should be undertaken. This should include, as far as possible, an evaluation of how water provision has influenced the social environment. This may involve an investigation of changes in lifestyles and natural resource utilisation over time.

2. Predictions of the positive and negative socio-economic effects of the proposed water supply upgrading project in both the short and the long term. Various management scenarios should be developed. The social costs and benefits and necessary resource replacements associated with the proposed scenarios, should be identified.

3. Identification and evaluation of any remedial measures which may be required and recommendations for a simple and cost-effective monitoring program should be suggested.

1.4 RELATIONSHIP OF THIS REPORT TO OTHER REPORTS

The Baseline Report for the SIA of the upgrading of the Olushandja Dam (UCT, 1995) prepared by the UCT study team, forms the basis for this report. A full EIA report will be produced by the Environmental Evaluation Unit at UCT. The EIA report will be based on all the specialist reports as well as the various dissertations written by the masters students from the UCT study team. The subjects of the other specialist studies include: the distribution of fresh-water snails; limnology; fish; and, aquatic and wetland plants (see Appendix 1 for the specialists involved in the EIA). The information from the specialist reports, which has a bearing on the social aspects considered in the SIA, has been included in this report.

1.5 APPROACH TO THE SOCIAL IMPACT ASSESSMENT

The following section will briefly describe the information contained in the Baseline Report (UCT, 1995) and the study approach adopted in the SIA.

1.5.1 The Baseline Report

The objectives of the Baseline Report are to give the background and context to the project and describe the affected environment. The information contained in the Baseline Report is discussed below.

1.5.1.1 Report structure

* The introduction gives a detailed description of the project, relates the terms of reference for the SIA and states the assumptions and limitations of the study.
* Chapter 2 describes the biophysical and social environment of the Omusati region.
* Chapter 3 describes the biophysical and social environment specific to the study area. It also includes a description of the existing infrastructure and services as well as the development projects located within the study area.
* Chapter 4 explains the methodology and techniques employed in the data collection

as well as the limitations and shortcomings associated with the methodology.

* The final chapter includes a collation of the data accumulated in the field.
* The appendices contain the summaries of the household and key-informant interviews and the community meeting, the minutes of the consultations with specialists and interested and affected parties; and, minutes of the steering committee meetings.

1.5.1.2 Method of data collection

A qualitative approach was adopted in the collection of data. A qualitative approach was preferred to a quantitative approach as the aim of the data collection was to gain an insight into people's opinions and perceptions, rather than to collect statistical and quantifiable data.

The methods of data collection that were used are listed below.

→ Consultations were held with various specialists, interested and affected parties, and a number of organisations and individuals working in and around the study area (see Appendix 3 for a list of individuals and organisations consulted).

→ Primary data was collected in the form of household and key-informant interviews as well as a community meeting. A Participatory Rural Appraisal (PRA) technique, namely, *land-use mapping*, was employed in the community meeting. 80 households within the study area were interviewed. The key-informant interviews included interviews with representatives from the four day clinics in the study area; Elao and Epalela market gardens; various schools and the church at Onesi. Three headman were also interviewed. Refer to Fig. 3 (Appendix 2) to see the distribution of interviews.

→ Secondary data sources were reviewed.

→ Observations were made in the field.

1.5.2 Approach and Methodology Adopted in the SIA

1.5.2.1 Fulfilling the terms of reference

Using the data contained in the Baseline Report, this report identifies and assesses the social impacts related to the influence of water provision, (in the form of Olushandja Dam), on the social environment as well as the impacts associated with the upgrading of the dam. The upgrading of the dam is assessed in terms of the three management scenarios for the Olushandja Dam proposed in this study. The objectives of the assessment and evaluation of the alternative management scenarios are twofold. Firstly, to determine which of the management scenarios will have the least negative impacts while maximising the social benefits. Secondly, to suggest mitigatory measures for the negative impacts associated with each of the management scenarios. It is proposed that the recommendations should be applied as part of an environmental management plan for the Olushandja Dam. This fulfils the requirements of the Scope of the Study specified in the terms of reference.

1.5.2.2 Method of impact identification and assessment

A checklist of impacts was compiled by the author based on the results of the data collection and the checklist of environmental characteristics in the Integrated Environmental Management (IEM) Guidelines Series (Department of Environment Affairs, 1992). The assessment of the impacts associated with the management scenarios is done by ascribing a positive or negative significance rating of either high, moderate or low, to each impact. A significance rating is assigned without mitigation or optimisation and after considering possible mitigation/optimisation measures, significance is reassigned according to the potential for mitigation or optimisation. Significance is judged according the context (spatial and temporal dimensions of an impact) and intensity (the severity of an impact) of an impact.

1.5.2.3 Comparative evaluation of alternative management scenarios

The evaluation of the management scenarios involves two steps. Firstly, those impacts assigned either a high positive or high negative significance rating in the assessment are

summarised in a decision-making framework. The framework assists in displaying the significant impacts related to each impact visually and aids the comparison of the three scenarios. Secondly, the alternatives are evaluated in terms of Stauth's evaluation criteria of equity, efficiency and sustainability, to determine which alternative is in the best overall interest of society (Stauth, 1989). On the basis of the evaluation and the framework the preferred management scenario is selected.

1.5.2.4 Review of the EIA and SIA

The principles and process of the EIA of the entire study as well as of the SIA presented in this report will be reviewed in the light of environmental and social impact assessment theory. An overview of relevant literature will be presented, followed by an assessment of the degree to which the principles and processes followed in the EIA and SIA accord with the theory presented in the overview. The objective of the review is to determine the adequacy of both processes and to point out the strengths and shortcomings of the studies.

1.6 ASSUMPTIONS AND LIMITATIONS

The assumptions and limitations listed below pertain to the undertaking of this SIA report and do not include all the assumptions and limitations relating to the Baseline Report or to the full EIA.

1.6.1 Assumptions

- The reader has read and is familiar with the Baseline Report, as the information from the Baseline Report will only be repeated where it is essential.

- The technical reports produced for and by DWA, regarding the Calueque-Olushandja water network, are correct and reflect the true situation at the time of writing.

- In the collection of the primary data, which forms an important part of this assessment, Oshiwambo interpreters were used to translate interviews with local

residents and key-informants. It is assumed that the translations reflect the answers reasonably accurately.

1.6.2 Limitations

- At the time the SIA was commissioned, the upgrading scheme was already under way. Consequently, an identification of alternative project actions was not undertaken in this study. This assessment therefore only serves to identify the preferred management strategy of the Olushandja Dam and to recommend mitigatory measures to minimise the negative impacts of the proposed project actions.

- The alternative management strategies assessed in this report were generated by the writer, as DWA has not as yet put forward a proposal regarding management strategies for the Olushandja Dam. It would have been preferable if DWA could have formulated possible management alternatives in collaboration with the study team prior to the commencement of the study. This would have ensured that the impacts associated with these alternatives would be assessed and evaluated.

- The lack of an official government policy on compensation makes it difficult to adequately address this issue. The problem is compounded by the fact that Olushandja Dam is located in a communal area and is regarded as a common resource. Given the co-existence of both tribal and political authorities in such areas it is unclear as to who will be responsible for implementing any recommendations pertaining to compensation.

- The issue of inundation due to a rise in the water level of the dam was not broached in the household interviews, as the study team felt that it may alarm people and because the possibility of inundation is not certain. However, it would have been useful to obtain the opinions of the people who would be affected by a rise in water level, on issues related to inundation, relocation and compensation.

- The sampling technique employed to select the sample population for the household interviews was non-probability sampling. This means that it is an indicative sample rather than statistically representative. Therefore, the results obtained in the household interviews cannot be generalised to the broader population. In this study the findings are used to illustrate the possible impacts associated with certain actions and to provide a sense of the social environment in the study area.

- Presently DWA does not have guidelines for the integration of environmental considerations into the planning and execution of regional or national water development projects, which makes it difficult to contextualise proposed recommendations.

1.7 REPORT STRUCTURE

This report is divided into seven chapters:

Chapter 1 is a general introduction to the project and to the aims and objectives of this report. It also includes the terms of reference for the SIA, the approach and methodology to the study, as well as the assumptions and limitations of the study.

Chapter 2 contains a description of the affected environment, in terms of the biophysical and social environment, as well as the policies and plans relating to the study area and/or to the project.

Chapter 3 presents an overview of environmental assessment theory including South Africa's Integrated Environmental Management (IEM) procedure and Namibia's Environmental Assessment Policy. Following this, is the review of the EIA of the upgrading project.

Chapter 4 presents an overview of SIA theory and Participatory Rural Appraisal (PRA) literature. This SIA and the PRA exercise carried out in the community meeting are then reviewed.

Chapter 5 includes the assessment of the influence of water provision on the social environment and the assessment of impacts related to the three management scenarios proposed in this study. Mitigation and optimisation of the impacts are included in the assessment of each impact.

Chapter 6 presents the comparative evaluation of the three management scenarios. It contains the decision-making framework and the evaluation of the scenarios, according to the criteria of equity, efficiency and sustainability.

Chapter 7 contains the conclusions reached in the study and the recommendations regarding the social aspects associated with the presence of the dam and the upgrading project. Mitigation and optimisation of the impacts related to the preferred management scenario are included in the recommendations.

CHAPTER 2

DESCRIPTION OF THE AFFECTED ENVIRONMENT

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2.1 INTRODUCTION

The following chapter will briefly describe the main characteristics of the biophysical and socio-economic environment of the study area, as well as the policies and plans pertaining to the study area and to the project. The information regarding the biophysical and socio-economic environment is drawn from the Baseline Report (UCT, 1995), where a more detailed description of the affected environment can be found. The section concerning policies and plans is discussed in some detail as most of this information is not contained in the Baseline Report.

2.2 THE BIOPHYSICAL ENVIRONMENT

2.2.1 Location of the Study Area

The Olushandja Dam is situated in the north west of the Omusati region in northern Namibia. The study area extends 10km to the east, west and south of the Olushandja Dam and as far as the Angolan border to the north (refer to Fig. 1, Appendix 2). The dam is 18km in length and 300m wide at its broadest point, while the maximum depth is 3.5m.

2.2.2 Environmental Characteristics of the Study Area

2.2.2.1 Drainage

The area is characterised by the interconnected ephemeral drainage channels, known locally as *oshanas,* which form part of the Etaka-Cuvelai drainage basin. When sufficient rain has fallen on the flat plains of southern Angola and northern Namibia the *oshanas* begin to flow. At times when the catchment receives a higher rainfall than normal, floods (*efundja*) occur. With the occurrence of *efundjas* the water flows in a southerly direction down the *oshanas*

and may reach as far as Lake Oponono and ultimately Etosha Pan (refer to Fig. 1, Appendix 2). The Oshana Etaka is one of the well defined drainage systems which passes through the study area. In general, the drainage system is poorly developed due to the flat topography, the sandy soils and the ephemeral flow of the rivers.

2.2.2.2 Geology and ground water resources

The geology of the area is largely made up of very thick unconsolidated to poorly consolidated beds of the Kalahari Group. It is within the geological formation of the Kalahari Group, that the ground water is contained. Most of the ground water is found in the deep regional aquifer, where the water is extremely saline. However, two forms of fresh water lenses are evident, namely discontinuous perched aquifers (DPAs) and main shallow aquifers (MSAs). The water quality of the DPAs (which provide water at shallow depths) is good, while in the MSAs (which are located between 5m and 50m) the water quality varies from drinkable to saline.

2.2.2.3 Soils and vegetation types

The Omusati region is made up of a number of soil types, with the main soil types being: mixed solonetz soils with pans; locally derived aeolian sands and upland black clays. The vegetation type in the study area is predominantly characterised by mopane woodland and mopane savanna. However, due to human impacts and the existence of the Olushandja Dam, there are variations in the vegetation types. These variations include: water tolerant grasses; a variety of grasses and herbaceous ground cover; acacia scrub and an invasive weed (*Pechuel-Losche leubnitziae*).

2.2.2.4 Climate

The climate in this region is classified as arid to semi-arid. The rainfall is seasonal, with most of the rain occurring in the summer months between January and March. The average rainfall for the Omusati region is about 450mm, which is relatively high compared to the average of 250mm for the rest of Namibia. Evaporation is highest during October and lowest in June, as it is enhanced by low relative humidities, high daily temperatures and wind.

2.2.2.5 Aquatic Fauna

The aquatic resources found in the study area are largely associated with the Olushandja Dam as well as with the seasonal *oshanas*. A total of 39 species of fish have been recorded in the dam to date and represent both resident populations and new introductions entering the dam from the Calueque-Olushandja canal.

2.3 THE SOCIO-ECONOMIC ENVIRONMENT

2.3.1 Demographic Features

The social environment of the study area conforms with the social environment generally observable in northern Namibia. The Omusati region has the largest population of Namibia's 13 regions, with an estimated population of 189 919. The aerial photographs of the study area (taken in 1995), showed that there are 2614 homesteads located within the study area. The average household size for this region is 5.9 people, thus, the approximate population size of the study area is 15 422. However, the statistics disguise the fact many households are considerably larger. The majority of the population live in a rural environment where settlements are in the form of scattered homesteads (*egumbo*), however, it is difficult to identify systematic patterns of location. Household structures are characterised by the important role played by the head of the household. Traditionally men head the household. However, due to the system of migrant labour which operates in northern Namibia, it is not unusual for women to fill the position as household head.

2.3.2 Leadership Structures

The leadership structures in the area include both traditional leaders and political authorities. The political structures were set up as recently as 1992, and thus the role of the political authorities is still to be defined. The traditional leadership structures have been a feature of the social context of the area for a long time. However, their authority has been challenged on a number of fronts and, most recently, by the democratically elected councillors. The Traditional Authorities Bill, still to be passed by Parliament, attempts to define the role of

the traditional leaders in the light of the recently established political structures.

2.3.3 Rural Land Use

Most of the people in the study area engage in various forms of rural land use for subsistence purposes. The traditional modes of subsistence include rain-fed agriculture and livestock farming. The principal crop is pearl millet, which is locally known as *mahangu*, while dry-land types of vegetables are also grown. Livestock, predominantly cattle and goats, are kept for domestic consumption and are sometimes sold to generate income. Cattle are also seen as an important symbol of status and wealth. As a result of increases in human and livestock populations, the pressures on grazing land has increased and has necessitated the need for migratory seasonal grazing (*ohambo*). Cattle get taken on *ohambo* to the cattle posts which are located to the west of the study area. Fishing also serves as an important source of protein as well as a means of generating income for people living in close proximity to the Olushandja Dam. People also fish in the seasonal *oshanas* when the floods are substantial enough to allow the migration of fish from the Cunene River to the *oshanas* in the south.

2.3.4 Infrastructure and Services

2.3.4.1 Schools and clinics

There are a number of schools in the study area, however there is a shortage of qualified teachers and the facilities are generally poor. There is also a shortage of clinics in the area, while access to the clinics at Onesi, Eunda, Mahanene and Oshaala is hampered by factors such as a lack of transport, poor roads and the dispersed nature of the settlements. The clinics are, however, well supported. The major health problems include various tropical diseases and the occurrence of bilharzia is fairly widespread due to the presence of the Olushandja Dam.

2.3.4.2 Water supply

The water supply network includes rural and bulk water supply networks which are operated by the Department of Water Affairs (DWA). The pipelines, which form part of the rural water supply network, supply purified water, while the canals which constitute bulk water supply, provide raw water (refer to Fig. 2, Appendix 2). The *oshanas* and pans also serve as an important source of water during the wet season.

2.3.4.3 Settlements and development projects

A number of settlements and development projects occur within the study area. There is one informal settlement, namely Epalela township, while the formal settlements include the towns of Eunda and Onesi. The projects located on the immediate banks of the dam are the Epalela and Elao market garden projects. The Etunda Irrigation Project is situated on the western side of the study area. Refer to Fig. 2 in Appendix 2, for a map showing the settlements.

2.4 POLICIES AND PLANNING

The following section will consider the policies and plans which relate to the study area and those that have a bearing on the project. Most of the information discussed below was not incorporated in the Baseline Report and will therefore be discussed in some depth.

2.4.1 Policies and Plans Concerning Water

2.4.1.1 The Water Act, 1956 (No. 54 of 1956)

This Act was promulgated by the parliament of South Africa and was hence applicable to Namibia, then known as South West Africa. It has been proposed that a new Water Act be drafted and passed as a matter of urgency, as the present Act is not appropriate to the water environment of the country and furthermore does not reflect the changes which have taken place in the water sector and the country as a whole (DWA, 1994a). A new Water Act may affect the functioning of the rural and bulk water supply systems, which could in turn have

implications for the functioning of the Olushandja Dam.

2.4.1.2 Commercialisation of the DWA Bulk Water Supply Function

At present a Bill is being prepared with the objective of establishing a Namibian Water Corporation, which will take control of the bulk water supply function from DWA. Commercialisation is defined in the Executive Summary - WATCOM Project (DWA, 1994a) as:

> A process whereby a directly controlled State activity is transformed into a suitable form, where a set of corporate values as well as operational and financial motives are developed which will relate to the needs of its demand-led market. Ownership of the commercialised entity is retained by government.

In this way government bodies can move into the private sector where there is less political interference and profits can be made. Furthermore assets are retained by the state and the state does not alienate its investment (Cashman, pers.comm., 1995).

With regard to water supply functions, it is envisaged that the bulk water supply function will be transferred from DWA to the commercialised entity, while the rural water supply function will remain DWA's concern. Even though the bulk water supply function will be handed over to the Water Corporation, DWA will have the paramount role of the overall management of national water resources. Olushandja Dam forms part of the bulk water supply system and would therefore be the responsibility of the Water Corporation once commercialisation takes place.

Another point of interest pertaining to the draft Bill is the inclusion of environmentally related comments, one of which (S.12) refers to the duties of the Corporation with regard to nature conservation and the protection of the environment (Nambian Government, 1994a). However, there is no mention of a requirement to carry out an environmental impact assessment in cases where an activity of the Corporation may have a substantial direct or indirect effect on the environment (Glazewski, 1995). This could have implications for the natural resources associated with the Olushandja Dam should, the Water Corporation decide

to alter the water levels of the dam.

The powers of expropriation afforded to the Corporation, include the right to expropriate movable and immovable property in the public interest, subject to the payment of fair and reasonable compensation. Furthermore, it is stated that any form of expropriation will be subject to the Expropriation Ordinance of 1978 (Ordinance 13) (Nambian Government, 1994a). Hence, if the Water Corporation opted to raise the level of Olushandja Dam to its full capacity level, the homesteads, which are located within the full supply limit of the dam, could be expropriated but the households would have to receive reasonable compensation. However, there is no official policy on compensation which determines reasonable and appropriate forms of compensation under different circumstances (Werner, pers. comm., 1995). At present compensation is worked out through negotiations with the affected communities.

2.4.1.3 Rural Water Supply

The Directorate of Rural Water Supply is responsible for supplying rural communities with purified water. Olushandja Dam is controlled by the bulk water supply division of DWA and is the proponent of the upgrading project. Recommendations regarding the provision of purified water to the communities in the study area would thus have to be directed at the Directorate of Rural Water Supply.

In 1994 the Ministry of Agriculture, Water and Rural Development produced a series of Strategy Papers which will act as a basis for implementing the policy of community participation, which has been adopted by the Ministry. In short, the policy encourages communities in rural areas to participate fully in the planning, management and operation of their water supply points (DWA, 1994b). The overall objective of the Directorate of Rural Water Supply, as stated in the Strategy Papers, is to meet the reasonable needs and expectations of the rural population by exploring and creating sufficient rural water supply schemes. Other objectives include: contributing to improved public health; reducing the burden of collecting water; and promoting community based social development, paying particular attention to the role of women. Some of the issues discussed in the Strategy

Papers, include the concept of creating a sense of ownership of rural water supply schemes, as well as the need to get communities to contribute to the operation and maintenance costs of the services (DWA, 1994b).

2.4.2 Development Plans

In 1994 the National Planning Commission (NPC) produced a document, namely, National Development Planning and the Regions of Namibia, with the objective of establishing a link between development planning at national level and planning at a regional level (NPC, 1994). The study provides an overview of the development which has taken place in the regions between Independence (1990) and the undertaking of the study in 1994. It also identifies development and planning priorities for each of the regions. The status of regional development planning in the Omusati region, within which the study area is situated (refer to Fig.1, Appendix 2), will be discussed briefly.

At the time when the NPC study was being carried out, there were no formal structures in place for regional planning within the Omusati region. One of the main obstacles in establishing planning structures and writing up a comprehensive development plan was perceived to be the lack of trained personnel who would be able to initiate such plans. The major development priority identified was the need for potable water in order to advance the regions agricultural and human potential (NPC, 1994). Water for irrigation purposes was also seen as an important part of development initiatives for the future. The second priority was that of education and thirdly health. The major obstacle to development in the region, as is the case in most of Namibia, is the lack of water.

2.4.3 Environmental Assessment Policy

Namibia's Environmental Assessment (EA) policy was approved in August 1994. The policy aims to promote sustainable development and economic development while protecting the environment in the long term (Directorate of Environmental Affairs, 1995). The policy promotes the assessment of individual projects as well as policies and programmes. The institutional structures and procedures as well as the appropriate legislation are still to be put

in place so as to implement the policy effectively. At present there are no legal requirements to carry out environmental assessments thus the EA policy acts as a guideline for assessments.

2.4.4 Traditional Authorities Bill

The Traditional Authorities Bill, still to be passed by Parliament, addresses the roles of the traditional and political authorities. In brief, the Bill provides that the role of the traditional leaders will not change significantly, but will be subordinate to the powers of the political authorities at a national, regional and local government level (Namibian Government, 1994b). At present the traditional leaders do not have legislative backing, while the regional councillors have no significant powers (Werner, pers.comm., 1995)

CHAPTER 3

REVIEW OF THE ENVIRONMENTAL IMPACT ASSESSMENT

CHAPTER 3

REVIEW OF THE ENVIRONMENTAL IMPACT ASSESSMENT

3.1 INTRODUCTION

The overall objective of this chapter is to present the theoretical considerations of environmental impact assessment (EIA) and the strengths and limitations in the application of EIA theory. More specifically, the chapter provides the theoretical context in which the process of the EIA of the upgrading of the Olushandja Dam will be reviewed, so as to determine whether the process of the impact assessment accords with the principles and procedures of Integrated Environmental Management (IEM) and Namibia's Environmental Assessment (EA) policy.

3.2 ENVIRONMENTAL IMPACT ASSESSMENT

3.2.1 Origins and Philosophical Background

The environmental movement of the 1960's and 1970's provided much of the moral and philosophical impetus for the development and institutionalisation of EIA. Public concern for the state of the environment was stimulated and fuelled by influential publications, such as Rachel Carson's *Silent Spring* and Hardin's *Tragedy of the Commons*. The evolution of EIA in the United States was coupled with the environmental conservation ethic rooted in the social values of the time, as well as the administrative and legal traditions of the United States (Fuggle, 1990). The implementation of the National Environmental Policy Act (NEPA) in the United States in 1970, marked the beginning of environmental impact assessment. This Act set out a legal mandate for the consideration of environmental factors at all levels of decision-making in federal agencies and of all federally funded development projects. Since the enactment of NEPA many developed countries, primarily Western industrialised countries, have adopted similar legislation (Fuggle, 1990). However, in general, developing countries have been wary of implementing legislation which may commit the state to consider the environmental consequences of development projects (Fuggle, 1990).

3.2.2 Defining EIA

EIA is defined by Munn (1979) as a process for identifying the likely consequences for the biogeophysical environment and for human health and well-being of implementing certain actions. This information is then conveyed to those responsible for sanctioning the proposal at a stage when it can substantially influence decision-making. Another definition of EIA, offered by Preston *et al* (1992), states that EIA should be seen as the administrative or regulatory process by which the environmental impact of a project, plan or policy is determined. The EIA process broadly entails the following steps: baseline studies (includes scoping); impact prediction; evaluation of impacts; identification of mitigatory measures; documentation; implementation of the project/policy and lastly monitoring the effects of the project/policy (Beanlands, 1983; Wathern, 1988).

3.2.3 EIA in Developing Countries

One of the major criticisms levelled at EIA concerns the difficulty of applying its criteria and methodologies in the context of developing countries (Fuggle, 1990; Yap, 1990; Boggs, 1991). Fuggle (1990) argues that in countries where basic needs are still lacking, impact assessment should encourage early consideration of realistic and socially responsible alternatives for development proposals rather than prevent development. Furthermore, the successful implementation of impact assessment relies greatly on democratic participation in decision-making and the disclosure of information to the public. These traditions are generally lacking in developing countries and thus impede the effective implementation of impact assessments (Yap, 1990; Boggs, 1991). Another major problem is the lack of legal requirements to facilitate the implementation of the recommendations proposed in assessments. In many cases, the EIAs for large projects are funded by multinational corporations or development agencies. This can give rise to many shortcomings. One shortcoming is the inappropriate use of methodologies within the biophysical and social context within which they are applied. Furthermore, the use of local experiential knowledge is generally not used or encouraged and thus problems associated with cross-cultural communication and perceptual differences often arise (Yap, 1990; Fuggle, 1990; Burdge; 1990; Boggs, 1991).

The imposition of the environmental and development perceptions of developed countries onto less developed countries should be questioned and challenged in an attempt to develop more appropriate procedures for EIA in the developing world. South Africa's Integrated Environmental Management procedure, which aims to encompass environmental planning, assessment and management, is seen to render an African supplement to EIA. IEM's potential to provide an iterative and adaptive approach to environmental planning is one of its most important and valuable features for application in developing countries.

3.3 INTEGRATED ENVIRONMENTAL MANAGEMENT

3.3.1 A Background to IEM

The proponents of IEM argue that the inevitability of industrial and infrastructural development in developing countries, must be recognised and the objective of environmental evaluation must therefore be to guide development and minimise the negative impacts (Hill & Fuggle, 1988). IEM is defined by Fuggle (1990:38) as follows:

> "IEM is a systematic approach developed for ensuring the structured inclusion of environmental consideration in decision-making at all stages of the development process. The objective of IEM is not to impede development, but to provide an effective approach, using interactive and iterative evaluation techniques, to improve a proposal, or suggest more environmentally acceptable ways of meeting the purpose and need of a development proposal. This enables the responsible authority to identify those actions which are in the best overall interests of society without jeopardising the project as a whole".

3.3.2 Principles and Procedure of IEM

The basic principles underpinning IEM are:

* a broad understanding of the term 'environment';
* open and participatory planning in consultation with interested and affected parties;
* informed decision-making;

* accountability for decisions and the information on which they are based;
* consideration of alternative options, and
* a democratic regard for individual rights and obligations.

IEM can be applied to all actions which fall into three main categories: policies, programmes and projects.

The IEM procedure includes three stages: plan and assess proposal; decision and implementation. Refer to Diagram 1 (p24) for a flow diagram of the IEM procedure. Each of these stages will be discussed below.

Stage 1: Plan and Assess Proposal

Proponents of development projects are encouraged to give early consideration to environmental issues by:

- notifying and consulting with authorities and members of the public likely to be interested in, or affected by, the proposal;
- identifying proposal alternatives, and issues associated with these alternatives;
- ensuring that proposals meet with policy, legal and administrative requirements, and
- considering possible mitigatory measures and management plan options.

The proposal can then be classified in one of three ways depending of the type of environmental consideration necessary: *no formal assessment* (when the proposal will clearly not result in significant impacts); *initial assessment* (when there is uncertainty over the nature of impacts) and *impact assessment* (if it is clear that the project will result in significant impacts) (Department of Environment Affairs, 1992).

Stage 2: Decision

At this stage the responsible authority either grants or refuses to grant approval for the proposal. If the information provided is inadequate, further information must be supplied before the proposal is considered again. The authority may set conditions of approval, which could involve the preparation of a management plan, or a commitment to suggested mitigatory and rehabilitation requirements.

THE IEM PROCEDURE

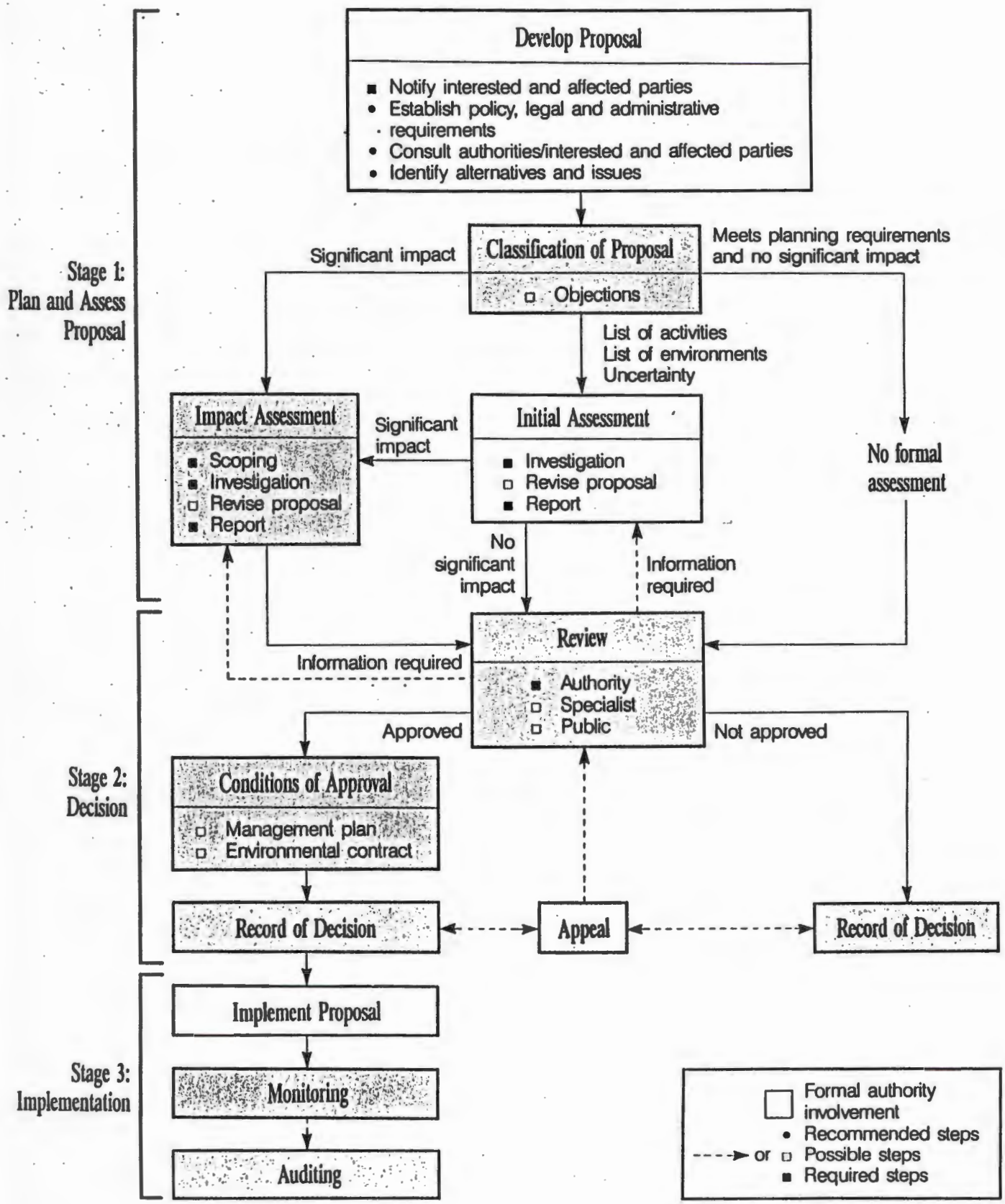

Diagram 1: The IEM Procedure

(Department of Environment Affairs, 1992:1:10)

Stage 3: Implementation

Implementation takes place after the decision has been made. In certain instances there may be conditions of approval, a management plan or an environmental contract. Monitoring and periodic audits are employed to ensure that the project is being implemented according to the agreement and to check the accuracy of predictions.

3.3.3 IEM: A Critique

IEM has proved to be a very valuable approach to environmental evaluation, particularly in the context of developing countries. However, it has been criticised on a number of counts. One of the criticisms concerns the issue of public participation. Quinlan (1993) argues that the scoping procedure in the IEM process fails to address the practical questions on how to facilitate public participation throughout the planning, decision and implementation stages. Up to this point IEM has largely employed the technique of consultation to involve the public in assessments. This gives the public an opportunity to voice their opinions and concerns but it does not necessarily guarantee that their views will influence decision-making (Cock, 1994).

Another debate centres around the incongruency of IEM's commitment to wide disclosure of information and public participation on the one hand, and discretion on public disclosures on the other (Quinlan, 1993). In a document produced by the Council for the Environment concerning IEM in South Africa it is stated that at the proposal generation stage, the "proponent should always be assured confidentiality, where necessary, to safeguard his interests and thus ensure that he is cooperative and forthright in his dealings with the responsible authority at this sensitive stage of the development process" (1989:11). There seems to be an inherent tension in promoting both the disclosure of information to the public and the importance of confidentiality of proposals in the case of sensitive or controversial issues (Preston *et al*, 1992).

If IEM is to fulfil its principles and be relevant to democratic development, public participation needs to be more than rhetoric and attention should be paid to the incongruencies in IEM, such as the one discussed above.

3.4 NAMIBIA'S ENVIRONMENTAL ASSESSMENT (EA) POLICY

Namibia's Environmental Assessment (EA) policy, which was approved in August 1994, states that it strives to implement a sound environmental policy which aims to achieve Integrated Environmental Management (Directorate of Environment Affairs, Namibia, 1995). Furthermore, the principle of achieving and maintaining sustainable development is strongly advocated for all policies, programmes and projects which are undertaken in Namibia.

The EA procedure is very similar to that of IEM. A flow diagram presenting the EA process is contained in Diagram 2 (p27). The differences between Namibia's EA procedure and IEM are discussed below.

→ The EA procedure is presented as 13 steps whereas IEM is presented as 3 distinct stages within which there are a number of steps. The procedures are however, for the most part, the same. Refer to Diagrams 1 and 2 to compare the two processes.

→ The first two steps in the EA procedure require the submission of the project, or policy proposal, to the Environmental Commissioner who is then responsible for administering the EA process. The Commissioner will be appointed by the Ministry of Environment and Tourism and will be housed within the office of the National Planning Commission, (a Commissioner has not as yet been appointed). The functions of the Commissioner will include: registration of proposals; establishing the procedural framework for the process in consultation with the proponent; screening; evaluation; and, review. In the IEM procedure, there is no Environmental Commissioner, but the relevant authority in each case fulfils the functions listed above. There is also no process of registering proposals in IEM.

→ In the EA procedure proposals can be classified either as requiring no formal assessment or requiring a full EA, whereas IEM includes the option of an initial assessment.

NAMIBIA'S ENVIRONMENTAL ASSESSMENT PROCEDURE

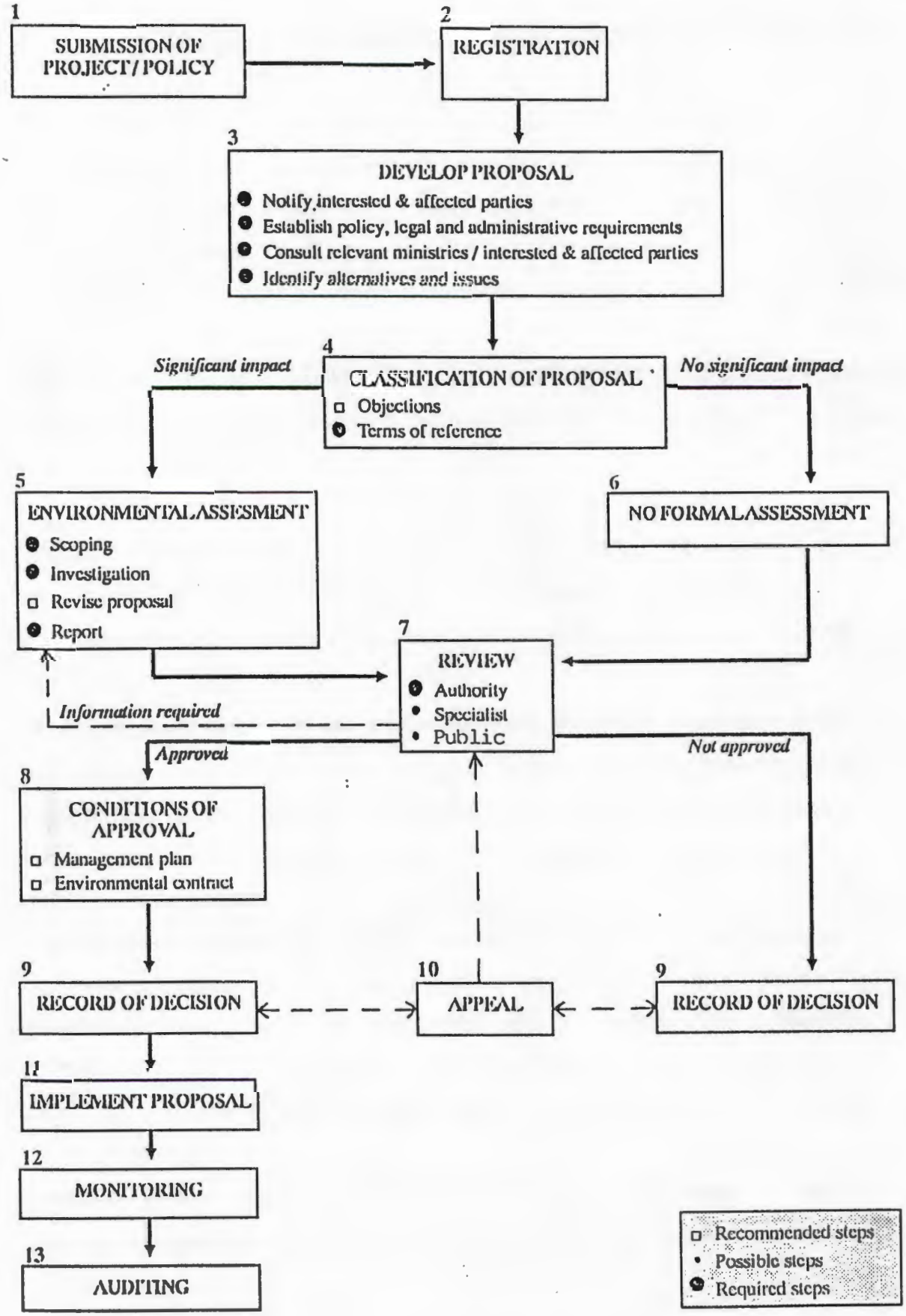

Diagram 2: Namibia's Environmental Assessment Procedure

(Directorate of Environment Affairs, 1995:6)

→ The EA procedure states that the responsibility of ensuring that monitoring takes place lies with the Environmental Commissioner and the proponent shall be responsible for meeting the costs. The IEM guidelines do not specify who is responsible for ensuring that monitoring programmes are implemented.

→ The IEM guidelines include a List of Environments and a Checklist of Environmental Characteristics, which indicate areas, features and environmental characteristics which may potentially be affected by development actions, or which could place significant constraints on proposed development. The EA guideline includes a List of Activities but no list of environments or environmental characteristics.

Apart from the above mentioned differences between the EA procedure and IEM, the two procedures are the same.

3.5 REVIEW OF THE OLUSHANDJA DAM EIA

3.5.1 Introduction

The following section will evaluate the process of the EIA of the upgrading of the Olushandja Dam in the light of IEM and Namibia's EA procedure. A combined review of the EIA in terms of IEM and Namibia's EA procedure will be undertaken because of the similarity between the two procedures.

3.5.2 A Review of the Study in terms of IEM and Namibia's EA Procedure

The EIA process of the Olushandja Dam upgrading project has not, up to this point, accorded with the IEM and EA procedures. (Refer to Diagram 3 (p30) for a flow diagram of the EIA process). In brief, the process has been as follows:

1. The proposal for the upgrading project was developed. Alternative project actions were not identified.
2. Funds were required for the implementation of the upgrading project, so a number

of donors were approached.

3. The Dutch Directorate General for International Co-operation (DDGIC) agreed to fund the project, on condition that an EIA be conducted.
4. Terms of reference for the various components of the EIA were drafted by DWA in October 1994.
5. Consultants were appointed in December 1994, to carry out the different studies.
6. Investigations were conducted between January and April, 1995.
7. Consultants reports were completed by the end of June 1995.
8. The final EIA report, which will be comprised of an evaluation of the various consultant reports, is to be completed by October 1995.

The shortcomings in the EIA's degree of compliance to the IEM and EA guidelines will be discussed below.

- There was a failure to identify alternatives at the stage when the proposal was being developed. This does not correspond with the recommended steps in the *develop proposal* stage in the EA and IEM procedures, which encourage the identification of alternatives and issues related to the alternatives.

- There was a lack of scoping at the outset of the EIA. Scoping should determine the extent of, and approach to, the impact assessment (DEA, 1992; Namibia DEA, 1995). In this case there was little involvement of interested and affected parties and no identification of alternative project actions.

- The reason for conducting an impact assessment was due to the donors requirement for an EIA. There was no *classification of the proposal* on the basis of the potential environmental effects of the project, as recommended in the IEM and EA guidelines.

- The compartmentalisation of the different parts of the EIA is also problematic. There was little chance for interaction between the specialists during the field work, with the result that the reports have been produced in isolation from each other. This detracts from the inter-disciplinary nature of the assessment, a concept which is

THE OLUSHANDJA DAM EIA PROCESS

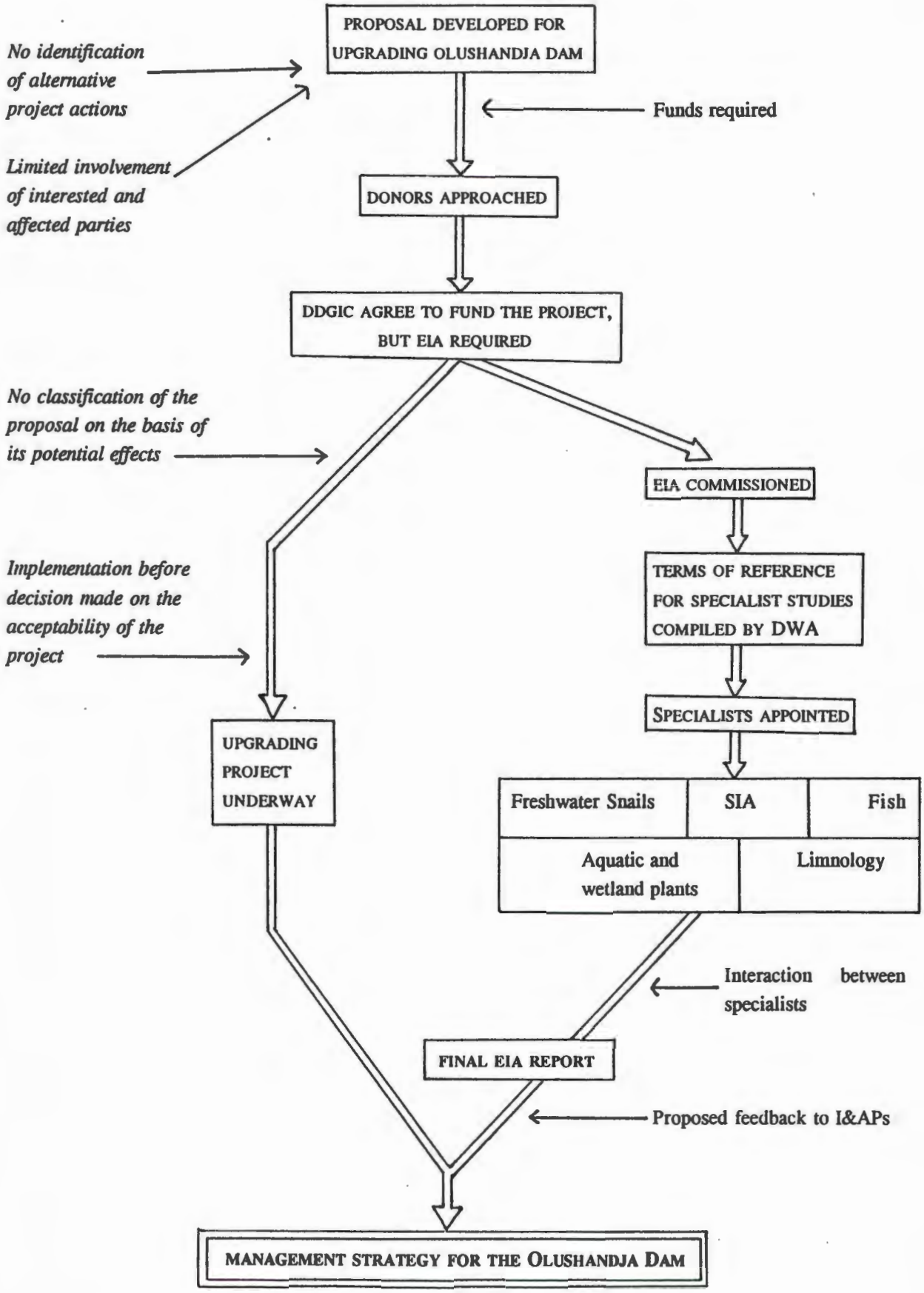

Diagram 3: The Olushandja Dam EIA Process

promoted in both the IEM and EA guidelines. However, during the compilation of the final impact assessment report, there will be opportunities for interaction between the specialists.

- Since the upgrading of the dam is already underway, the decision regarding the environmental acceptability of the proposal, (which should follow after the impact assessment, Stage 2 of IEM and Step 7 in the EA procedure), becomes redundant, as the decision to upgrade has already been taken. Thus the EIA can only act as a basis for recommendations for mitigatory measures to minimise negative impacts of the project and to recommend an appropriate management strategy for the operation of the Olushandja Dam.

Perhaps the biggest question relating to this EIA, is the degree to which it fulfils a "rubber-stamp" function in order to obtain funds from the DDGIC. It will be important that the recommendations made in the EIA are implemented and adhered to.

Another issue concerns the commercialisation of the bulk water supply function of DWA, of which Olushandja Dam is a part. It is not clear whether the public utility company will be bound to the plans/strategies implemented by DWA and to what extent it will comply to recommendations made in the EIA.

CHAPTER 4

REVIEW OF THE SOCIAL IMPACT ASSESSMENT

CHAPTER 4

REVIEW OF THE SOCIAL IMPACT ASSESSMENT

4.1 INTRODUCTION

The following chapter will discuss the theoretical background of social impact assessment (SIA) and participatory rural appraisal (PRA). In the light of these theoretical considerations, the SIA presented in this report and the PRA exercise carried out as part of the data collection, will be reviewed. The aim of the review is to determine to what extent the SIA and PRA exercise achieved the goals purported in the theory and to highlight the shortcomings and problems experienced, as well as the lessons learned.

4.2 SOCIAL IMPACT ASSESSMENT (SIA)

4.2.1 Definitions and Features of SIA

The origins of SIA can be traced back to the early days of sociology when the likes of Toennies and Durkheim were studying the social consequences of the Industrial Revolution (Freudenburg, 1986). However, the major influence on the field of SIA as we know it today, was the passing of the National Environmental Policy Act (NEPA) of 1969, in the United States. NEPA required the preparation of impact statements whenever a project would result in significant environmental change (Burdge, 1990). Initially the social assessments were limited in scope. However, the need for comprehensive social assessments was increasingly recognised due to the many developments which resulted in significant social impacts (Bisset, 1984).

No single definition of SIA exists. One definition, offered by Burdge and Robertson (1990:88), is as follows:

> "SIA is a systematic process that attempts to determine the impacts on the day-to-day quality of life of persons whose environment is affected by physical development or policy change".

A more specific definition is given by D'Amore (in Craig, 1990:38):

> "SIA is an attempt to predict the future effects of policy decisions (including the initiation of specific projects) upon people, their physical and psychological health, well-being and welfare, their traditions, lifestyles, institutions and interpersonal relationships".

A useful approach to understanding SIA, is to view it as a field of applied policy and planning which should be employed both flexibly and sensitively, always taking into account the nature of the communities in question, the decision processes and any other issues which may be involved (Craig, 1990).

The features characteristic of the SIA process, as identified by Burdge and Robertson (1990), are listed below.

1. SIA is a systematic effort to identify, analyse and evaluate social impacts of a proposed project or policy change on the individuals and social groups within a community or on an entire community. This is done in advance of the decision-making process in order that the information derived from the SIA, can actually influence decisions.

2. SIA is a means for developing alternatives to the proposed course of action and determining the full range of consequences for each alternative.

3. SIA increases knowledge on the part of the project proponent and the impacted community.

4. SIA raises consciousness and the level of understanding of the community, and puts the residents in a better position to understand the broader implications of the proposed action.

5. SIA includes within it, a process to mitigate or alleviate the social impacts which are likely to occur.

The SIA presented in this report, will be evaluated in terms of the above five features of SIA (Section 4.4).

There is a wide variety of methodologies and techniques currently practised in SIA, however, two dominant approaches can be identified, namely, technical and participatory approaches. The technical approach tends to seek quantitative demographic data and the emphasis is placed on the end product rather than the process of the SIA. Examples of techniques employed in the technical approach include: census data, secondary information and case studies. The participatory approach focuses on community development and action and seeks the opinion of the local people (Craig, 1990). Participatory methods include: participant observation; community forums; and, structured or unstructured interviews. Both the technical and participatory approaches have an important role to play in SIA and should be used in conjunction with each other so as to gain quantitative, as well as qualitative data.

An important feature of SIA is the role it can play in understanding and promoting social change (Burdge, 1990; Craig, 1990). Escalating citizen concern for environmental issues, and the increasing demand by the public to be involved in decision-making processes, can be seen as an attempt to change societal values towards the environment (Craig, 1990). SIA can promote social change by addressing social and economic values that have an influence on the inter-relationship between humans and the environment. SIA also presents the opportunity to involve people in the decision-making processes which affect their lives, thereby contributing to the democratisation process within society.

4.2.2 Problems associated with SIA

Some of the major difficulties associated with SIA are discussed below.

4.2.2.1 Inter-disciplinary nature of SIA

The first problem concerns the difficulties related to the inter-disciplinary nature of SIA. The differences in ideologies and assumptions of the various disciplines (in which the various professionals from an inter-disciplinary team are schooled) can lead to potential conflict and

tensions (Freudenburg, 1986; Rickson *et al*, 1990). It is important that the inter-disciplinary teams are well organised and that a good system of communication and interaction is established.

4.2.2.2 Difficulty in predicting social impacts

The inherent difficulty in predicting social impacts is another major problem in SIA (Bisset, 1984; Freudenburg, 1986). The complex nature of social aspects means that there is no easy way of conducting a SIA. Freudenburg (1986:472) suggests that SIA practitioners should "plan for surprises" and pay more attention to the fallibility of their predictions. Quinlan and Zingel (1991) argue that the process of identifying distinct impacts and applying degrees of change and specific mitigatory measures related to each of the impacts, unrealistically compartmentalises the process of change. SIA should aim to understand social change as a process and try to perceive social impacts within this process of change.

4.2.2.3 Partial application of SIA

Social assessments are generally accepted as necessary but in many cases the recommendations from SIAs are only partially applied (Rickson *et al*, 1990). This may result in unanticipated impacts, or undetected cumulative impacts. Monitoring is also often neglected and thus long-term impacts may not be identified or mitigated.

4.2.2.4 Lack of social disaggregation

A frequent shortcoming in SIAs, is the tendency to speak of "the community" as a homogenous entity. It is of central importance that SIA practioners disaggregate social groups by variables such as location, income, occupation, gender, age and so forth, and realise that a community is constituted of people with different interests and values.

4.2.3 SIA in Developing Countries

The benefits of incorporating SIA into development processes within developing countries include benefits to the proponent and to the population affected by a proposal (Burdge, 1990). The proponents gain through a higher rate of project success, due to the better understanding and interaction between the proponent and the people. On the other hand, the affected population can benefit through the evaluation of the changes and impacts to be brought about by the project. Knowledge and information made available to the people prior to project implementation allows time for the modification of the project proposal, if necessary, or the formulation of more appropriate mitigatory measures (Burdge, 1990).

The implementation and expansion of SIA in developing countries is, however, associated with a number of problems. The first of these is connected to the political context of developing countries, where major institutional structures, such as states, international organisations and corporations make it difficult to relay the wants and needs of communities to the decision-makers (Henry, 1990). Other authors have argued that the lack of legal and administrative frameworks, coupled with financial limitations and shortages in human resources capable of carrying out assessments, all contribute to the problems facing SIA in developing countries (Burdge, 1990; Rickson *et al*, 1990).

The different perceptions of what constitutes development and progress may also lead to difficulties. The rating of an impact as either positive or negative will, to a large extent, depend on the researchers perception of development and progress (Henry, 1990; Quinlan and Zingel, 1991). Quinlan and Zingel (1991) illustrate this problem by using the example of land tenure in rural African communities. A change in land-tenure systems may have a negative effect on the tribal authority in a rural African community, but the diminution of tribal authority may be a positive indication of development.

A comprehensive list of suggestions for implementing SIA in third-world countries was formulated by Burdge (1990). These suggestions are as follows:

1. Use of existing organisational resources.
2. Flexibility in the choice of methods used.
3. Use of local people to decrease the perceptual gap between the researcher and the community under investigation.
4. Use of methods and concepts which are appropriate to the context in which they are applied.
5. Quantification of social characteristics and impacts.
6. Allow indigenous populations to express their opinions traditionally.
7. Consult anthropological literature.
8. Selection of SIA variables through scoping.
9. Avoid repetitive data collection.
10. Never use SIA to justify a decision already made.
11. Include specific recommendations for mitigation.

The SIA presented in this report will be evaluated in terms of the above suggestions and the five features of SIA identified by Burdge and Robertson (1990), (discussed in Section 4.2.1). The review of the SIA is contained in Section 4.4.

4.3 PARTICIPATORY RURAL APPRAISAL (PRA)

4.3.1 Principles and Features of PRA

PRA is a fast developing body of methodology, specifically aimed at developing countries. The development of this approach stems from the recognition of the inappropriate nature of conventional methods such as formal questionnaires (Chambers, 1993; MIDNET, 1993). In the late 1980's the Rapid Rural Appraisal (RRA) approach was very popular, however this mode of research was still largely extractive. This weakness of RRA was later acknowledged and hence came the evolution of PRA. In this approach the emphasis is on participation and two-way learning rather than simply gathering information (Chambers, 1993).

PRA is based on the philosophy that "different people perceive and understand reality in different ways. Thus community members, development workers and researchers often see

and interpret their environment in ways which are very different, but equally important" (Theis & Grady in CATAD 1991:76). Some of the main principles and features of PRA are given below.

* Respecting people's knowledge and learning from them, while using their criteria, classification and categories, and understanding and appreciating indigenous technical knowledge.
* Progressive learning through the use of flexible, exploratory, interactive and inventive methods.
* Listening to the disadvantaged members of the community by speaking to, and hearing those, who are not normally asked or heard.
* Triangulation by comparing information using different methods, sources and disciplines, and cross-checking these to get closer to the truth.
* Embracing error, as mistakes are part of the learning process.
* Focusing on relevant information, so as to provide a more efficient method of information gathering.
* Sharing information and ideas between the people, the people and the researcher and, between different researchers and organisations.

(Chambers, 1993; MIDNET, 1993; CATAD, 1994)

The techniques used in PRA are numerous and varied. The most frequently used methods include: time lines; transects; mapping; venn, seasonal and flow diagrams; ranking and pocket chart voting (MIDNET, 1993; CATAD, 1994). The most important aspect of all the methods used in PRA is the visual sharing of the information. This enables all those present to see, discuss, and manipulate the information in a way in which they feel comfortable. Thus, the emphasis is placed on the opinions of the people and not on the supremacy of being literate (Chambers, 1993). Furthermore the information is shared and is not "owned" or "controlled" by the researcher.

4.3.2 Potentials and Pitfalls of PRA

4.3.2.1 Advantages of PRA

There are many advantages of using PRA in developing countries. The most significant advantages include the following:

- → greater involvement and participation of the affected communities;
- → meaningful interjection of public participation into the development process;
- → increased awareness among people about their problems, and the means by which they can tackle these problems;
- → local resources are utilised and developed;
- → problems can be identified quickly and the information can be cross-checked; and,
- → planning procedures are decentralised and improved.

(CATAD, 1994; Edwards, 1995)

4.3.2.2 Pitfalls of PRA

The pitfalls of PRA should be examined and challenged continuously. The notable pitfalls of PRA are mentioned below.

- → Dangers in raising the expectations of the people involved by not clarifying the objectives and limitations of the project. PRA exercises should always be followed up by action.
- → In some cases people become suspicious of frequent visits and if there are no notable benefits people may feel deprived and frustrated.
- → PRA requires being open to all the strategies that people may choose. This may not always result in favourable conditions for project planning, and could thus present certain problems or limitations to the project.
- → Many claim that their work is PRA, when in fact it is still extractive rather than participatory.

(CATAD, 1994; Edwards, 1995)

4.4 REVIEW OF THE OLUSHANDJA DAM SIA

The following section will evaluate the SIA presented in this report in terms of the five features of SIA identified by Burdge and Robertson (1990), as well as Burdge's (1990) suggestions for implementing SIAs in developing countries.

4.4.1 Review of the SIA in terms of Burdge and Robertson's Five Features of SIA

Burdge and Robertson's (1990) five features of SIA, and the authors assessment of the extent to which the process of the SIA presented in this report complied with these features, are discussed below.

Systematic identification, analysis and evaluation of impacts in advance of decision-making

The SIA has identified, analysed and evaluated the social impacts of the upgrading of the Olushandja Dam but the decision to upgrade the dam has already been taken. Thus, the information derived from the SIA will influence decision-making, only in terms of mitigation of the negative impacts related to the upgrading and recommendations for an appropriate management strategy for the dam.

Develop Alternatives

Alternatives to the proposed course of action, in this case the upgrading of the Olushandja Dam, were not developed due to the fact that upgrading is already underway. However, alternative management strategies for the operation of the dam, once upgrading has taken place, are being considered.

Increased Knowledge

The SIA will provide the proponent with increased knowledge about the predicted impacts of the upgrading project on the communities living in close proximity to the dam. However, information regarding the upgrading was not disseminated to the affected communities, due to the uncertain nature of what the consequences of the upgrading project may be. The SIA study team did not want to unnecessarily alarm people and, therefore, merely sought insight into the interrelationship between the people and the dam. Thus, much of the study was

extractive rather than building knowledge within the population. However, the proposed feedback to the communities after the completion of the EIA report, could serve to increase peoples' knowledge regarding the upgrading project.

SIA raises consciousness

SIAs should raise the consciousness of the community and enable them to understand the broader implications of the proposed action. As mentioned above, the communities were not informed about the upgrading or the possible implications. Although, the household interviews and the PRA exercise did serve to raise the consciousness of the people with regard to their dependence on the Olushandja Dam and other aspects of their environment.

SIA includes mitigation

The SIA does include mitigatory measures for the social impacts of the upgrading project.

In summary, the SIA was not characteristic of the general features of SIA identified by Burdge and Robertson.

4.4.2 Review of the SIA in terms of Burdge's suggestions for SIA in Developing Countries

A comparison between the suggestions made by Burdge (1990), for SIA in developing countries, and the SIA presented in this report follows.

Use of existing organisations

Community organisations such as the churches, schools and clinics were visited, in order to gain insight into the area and its people. Other governmental and non-governmental organisations were also consulted to gain information and to point out important issues which needed to be addressed.

Flexibility in the choice of methods used

A number of methods were used including: informal consultations with interested and affected parties; key informant and household interviews; a community meeting (in which

a PRA technique was employed); observations and secondary data sources.

Involvement of local people

The study team, coming from a different country and from different cultural and language groups to the affected community, involved a few local people (employees from DWA) in the study to act as translators. This proved to be very helpful, not only in terms of their skills as translators, but also in terms of the insights and interpretations which they shared with the study team.

Use of appropriate methods and concepts

This was done as far as possible. The questionnaires were constructed using open-ended questions and contained local terms and concepts. However, in a population where the rate of illiteracy is fairly high, the use of questionnaire surveys may be foreign and intimidating. The community meeting gave people the opportunity to interact and discuss issues freely, while the study team acted as merely facilitators for the process.

Quantification of social characteristics and impacts

Although the questionnaires generated some quantifiable data the emphasis was placed on gaining qualitative data, which could render more in-depth information concerning the community and their perceptions. The importance of the quantification of social characteristics and impacts is however questioned by the author and others, as aspects such as peoples perceptions and insights cannot be quantified, but are very useful sources of information (Bisset, 1984; MIDNET, 1993).

Allow indigenous people to express their opinions traditionally

The community meeting gave the people the opportunity to express their opinions openly and freely. Although the household interviews, although loosely structured, were in many cases a foreign way of interacting, as the study team were dictating the direction of the conversation and furthermore, all the responses were being recorded.

Consult anthropological literature

The sources of anthropological literature, pertaining to the area, were not followed up.

Selection of SIA variables through scoping

Scoping was done on the first field trip, where a number of interested and affected parties were consulted and, general observations were made. Scoping helped to identify the potential impacts of the project and thus, helped to structure the household interviews in such a way that relevant questions were included and an appropriate research approach was adopted.

Avoid repetitive data collection

Data searches were conducted to identify the existing data sources. Furthermore, organisations and individuals working in the study area were consulted to determine what other studies were taking place in the area so as to avoid duplication of research.

Never use SIA as a justification for a decision already made

The study process did not meet this suggestion, as the decision to upgrade *has* already been taken by the DWA. The EIA was commissioned due to the requirement of the DDGIC for an EIA, in order to receive funding. It is not sure whether the study will be used merely to fulfil a "rubber-stamp" function or whether the proponent will be committed to the recommendations made in the EIA.

Includes specific recommendations for mitigation

Specific recommendations on mitigatory actions are included in the assessment.

Despite the shortcomings, this SIA has gone some way in achieving Burdge's suggestions for SIAs in developing countries.

4.5 REVIEW OF THE PRA EXERCISE

This section will briefly evaluate the PRA exercise carried out as part of the field work for the study. It will be reviewed in terms of the principles of PRA and, the major lessons learned through the process. A detailed description of the exercise, the difficulties encountered and suggestions of how to deal with such difficulties, can be found in Appendix 7 of the Baseline Report (UCT, 1995).

4.5.1 Background to the Community Meeting

The community meeting was held in one of the local villages in the study area. The event was organised with the assistance of one of the senior headman of the area, at the study teams' request. There was a very large attendance (approximately 100 people). The group was constituted of more or less the same proportion of men and women. After the introductions by the councillor and the study team, the community split into three groups each accompanied by three members of the study team, to act as translators, facilitators and scribes. The PRA exercise employed in the groups was land-use mapping. The aim of the exercise was to get people to draw the most important places in their areas on a big sheet of paper. This technique is very useful for getting a spatial idea of how the community operates as well as eliciting information on the interaction between the people and their environment. To conclude the meeting, the main issues that arose out of each of the groups were fed back to the community, by the study team, so that any misconceptions could be clarified and any additional questions and issues could be raised. A commitment was made to give feed-back, of the results, to the community, at the end of the year.

4.5.2 Review of the Exercise

Although the community meeting was a viewed by the study team as a very useful exercise in terms of engaging most of the participants in the process and, gaining meaningful information, a number of criticisms can be made of the exercise.

The underlying ethic of PRA is long-term commitment to the process of participatory development. This exercise was a once-off event and did not allow for incremental knowledge building or empowerment within the community. Furthermore, it did not fulfil the principle of iterative and progressive learning through the use of flexible and exploratory methods. As there was not enough time to engage with the community and get to a stage where the participants could decide on what methods they would like to use, the study team determined the method and the process to be followed. The study team merely got the consent of the participants, not the guidance and input, which should be the course of action in a PRA exercise.

Another problem concerns the matter of raised expectations. The community were told at the beginning of the meeting that no promises could be made, and that the purpose of the meeting was to help the study team to understand how the community use water and more particularly the Olushandja Dam. However, even though it was explicitly stated that the study team could not make any commitments in terms of fulfilling the communities requests, it is possible that their expectations may have been raised, with respect to water provision and the construction of a bridge across the dam.

The problem of raised expectations is not one specific to this study but is rather one of the inherent difficulties associated with PRA (Edwards, 1995; Adriance, 1995). Expectations can be raised by encouraging the participants to share information about their different circumstances and needs and also by letting them see that the "researchers" are interested in listening and working with them. It is therefore, essential that the objectives and limitations of the project are clarified from the start.

4.5.2 Lessons Learned

The most important lessons learned from the PRA exercise are summarised below.

- The objectives and limitations of the project have to be clarified so that people's expectations are not raised unrealistically.

- PRA is difficult. It takes more than just applying a technique and gaining information. It involves a process of 'unlearning' from being a 'knower' to sharing and learning new ideas (Marindo-Ranganai, 1995). In analysing the process of the exercise, the study team acknowledged the difficulty in "sitting back" and letting the people take control. This essential if it is to be a true PRA exercise.

- PRA should not be a once-off research tool, as in the case of this exercise, but rather an ongoing commitment to participatory development. The exercise gave the study team valuable insights into the dynamics of the community, but the community has not gained much as the interactive process is not ongoing.

- One must be careful not to use PRA for PRA's sake. Labelling an exercise as "PRA", when in fact it is still extractive rather than participatory, is misleading and does not do justice to the principles of PRA. It was very interesting for the study team to carry out a PRA exercise but it was not true PRA as it was a once-off exercise.

- The more practical lessons learned from the exercise includes, the fact that coordinating a mapping exercise in large groups (approximately 30 people), is very difficult. The problems include recording the inputs from a group this size and ensuring that everyone in the group has the opportunity to speak.

This concludes the chapter on the theoretical considerations of SIA and PRA. The following chapter contains the assessment of the influence of water provision on the social environment and the assessment of the impacts associated with the proposed management scenarios of the Olushandja Dam.

CHAPTER 5

ASSESSMENT OF IMPACTS

CHAPTER 5

ASSESSMENT OF IMPACTS

5.1 INTRODUCTION

The objective of this chapter is twofold. The first objective is to assess the influence of water provision (in the form of Olushandja Dam) on the social environment of the study area. The second objective is to assess the impacts associated with the three management scenarios considered in this study. The chapter starts with a description of the methodology used to identify and assess the impacts related to the management scenarios. Following the methodology, the influence of water provision on the social environment is assessed in a narrative form, based on the results of the field work. A summary framework of all the impacts associated with the three management scenarios, and their ascribed significance ratings, is presented in Section 5.4.3, to provide the reader with an overview of the impacts that will be dealt with in the impact assessment. The impacts are then described and assessed in Section 5.4.4.

5.2 METHOD OF IMPACT IDENTIFICATION AND ASSESSMENT

5.2.1 Impact Prediction

Impacts were identified through a number of methods. Consultations with specialists and interested and affected parties served to highlight potential impacts, while the household and key-informant interviews and the community meeting, brought the concerns of the people likely to be affected by the project, to light. Observations in the field as well as various secondary data sources also helped to identify potential impacts.

A preliminary checklist of impacts was compiled by the author, from the impacts identified through the above mentioned sources as well as from the Checklist of Environmental Characteristics in the IEM Guidelines Series produced by the Department of Environment Affairs (DEA) in 1992. The checklist can be found in Appendix 4 (Table 1)

Fuggle (1992) lists a number characteristics which impact identification methods should strive

to achieve. These characteristics will be stated briefly (the statements written in italics), and in each case mention will be made of the degree to which the impact prediction process followed in this study, complied with the characteristic in question.

Comprehensive: *consideration must be given to the full range of impacts caused directly or indirectly by the project.*

As this is a social impact assessment, consideration was given to the social effects of the project, while the other specialists considered other aspects of the project. It is favourable if the various specialists collaborate in drawing up the checklist of impacts, as impacts are by nature interrelated and should ideally not be regarded in isolation from each other. However, the insights gleaned from the interaction within the study team, the interviews with the interested and affected parties and specialists, and the various household and key-informant interviews, contributed to the compilation of a comprehensive checklist of impacts.

Precise: *general categories of either project actions or impacts should be avoided. Instead specific elements of the action and the effects should be identified and assessed.*

It was difficult in many cases to identify the specific cause-and-effect relationships and the impacts were grouped to a certain extent to facilitate assessment.

Project-specific: *changes due to other factors should be separated from the actions of the project.*

Each impact listed in the preliminary checklist was considered individually to determine whether the effect was directly or indirectly related to the upgrading project, or to the existence of the dam. Those impacts which were considered not to be connected to the dam or the project, were not included in the assessment. The impacts which were considered as having a possible influence on decision-making regarding the social environment in which the dam is located, the management of the dam or the choice of the preferred management alternative, were included in the checklist of impacts.

Accurate: the location, time (phase of the project), and duration (period of time over which the impacts will occur) of impacts should be identified.

It was not always possible to predict the duration of an impact as the recovery and adaption to new circumstances are often unpredictable. Thus, the impact prediction was not entirely accurate as the duration of impacts was not always identified.

Consistent: different analysts using the same method of impact identification should be able to make the same assessment. The method should thus be free from analyst bias.

By considering the issues and concerns identified through the various baseline studies (consultations; interviews; observations and review of secondary data sources) as well as systematically working through the Checklist of Environmental Characteristics (DEA, 1992) the impacts were identified comprehensively. However, the impacts identified by the author were not reviewed by any interested and affected parties or specialists. This could have highlighted any possible analyst bias and should be carried out in the process of a normal, comprehensive EIA.

5.2.2 Method of Assessment

The assessment of the impacts involves ascribing a degree of significance to each potential impact in terms of a number of criteria. Significance reflects informed value judgements concerning the importance of a particular impact to society using reasonable criteria (Fuggle, 1992). The process of ascribing a measure of significance to an impact is a difficult task. This difficulty is related to the fact that the judgement of significance is a subjective process as there are no objective measures which can be used in assigning significance (DEA, 1992). In terms of IEM theory, judgements as to what constitutes a significant impact requires the consideration of both context and intensity (DEA, 1992). A discussion regarding the concepts of context and intensity will follow.

Context refers to the spatial and temporal dimensions of an impact. A consideration of context would include the examination of the following criteria:

* **Magnitude**: the measure of the size or extent of an impact. In this assessment difficulties were experienced in quantifying all the impacts. In many of the assessments the difficulty was due to a lack information on specific aspects such as the exact size of the population that would be affected by an impact. However, impacts are assessed in quantitative terms where possible.

* **Time and Duration**: time refers to the phase of the project in which the impact will be caused, while duration is the time period over which an impact will have an effect on the environment. In this assessment duration is stated as short-term (a few days or months), medium-term (a few months to a few years) or long-term (unlimited duration).

* **Extent**: this is the geographical area within which an impact may have an influence, for instance it may be localised, local, regional, national or international. The extent of impacts referred to in this assessment include localised areas (reference will be given to the particular area which will be affected), local (the study area, which comprises the area within a 10km radius from the dam) and regional (within the Omusati region).

Intensity refers to the severity of an impact resulting from an action. Considerations of intensity would be determined by the degree to which the proposed action:

→ involves impacts which are irreversible;
→ is highly uncertain or unknown;
→ results in cumulative, synergistic or residual effects;
→ has long-term effects;
→ contradicts (or furthers) local, regional or national interests or policies;
→ affects the overall well-being of people;
→ affects public health and safety;
→ affects resources of special significance; and,
→ has the potential to optimise existing conditions.

(Preston *et al*, 1992; DEA, 1992).

The above criteria of context and intensity have been applied to each of the impacts identified in this study. Based on this, the impacts have been assigned a positive or negative significance rating of either high, moderate or low.

The presentation of the assessment of impacts is done according to the layout recommended in the IEM Guideline Series (DEA, 1992). The assessment of each impact is presented in the following manner:

Impact: a highlighted statement of the nature of the impact.

Discussion of impact: an expanded explanation of the nature of an impact.

Affected Parties: the groups of people potentially affected by the particular impact.

Significance without optimisation/mitigation: A significance rating without any optimisation or mitigation.

Reasons: the criteria influencing the significance of an impact.

Optimisation/Mitigation: Suggested methods to maximise benefits or minimise costs.

Significance with optimisation/mitigation: where appropriate significance is reassigned according to the potential for optimisation or mitigation.

5.3 ASSESSMENT OF THE INFLUENCE OF WATER PROVISION ON THE SOCIAL ENVIRONMENT

The following section addresses one of the components of the terms of reference (point 1 under Scope of the Study, p3) which requires an evaluation of how water provision (in the form of Olushandja Dam) has influenced the social environment in the study area. Changes in lifestyles and natural resource utilisation over time should be considered. It also requires a comparison of social groups that have different degrees of access to water from the

Olushandja Dam and other water supply infrastructure.

The assessment is based on the information contained in the Baseline Report of the SIA of the upgrading of the Olushandja Dam (UCT, 1995). The relevant information in the Baseline Report consists of the results of the household and key-informant interviews, as well as the review of the secondary data sources.

5.3.1 The Effects of the Introduction of a Permanent Water Source

Historically, the people living within the ephemeral *oshana* system relied on the *oshanas* as a source of water during the wet season, while in the dry season they made use of hand dug wells, which in many cases were some distance away. The construction of the Olushandja Dam introduced a permanent source of water into the area and has inevitably had a number of positive and negative influences on the social and biophysical environment. One of the positive aspects of the presence of the dam is that it has lessened the burden of collecting water from sources which are a long distance away. It has also introduced certain economic activities in the area, such as fishing and market gardens. Furthermore, the dam serves as a permanent water source whereas in the past, people had to rely on the ephemeral flow of the *oshanas*.

The negative aspects connected to the presence this permanent water source include:

* the increased incidence of water related diseases such as bilharzia, malaria, diarrhoea and gastritis;
* disruptions to the mobility and movement patterns of the people living in the vicinity of the dam, who need access to the opposite side of the dam; and,
* the negative effects on grazing land, as the grasses which are adapted to the ephemeral *oshana* system cannot grow in a perennial water body.

The positive and negative influences of the Olushandja Dam will be discussed further within the remainder of the sections below.

5.3.2 Settlement Patterns

One of the objectives of the SIA was to determine whether the construction of the Olushandja Dam has brought about settlement within close proximity to the dam. The population density in close proximity to the dam (within a 5km radius of the dam, which is referred to as Zones A and B of the study area) is slightly greater than the density in the outskirts of the study area (within the outer 5km of the study area, Zone C). See Figure 3 (Appendix 2) for an illustration of the Zones A, B and C. The aerial photographs, (taken in April, 1995), show that there are 1325 homesteads within Zones A and B, (765 in Zone A, 560 in Zone B), and 1289 homesteads in Zone C. Refer to Figure 4 (Appendix 2) for the population distribution within the study area.

The slightly greater population density found in Zones A and B can be explained by a number of factors, of which the presence of Olushandja Dam is but one. The responses obtained in the household interviews, regarding peoples perception of whether more people had moved into Zones A and B due to the dam, showed that people move into the area for a variety of reasons and that the dam is not a central motivating factor.

The greater supply of water within Zones A and B is one of the explanations for the greater population density within these Zones. The water supplied in these zones is in the form of Olushandja Dam and the Olushandja-Tsandi pipeline (which lies to the west of the dam, within Zone B). The existence of the infrastructure and services in the towns of Eunda and Onesi, also contributes to the population density in Zone A and B (see Fig. 2, Appendix 2 for infrastructure and services in the study area).

The traditional allocation of land by the headman is another important factor determining settlement patterns. Land is acquired through negotiations with the headman and, as a rule, people do not occupy land without consulting the traditional authority in the area. Other factors influencing settlement include the need to relocate due to marriage, separation or overcrowding within the household or within the area of original settlement.

The presence of Olushandja Dam has had an important influence on the development of

Epalela Township (refer to Fig. 2, Appendix 2). The settlement originally developed as a result of the initiation of trade between locals and the soldiers who had established an army base close to the north wall of the Olushandja Dam. However, a large proportion of the residents of Epalela turned to fishing in Olushandja Dam as their main source of income. Hence, fishing forms an important part of the economic basis of the township. People also utilise the dam as a supply of water for household consumption and use.

Therefore, Olushandja Dam is one of a few factors which has influenced settlement patterns within Zones A and B, and has played an important role in the development of Epalela township.

5.3.3 Movement Patterns and Mobility

The Olushandja Dam has had a significant impact on the movement patterns and mobility of people living around the dam. The presence of the dam obstructs direct access from the eastern side of the dam to services such as clinics, churches and schools provided at Eunda and Onesi. Social interaction between family and friends on opposite sides of the dam is also interrupted by the presence of the dam.

A section of the road that once existed between Eunda and Oshaala, was inundated, hence obstructing all modes of transport between these two points. The roads at the north and south walls of the dam are the only routes of passage around the dam. These two points are 18km apart, making it long journey for those people living mid-way between the north and south dam walls to get to the other side of the dam. A number of fatalities have occurred as a result of people trying to wade through the dam and then drowning. The difficulties associated with access around the dam were mentioned in many of the household interviews and was one of the main points of discussion in the community meeting. It is an issue which needs serious consideration and will be discussed in the assessment of the alternative management scenarios, where possible mitigatory measures will be examined.

5.3.4 Incidence of Disease

The presence of a permanent water source has introduced water-borne diseases such as bilharzia and, water related diseases such as malaria, diarrhoea and gastritis, into the area. The representatives from the clinics in the study area stated that there was a strong correlation between the dam and certain diseases. One third of the households interviewed in Zone A, indicated that a member of the household urinated blood (an indication of bilharzia), while nine households reported that family members suffered from diarrhoea and stomach aches.

One of the main problems curbing the prevention of the contraction of water related diseases is that people do not boil the water before they drink it. The household interviews indicated that, in general, people do not boil the water before they drink it (50 out of the total 80 respondents, and only 4 out of 30 households interviewed in Zone A), despite the fact that most people have been advised, by the clinics or health authorities, to do so (in Zone A all but one household had been told by the clinics to boil the water from the dam). The reasons given for not boiling water, were that they do not have the time, they lack containers in which they can store water and they are not used to doing so. The result of an increase in the incidence of water related diseases, is that it places greater pressure on the health services in the area who have to attend to the health problems.

The above issue will be discussed again in the assessment of the alternative management scenarios (Impacts 9 and 10).

5.3.5 Daily Routines

The Olushandja Dam has influenced the daily routines of the households living in close proximity to the dam, in a number of ways. A positive aspects is that it has reduced the burden of walking long distances to collect water. The negative effect it has had on peoples daily routines is that it obstructs peoples access to community services such as clinics, churches and schools. This is particularly a problem for households living on the eastern side of the dam, who do not have direct access to services provided at Eunda and Onesi.

Water collection routines are dictated by the distance between the homestead and the water source. Routines may differ in terms of the number of times a day water is collected and the frequency of doing washing. Those in close proximity to a water source collect water up to three times a day and do washing on a frequent basis, however, those some distance from water may collect water only once a day and do their washing less regularly. Hence, the utilisation of water increases with increased proximity to a water source. (This was found to be the case for the utilisation of all water sources, not only Olshandja Dam).

5.3.6 Economic Activity

Economic activities directly related to Olushandja Dam include fishing and the establishment of the Elao and Epalela market gardens. Prior to the construction of the dam, fish were carried by floodwaters down the Oshana Etaka, but as this is an ephemeral system this resource would disappear in the dry season. With the Olushandja Dam providing a relatively deep, non-seasonal water source, the permanent source of fish is a direct benefit for the surrounding communities. Many people in the area fish for subsistence purposes (approximately 30% of the households interviewed are involved in fishing activities for household consumption), while there is a fairly large contingent of fisherman for whom fishing is their main source of income (only 5 households interviewed were selling fish but, a group of fisherman interviewed at Epalela township, indicated that many people from Epalela are reliant on fishing as a source of income).

The market garden projects, namely Epalela and Elao, are situated on the immediate banks of the Olushandja Dam (refer to Fig.3, Appendix 2). They are dependant on irrigation as a means to water their crops and derive direct benefit from their access to the water in Olushandja Dam. The market gardens provide employment for a number of people, (25 people are involved in the Epalela project while Elao has 20 participants). The produce is sold locally and regionally. Epalela Market Garden sells its produce at the Epalela township and in Ombalantu. Eloa supplies fresh produce in some of the regional centres, including Ondangwa, Ruacana, Ombalantu, Tsandi and Oshikati, as well as the local settlements of Eunda and Onesi, (refer to Fig. 2, Appendix 2 for the location of these settlements). The income generated by the Elao market garden is approximately N$ 5000 - 6000 a month,

while the estimate given by Epalela for one weeks earnings was approximately N$ 300.

These projects may provide the impetus for the establishment of more market gardens or may encourage local people to follow suit on a smaller scale. Thirteen households interviewed (out of 30) in Zone A indicated that they had become aware of irrigation through the presence of the market gardens. All of these respondents stated that they would be interested in irrigating their crops and some mentioned that they would like to establish something similar to the market gardens. However, the overriding constraint mentioned by the respondents was a lack of finances, while another constraint included a lack of technical know-how regarding irrigation. Hence, due to the costs and skills required for establishing a market garden, it is unlikely that households who engage in a subsistence way of life will have the resources to start something of this kind.

5.3.7 Productive Resources

A result of replacing the natural flow of the Oshana Etaka with a permanent water source was the reduction of grazing in the area. This occurred because the grasses which are adapted to the ephemeral *oshana* system cannot grow in a perennial water body. The seasonal movement of cattle (*ohambo*) within the study area is directly related to the amount of grazing available. There is a limited grazing in the vicinity of the dam. This is due to the influence of the dam and overgrazing within this area. Overgrazing on the banks of the dam is fuelled by the fact that Olushandja Dam acts as a water source for livestock. The livestock drink at the dam, and hence graze around its edges. Overgrazing is also coupled with natural population growth, because with an increase in people, there is an increase in livestock numbers and a reduction in the land available for grazing.

5.3.8 Resource Utilisation

Population pressures throughout northern Namibia have resulted in a general increase in resource utilisation and it is difficult to relate changes in resource utilisation directly to the presence of Olushandja Dam. Overgrazing and deforestation is a general phenomenon within northern Namibia. However, overgrazing within the vicinity of the dam is also connected

to the presence of the dam, as it acts as a water source for livestock with the result that livestock graze on its edges.

The fish resources contained in the Olushandja Dam are exploited both as a source of protein and income. The results of the household interviews indicated that 30% of the respondents were involved in fishing activities. If this is generalised to the wider population within the study area, it indicates that approximately a third of the population are engaged in fishing activities for either subsistence or income generating purposes. However, there are no records that show the exact extent of the exploitation of the fish resources found in Olushandja Dam.

Water utilisation, as discussed in section 5.3.5, has been influenced by the presence of the dam as people tend to collect, and therefore utilise, more water when they are in close proximity to a water source.

5.4 ASSESSMENT OF IMPACTS ASSOCIATED WITH THE MANAGEMENT SCENARIOS CONSIDERED IN THIS STUDY

5.4.1 Description of the Three Management Scenarios

The management scenarios considered in this study have been formulated by the author. Alternative management scenarios are assessed in order to develop a management strategy for the Olushandja Dam, which will meet the purpose of increasing the surety of water supply to the region, while maximising the benefits of the dam and reducing any negative implications of the upgrading project. The reason for considering management scenarios as opposed to options such as altering the size of the dam through construction, is due to the results of a study done by Lund Consulting Engineers in 1992. The study assessed the feasibility of changing the size of the dam in order to increase its efficiency and the surety of supply but concluded, on a technical and financial basis, that the present size (full capacity of 42.3×10^6 m^3) is the best option. However, the study done by Lund Consulting Engineers, did not include an analysis of the social and environmental implications of changing the size of the dam. This means that reconstruction should not be disregarded as

a possible alternative in the future, but for the purposes of this assessment, the scenarios posed will only be in terms of the management of the dam.

A description of the management scenarios proposed in this study, including the reasons for proposing these scenarios, will be discussed below.

5.4.1.1 Scenario 1: Maintaining the present level of the dam (30% capacity at 1104,6 m.a.s.l)

This scenario is considered as it is the present operational system for the Olushandja Dam. The positive and negative effects associated with this strategy of operation must be investigated so as to determine whether it is a feasible management option. The reasoning given by the DWA for keeping the dam between 25% and 35% capacity is that this is the level at which balance between inflow, evaporation and seepage occurs (Haussler, pers.comm., 1995).

Once the full rate of $6m^3/s$ is abstracted from the Cunene River, this scenario would entail keeping the dam between 25% and 35% capacity, with the water level at approximately 1104.6 m.a.s.l. This means that the water stored in the Olushandja Dam will be much the same as the storage situation at present. However, the difference will be that the pumping facilities, which are being upgraded at present, will have greater pumping capacities and will therefore have the ability to distribute more water to the southern and eastern regional water networks (refer to Fig.2, Appendix 2). The surety of supply will thus be in terms of an increase in the amount of water that can be pumped into the regional networks, and not in terms of greater storage of water. However, Olushandja Dam can act as a back-up supply when the need arises.

5.4.1.2 Scenario 2: Fluctuating the water level between full capacity (1106 m.a.s.l) and dead storage level (1103,7 m.a.s.l)

The shortcomings experienced in meeting water demands during low flow periods of the Cunene River, which occur during the dry months when demand for water is the highest

(Lund, 1992), forms the basis of the rationale for proposing this scenario. In situations where peak demands exceed abstraction rates from the Cunene River, or in cases where technical problems are experienced at either Calueque or on the Calueque-Olushandja canal, this scenario would allow Olushandja to serve as a back-up water supply to the regional networks for longer periods of time than if the dam was maintained at 30% capacity (Scenario 1).

One example of how this scenario may operate is that Olushandja Dam could be kept at full capacity (1106 m.a.s.l) and utilised when the need arises and depending on the extent of the utilisation of water on the regional networks, the dam may be drawn down to dead storage level (1103,7 m.a.s.l). Another possibility would be to fill Olushandja to its full capacity prior to the dry season, to ensure supply during the dry months, and for the remainder of the year it may be kept at a sub-optimum level so as to curb evaporation losses.

This scenario thus entails water levels which fluctuate due to the dependability of supply from Calueque and the demands along the southern and eastern regional water networks. The maximum capacity of the dam is 42.3 x $10^6 m^3$ (100% full) which will put the water level at 1106 m.a.s.l. The maximum draw down level is 5 x $10^6 m^3$ (5% full) with the water level at 1103,7 m.a.s.l. This scenario could also include intermediate water levels, however for the purposes of this assessment, the fluctuating levels will be assessed in terms of the dam being either at full capacity or at dead storage level (Scenario 1 considers the scenario of an intermediate water level). In cases where the actual fluctuation of the water levels results in an impact, this will be identified and assessed.

5.4.1.3 Scenario 3: The no dam scenario

The no dam scenario is included because it will serve as a useful gauge by which to measure the need of Olushandja Dam within the bulk water supply system and to the people who use the dam. Another reason for considering this option is the low efficiency of the dam in terms of its high rates of evaporation. The high evaporation losses are due to the poor surface area to volume of water stored ratio (Lund, 1992). This scenario will thus highlight whether the benefits derived from Olushandja Dam outweigh its relatively low efficiency.

This scenario would be achieved by decommissioning the dam and then pumping the water from the dam into the regional networks. The north and south walls would have to be removed so that the natural flow of the *oshana* system (Olushandja Dam is situated in the Etaka Oshana) can re-establish itself.

The management scenarios will be referred to as Scenarios 1, 2 and 3 respectively.

5.4.2 Description of the Interested and Affected Parties

Interested and affected parties (I&APs) will be referred to in the assessment of the impacts, thus a brief description of the various I&APs, and their concerns in relation to the upgrading of Olushandja Dam, will be discussed below. Table 3 contains a summary of the I&APs, which includes a brief description of who the party is and what the concerns or issues related to each of the I&AP's are. The I&AP summary table is located at the end of this chapter (p110), and can be folded out and referred to during the assessment.

Department of Water Affairs (DWA)

As the proponent of the upgrading project of the Olushandja Dam, DWA has a direct concern regarding all aspects of the project. The particular concern of DWA is to improve the surety of water supply to the regional water networks. The objective of upgrading the Olushandja Dam is to increase the surety of water supply to the regions of northern Namibia.

Households living within/below the full capacity level (1106 m.a.s.l) of the dam

There are 30 households which are situated within or below the full capacity level of the dam. They would be directly affected by changes in the water level of the dam. The agricultural land of these households would be inundated if the dam was filled to full capacity, and where the homesteads are situated below the high level mark, these would also be inundated.

Households who utilise the dam for drinking, household and livestock purposes

Most of the households utilising the dam are situated in Zone A (24 out of 30 households interviewed in Zone A utilise the dam), however on the eastern side of the dam the

households in Zone B and C also use the dam, as there are no alternative water sources within this area. The households who are dependant on Olushandja Dam as a source of water for drinking and household purposes are subject to health effects related to the poor quality of water in Olushandja Dam. Furthermore, changes in the management of the dam will directly affect these people. If the dam was decommissioned, these households will lose their primary source of water for themselves and their livestock. Refer to Fig. 5, Appendix 2, for household utilisation of water in the study area.

People who are dependant on the dam for fishing

People who are dependant on the dam for fishing for subsistence and income generating purposes, would be affected if the management scenarios impact on the fish resources in Olushandja Dam. The major concern would be in the case of decommissioning, which would result in the loss of a food source and a source of income.

People who require access to the opposite side of the dam

The dam obstructs access to facilities and services located on the western side of the dam at Eunda and Onesi. It also constrains interaction between family and friends living on opposite sides of the dam. The only routes of passage around the dam are at the north and south walls, making it a long journey to get around the dam for people who do not stay in close proximity to the dam walls.

Market gardens

The Epalela and Elao market gardens are situated on the immediate banks of the dam and will be directly affected by changes in the water level. The people managing these gardens are solely dependant on Olushandja Dam for water to irrigate their crops.

Local and regional communities who will be affected by negative impacts on the market gardens and fishing activities associated with the dam.

The market gardens supply local villages including Epalela township, Eunda and Onesi, with fresh produce. Elao also supplies various regional centres including Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi, with vegetable produce. The communities who buy this produce would be thus be affected indirectly by negative effects on the market gardens.

The household interviews indicated that more than half, (45 out of 80 interviews), of the households buy fish from people who fish at Olushandja Dam. Fish thus serves as an important protein source for people living in the study area. Most of the respondents bought fish at Epalela or Onesi and various cuca shops (a small informal, general store) within the study area. Negative effects on the fish resources of the dam, due to changes in the water level, may result in a decline in fish catches, which will have an indirect effect on the people who buy fish and depend on it as a source of protein.

Regional users of the bulk water supply system

Water, which is channelled from Olushandja Dam into the Etaka and Olushandja-Ogongo canal networks (refer to Fig. 2, Appendix 2), is used for domestic consumption and livestock watering, all along these water carriers. Hence, Olushandja Dam plays a significant role in the regional supply of water and changes to the operation of Olushandja Dam may have various implications for the people who depend on these water supply networks. These people are also dependant on the surety of water supply offered by Olushandja Dam.

Health services in the area

There are certain water related diseases such as malaria, bilharzia and gastritis, associated with the Olushandja Dam, which the health services in the area have to attend to. If there is an increase in the incidence of water related diseases, as a result of changes in the water level, or if the water quality of Olushandja Dam deteriorates, it may result in additional pressures on health services and resources. The four clinics in the study area include the Mahanene, Eunda, Onesi and Oshaala clinics.

Etunda Irrigation Project

At present the irrigation scheme utilises water from the Ruacana-Mahanene pipeline (at a rate of 1200m^3/h) but a pressure pump station is under construction at the Calueque-Olushandja canal. Once the full 6m^3/s is being abstracted from Calueque, and the irrigation project has expanded, the project will utilise up to 2m^3/s of the 6m^3/s supply. This is a substantial proportion of the water supply and may have implications for the water supply in the bulk water supply system. Etunda would benefit from an increased surety of water supply offered by Olushandja Dam, for times when water cannot be abstracted from the canals or Calueque.

Department of Nature Conservation

Nature Conservation's interest is the protection and management of the birdlife found at the Olushandja Dam. There have been attempts by Nature Conservation to stop the poaching of pelicans and other birds in the area. Nature Conservation has also mentioned the possibility of establishing a bird sanctuary at Olushandja Dam. However, no further information has been found regarding this matter.

SWAWEK (South West African Water and Electricity Commission)

SWAWEK is legally responsible for the operation of the Calueque Dam and does not agree with the upgrading of Calueque and Olushandja Dam. They argue that both dams, but particularly Olushandja Dam, are inefficient because of the great evaporation losses. SWAWEK argues that the water would be better used for the purposes of generating electricity.

5.4.3 Summary Framework of the Impacts Identified for Scenarios 1, 2 and 3

The Summary Framework (Table 2, p65 and 66) contains a summary of the impacts associated with the three management scenarios, and the significance ratings for each impact with and without mitigation/optimisation. The key reasons influencing the significance ratings appear directly under the rating. The reasons are not detailed owing to space constraints. Detailed information regarding each impact is contained in the assessment. Shading signifies a high impact. Dark grey represents high negative impacts while light grey represents high positive impacts. The I&APs associated with each impact are also indicated. The Summary Table of the I&APs (Table 3, p110) can be folded out and referred to throughout the assessment.

The purpose of the Summary Framework is to give the reader an overview of the impacts dealt with in the assessment and to visually represent impacts of high significance.

Table 2: Summary Framework of Impact Assessment

* The significance ratings for each impact, with and without mitigation/optimisation, is presented for all three scenarios.
* The key reasons influencing the significance ratings are indicated directly below the rating.
* For Scenario 2, when the significance rating relates to full capacity or dead storage level, this is indicated. No indication of a specific water level means that the rating refers to a fluctuating water level.

* **Positive** impacts of high significance are shaded **light grey;** **Negative** impacts of high significance are shaded **dark grey**

Interest Group	Impact Statement	Scenario 1 Present Level	Scenario 2 Fluctuating Water Levels	Scenario 3 No Dam Scenario
		30% Capacity (1104 m.a.s.l)	**Between Full Capacity (1106 m.a.s.l) and Dead Storage Level (1103,7 m.a.s.l)**	**No Dam**
Elao and Epalela market gardens; 30 households that will be inundated; residents and fisherman of Epalela; people living in areas in which people resettle.	*IMPACT 1: The various management scenarios could affect the local settlement patterns and may also have an influence on the sub-regional settlement distribution (as a result of people relocating due to a rise in the water level or due to the decommissioning of the dam).*	**No impact**	At full capacity: *Without mitigation:* **MODERATE negative** Relocation could result in increased settlement density and pressure on resources. *With mitigation:* **LOW negative** Mitigation could curb the impacts associated with an increase in settlement density.	*Without mitigation:* **HIGH negative** Could result in the disintegration of Epalela township due to the loss of fishing activities. *With mitigation:* **MODERATE negative** Establishment of new opportunities would take time to implement and it is uncertain whether these will be acceptable to the fisherman.
DWA; 30 households that will be inundated; market gardens; communities that buy produce grown by the market gardens.	*IMPACT 2: If the dam was filled to its full capacity it would result in the inundation of 30 homesteads and the Epalela and Elao market gardens.*	**No impact**	Full capacity *Without mitigation:* **HIGH negative** Inundation and relocation could affect the overall well-being of people. *With mitigation:* **MODERATE to HIGH negative** Residual impacts related to relocation likely to occur despite mitigation.	**No impact**
Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local and regional settlements.	*IMPACT 3: A decline in the fish resources of the dam will have a negative effect on the fishing activities associated with the dam, which may in turn alter the economic profile of the area.*	*Without optimisation:* **MODERATE positive** No negative effects on fish; provides a source of food and income. *With optimisation:* **HIGH positive** Benefits to fisherman would be maximised; fishing carried out on a sustainable basis.	Full Capacity *Without optimisation:* **MODERATE positive** No negative effects on fish; provides a source of food and income. *With optimisation:* **HIGH positive** Benefits would be maximised; fishing carried out on a sustainable basis. Dead Storage Level *Without mitigation:* **MODERATE to HIGH negative** Impact of dead storage level on fish resources is uncertain. *With mitigation:* **Uncertain** Further investigation required.	*Without mitigation:* **HIGH negative** Loss of a source of income and food; will affect the overall well-being of people who are dependant on fishing. *With mitigation:* **MODERATE negative** Ensure the provision of alternative protein sources in stores; loss of a free food source.
People employed at Epalela and Elao; local and regional communities who buy produce grown by the gardens.	*IMPACT 4: The Elao and Epalela market gardens, which are situated on the immediate banks of the dam, are directly dependant on the dam for irrigation. A rise in the water level will result in the inundation of the gardens while the decommissioning of the dam could affect their access to water.*	*Without optimisation:* **HIGH positive** Employment opportunities; provision of fresh produce locally and regionally. *With Optimisation:* **HIGH positive** As above	Full capacity *Without mitigation:* **HIGH negative** Inundation; loss of food source; loss of employment opportunities. *With mitigation:* **MODERATE negative** Mitigation could reduce severity of impacts but financially costly for DWA. Dead Storage Level *Without mitigation:* **MODERATE negative** Short/medium-term impact on production and income generation. *With mitigation:* **LOW negative** Impacts can be allayed through mitigation.	*Without mitigation:* **HIGH negative** Loss of jobs; loss of a food source. *With mitigation:* **Uncertain** Feasibility of mitigatory measures is not certain.
30 households where agricultural land would be inundated.	*IMPACT 5: A rise in the water level of the dam will result in the inundation of productive land used for subsistence agriculture.*	**No impact**	Full capacity: *Without mitigation:* **HIGH negative** Impact on primary subsistence crop. *With mitigation:* **MODERATE to LOW negative** Mitigation would reduce the severity of impacts.	**No impact**
People who utilise the dam.	*IMPACT 6: The decomissioning of the dam may result in the loss of the Pila occidantalis species (freshwater snails), which would eliminate a potential economic and subsistence opportunity.*	*Without optimisation:* **LOW positive** Potential economic and subsistence opportunity but limited distribution of the species. *With Optimisation:* **UNCERTAIN** Further investigation into the potential of the species is required.	*Without optimisation:* **LOW positive** Potential economic and subsistence opportunity but limited distribution of the species . *With Optimisation:* **UNCERTAIN** Further investigation into the potential of the species is required.	*Without mitigation:* **LOW negative** Possible loss of species but impact is not certain. *With mitigation:* **UNCERTAIN** Further investigation into the possible impacts of decommissioning on this species, is required.
Local people who are dependant on the economic opportunities presented by the dam; non-local labour.	*IMPACT 7: The economic opportunities associated with the dam may result in the influx of non-local labour. This may have associated social effects such as competition for economic opportunities and conflicts between the local population and the non-*	*Without mitigation:* **MODERATE negative** Potential to hinder local interests. *With mitigation:* **LOW negative** Management and control of an influx of non-locals would prevent associated impacts.	*Without mitigation:* **MODERATE negative** Potential to hinder local interests. *With mitigation:* **LOW negative** Management and control of an influx of non-locals would prevent associated impacts.	**No impact**

Table 2 (cont)

Interest Group	Impact Statement	Scenario 1 Present Level	Scenario 2 Fluctuating Water Levels	Scenario 3 No Dam Scenario
People in Zones A and B who own livestock.	*IMPACT 8: A change in the level of the dam may impact on the grazing land adjacent to the dam.*	**No impact**	*Without mitigation:* **MODERATE negative** Potentially long-term effect on the grazing resources found in Zones A and B due to a inundation of grazing land around the dam and overgrazing of alternative resources. *With mitigation:* **UNCERTAIN** Mitigatory measures should be investigated.	*Without optimisation:* **LOW to MODERATE positive** Potential increase in grazing but impact is not certain. *With Optimisation:* **UNCERTAIN** Further investigation into the re-establishment of grazing is required
Households who utilise the dam for drinking, household and livestock purposes; health services in the area.	*IMPACT 9: Various freshwater snails are found in the dam. The management scenarios may affect the distribution of the freshwater snails, which will have an associated impact on the incidence of snail-borne diseases such as bilharzia in humans and liverfluke in cattle.*	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **MODERATE negative** Mitigation could decrease the distribution of snails and help to prevent the contraction of disease.	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **MODERATE negative** Mitigation could decrease the distribution of snails and help to prevent the contraction of disease.	**No impact**
People who are dependant on the dam for drinking water; health services in the area.	*IMPACT 10: The poor quality water in Olushandja Dam has a negative impact on the health of the people who drink the water, causing diseases such as diarrhoea and gastritis.*	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **LOW negative** Mitigation would contribute to the reduction and prevention of disease.	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **LOW negative** Mitigation would contribute to the reduction and prevention of disease.	**No impact**
Households who require access to the other side of the dam, but particularly households on the eastern side of the dam.	*IMPACT 11: The presence of the dam obstructs access to community services and facilities.*	*Without mitigation:* **HIGH negative** Affects access to services; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	*Without mitigation:* **HIGH negative** Affects access to services; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	**No impact**
People who have family or friends on the opposite side of the dam; communities on opposite sides of the dam.	*IMPACT 12: The presence of the dam interferes with inter- and intra-community contact.*	*Without mitigation:* **HIGH negative** Affects access; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	*Without mitigation:* **HIGH negative** Affects access; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	**No impact**
Health services in the study area; people who depend on these health services.	*IMPACT 13: The incidence of water related diseases associated with the dam puts pressure on the health services in the area who have to attend to these problems.*	*Without mitigation:* **MODERATE negative** Potential pressure on health services; potential to affect public health. *With mitigation:* **LOW negative** With mitigation the impacts can be successfully curbed.	*Without mitigation:* **MODERATE negative** Potential pressure on health services; potential to affect public health. *With mitigation:* **LOW negative** With mitigation the impacts can be successfully curbed.	**No impact**
DWA; regional users of the water supply network; Etunda Irrigation Project.	*IMPACT 14: The various management scenarios will provide different degrees of surety of water supply to the regions of northern Namibia.*	*Without optimisation:* **MODERATE to HIGH positive** Provides a measure of surety; but does not optimise surety of supply. *No optimisation:* This scenario does not include raising the level of the dam.	*Without optimisation:* **HIGH positive** Optimises the surety of supply. *With optimisation:* Surety is optimised.	*Without mitigation:* **HIGH negative** Fails to ensure a security of supply. *With mitigation:* **MODERATE negative** Mitigation would improve surety of supply but it would not be optimised.
71 households and market gardens located below the recommended limit of settlement; people who utilise the dam; future Water Corporation; DWA.	*IMPACT 15: The proposed commercialisation of the bulk water supply function may have a negative impact on people's land rights and rights to water use.*	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain andshould be established.	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people . *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain and should be established.	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people . *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain and should be established.
DWA, SWAWEK.	*IMPACT 16: The rate of evaporation from the dam decreases its overall efficiency.*	*Without mitigation:* **HIGH negative** Low efficiency. *With mitigation:* **HIGH negative** Mitigation would be financially costly for DWA and reduces the chance of it being implemented.	Full Capacity *Without mitigation:* **HIGH negative** Very low efficiency. *No mitigation.*	**No impact**
Department of Nature Conservation; DWA; people who utilise the dam who may be affected by the establishment of conservancies.	*IMPACT 17: Changing the water level or decommissioning the dam could result, respectively, in a decline or a loss of natural resources of conservation value.*	*Without optimisation:* **LOW to MODERATE positive** Resources are not negatively affected; potential to conserve resources. *With optimisation:* **HIGH positive** Protection of resources; environmental education.	*Without optimisation:* **LOW positive** Resources would not be affected with the exeption of a certain *Hoodia* species; potential to conserve resources. *With optimisation:* **MODERATE positive** Protection of resources; environmental education; costs associated with transplanting *Hoodia* species.	*Without mitigation:* **MODERATE to HIGH negative** Loss of resources; opportunity to conserve resources would be lost. *No mitigation.*

5.4.4 Impact Assessment

The assessment of each impact is presented in the following manner:

- → *Impact*: a highlighted statement of the nature of the impact.
- → *Discussion of impact*: an expanded explanation of the nature of an impact.
- → *Affected Parties*: the groups of people potentially affected by the particular impact.
- → *Significance without optimisation/mitigation*: A significance rating without any optimisation or mitigation.
- → *Reasons*: the criteria influencing the significance of an impact.
- → *Optimisation/Mitigation*: Suggested methods to maximise benefits or minimise costs.
- → *Significance with optimisation/mitigation*: where appropriate significance is reassigned according to the potential for optimisation or mitigation.

IMPACT 1: The various management scenarios could affect the local settlement patterns and may also have an influence on sub-regional settlement distribution, (as a result of people relocating due to a rise in the water level of the dam, which would result in inundation or due to the decommissioning of the dam).

Scenario 1

There is **no impact** on the local settlement patterns and thus on sub-regional settlement distribution, as this alternative reflects the present operation of Olushandja Dam, which does not have an influence on the settlement patterns at present.

Scenario 2

Discussion of impact:

This alternative entails fluctuating water levels which range between full capacity and dead storage level. If the dam was at full capacity, 30 homesteads as well as the Epalela and Elao market gardens would be inundated. These homesteads and markets gardens would thus have to be relocated on a permanent basis. (The impact of inundation and relocation will be discussed further under Impact 2). Depending on where the households resettle, there may

be an influence on settlement patterns at a local or sub-regional level. The influence would most likely be in the form of increased settlement density, which may in turn place pressure on the natural resources, as well as the facilities and services within the area. The majority of people interviewed in the household interviews were resigned to the fact that an increase in settlement was inevitable and uncontrollable, and felt unconcerned about people moving into their area. However a number of people (10 households) were concerned that an increase in settlement would result in an increase in pressure on the communal resources such as grazing.

Affected parties: The 30 households which will have to relocate; the Epalela and Elao market gardens; people living in areas in which people resettle.

Significance without mitigation: **MODERATE negative**
Reasons: Relocation will have a medium to long-term effect on settlement patterns; increased settlement density may place pressure on the natural resources (grazing; wood and water resources) and the community services, (such as clinics and schools), in the areas to which the households and market gardens are relocated.

Mitigation:

* Ensure that households and market gardens are relocated to areas where the natural resources and community services are not already under pressure.
* Ensure that there is equal access to natural resources such as grazing, wood and water resources, and community services such as clinics, schools and churches, for all affected parties.

Significance with mitigation: **LOW negative**
Reasons: Mitigation could curb the impacts associated with an increase in settlement density.

Scenario 3

Discussion of impact:

The no dam alternative would have a negative impact on Epalela township which is located near the north wall of the dam. Epalela is largely dependent on Olushandja Dam as a source

of water for the informal businesses, such as the *cuca shops*, the meat stalls, and the photo studio, as well as for household consumption and use. Furthermore, many fisherman, who live off the proceeds of their fishing, reside in Epalela and constitute a large proportion of the Epalela community (the population size of Epalela and the number of fisherman who reside within Epalela, were not obtained in the course of the interviews). If the dam was removed the fisherman would have to rely on the fish that is brought down by the *oshanas* in the wet season. However, the *oshanas* are seasonal and the amount of fish brought down in the *oshanas* is not as numerous as the fish populations associated with Olushandja Dam. The fisherman will therefore, not be able to sustain the income generated at present. The possible outcome of this is that the fisherman will have no cause to stay in Epalela, and an important component of the economic base of the area would be lost. This could lead to the gradual disintegration of this settlement.

The responses obtained in the household interviews, to a question concerning what people would do if the dam was no longer available, indicated that they would build wells like they use to, prior to the construction of the dam (22 out of 23 households who utilise the dam in Zone A gave this response). Thus, people would not necessarily move away from the area if the dam was decommissioned, but would make alternative arrangements for water.

Affected parties: Residents of Epalela; fisherman residing in Epalela.

Significance without mitigation: **HIGH negative**

Reasons: The effect of the disintegration of Epalela township and the loss of fishing as an economic activity in the area, could result in the decline of the local economy of Epalela and its surroundings. It may also have an effect on the regional economy of the Omusati region, as Epalela serves as an important business centre in the region (cumulative impact).

Mitigation:

* Epalela could be provided with a number of water points which would supply households and informal businesses with water.
* The creation of appropriate economic opportunities, such as brick making and the establishment of earth dams, which could be stocked with fish, could supplement the

economic base of Epalela, and provide alternative opportunities for the fisherman. However, the creation of new economic opportunities requires further investigation to determine what the most acceptable and appropriate opportunities would be for the fisherman.

Significance with mitigation: **MODERATE negative**

Reasons: The establishment of new economic opportunities would take time to implement and the acceptability of presenting the fisherman with alternative opportunities is uncertain and needs further research.

IMPACT 2: If the dam was filled to its full capacity, it would result in the inundation of 30 homesteads and the Epalela and Elao market gardens.

Scenario 1

There will be **no impact** as this scenario does not entail filling the dam to its full capacity.

Scenario 2

Discussion of impact:

This alternative entails fluctuating water levels which range between full capacity and dead storage level. If the dam was at full capacity 30 homesteads as well as the Epalela and Elao market gardens, would be inundated. These homesteads and markets gardens would thus have to be relocated.

The process of resettling households could have various impacts, which would have to be addressed and considered in more depth if this alternative is put into operation. The impacts could include:

* emotional trauma of relocation;
* breakdown or changes in social networks such as the interaction between families and friends;
* difficulties in adapting to a new social and physical environment;
* loss of access to services and opportunities;

* loss of productive land;
* community conflict, such as boundary disputes;
* problems connected to land rights and claims and,
* issues concerning compensation and allocation of land, such as appropriate compensation, unpredictable replacement costs and political considerations concerning the responsibility of allocating land (ie. traditional leaders versus political authorities).

The relocation of the market gardens could have the following negative consequences:

* the costs of relocating the infrastructure (irrigation systems and housing) and regrowing vegetable produce;
* production losses;
* loss of a food source during the relocation period, which has a local and regional effect, (the fresh produce from Elao and Epalela is sold at the local settlements of Epalela, Eunda and Onesi while Elao supplies a number of regional centres including: Oshakati; Ruacana; Ondangwa; Ombalantu and Tsandi); and,
* issues concerning compensation and allocation of land, such as appropriate compensation, unpredictable replacement costs and political considerations concerning the responsibility of allocating land (ie. traditional leaders versus political authorities).

Affected parties: DWA, 30 households which would be inundated, Epalela and Elao market gardens and the associated communities who buy produce grown by the market gardens.

Significance without mitigation: **HIGH negative**
Reasons: Irreversible impact; could have medium- to long-term effects on the affected parties; may affect the overall well-being of the people who are relocated.

Mitigation:
* Early and comprehensive planning, with contributions by all those affected, should begin as soon as possible so as to develop an appropriate management programme.
* Resettled households should be located as close as possible to the original communities, and to facilities and services.

* It should be ensured that the overall well-being of the affected population does not deteriorate due to the relocation and should be improved as far as possible.
* The market gardens should be compensated for production losses in the translocation period and all infrastructure should be replaced at the new site.
* The physical characteristics of the site, (ie. slope, soils, drainage and so forth), must be conducive to agricultural production, so that the quality of the produce does not decline.

Significance with mitigation: **MODERATE to HIGH negative**

Reasons: Irreversible impact; although careful consideration of all the issues associated with the relocation of homesteads and market gardens could reduce the severity of the impacts, residual impacts such as psychological impacts of relocation and disturbed social relations and networks, are still likely to occur despite mitigation.

Scenario 3

There will be **no impact** as the no dam option would not result in inundation.

IMPACT 3: A decline in the fish resources of the dam will have a negative effect on the fishing activities associated with the dam, which in turn may alter the economic profile of the area.

Scenario 1

Discussion of impact:

The present water level of the dam does not affect the fish resources in Olushandja Dam negatively. The dam has a good supply of fish with a total of 39 fish species recorded to date (Hay, 1995). Fishing serves as an important source of food for many households, while for many fisherman it is a source of income. The household interviews indicated that approximately 30% of the households are involved in fishing activities for subsistence purposes, while only 5 households reported that they sold the fish they caught. The households within all three zones utilise the dam for fishing purposes, although there are more people in Zone A and B than in Zone C, who fish at the dam (see Fig. 5, Appendix 2 for household utilisation of the dam). The reasons given for not engaging in fishing

included: a lack of equipment, such as fishing nets and baskets (26 households), a fear of the water (7 households) and, the distance to the dam is too great to fish on regular intervals (12 households in Zone C and 2 in Zone B). Another problem associated with fishing in the dam is the possibility of fisherman contracting bilharzia from standing and wading in the dam for long periods of time. Although none of the fisherman interviewed reported that they suffered from bilharzia, they are at a considerable risk of contracting the disease due to the amount of time they spend in the water.

An interview with a group of fisherman at Epalela township, revealed that the fisherman residing at Epalela are reliant on fishing as a source of income. Furthermore, 45 households (out of 80) reported that they bought fish from the fisherman selling their fish at Epalela, Onesi, Ombalantu or from fisherman "passing by". The fact that so many households buy fish, indicates that it is an important component of people's diets and furthermore, that it is an important economic activity for the people in the study area, particularly for the fisherman at Epalela. Fishing thus has a positive influence on the economic profile of the local economy of Epalela and other local centres (Onesi and Eunda) where the fish is sold. The regional economy is also influenced to some extent as fish from Olushandja is sold in a number of the urban centres within the Omusati region such as Ombalantu.

Affected parties: Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local settlements (Onesi, Epalela and Eunda) and regional centres (Ombalantu).

Significance without optimisation: **MODERATE positive**

Reasons: Fishing provides people in the study area and in regional centres, such as Ombalantu with a protein source; provides fisherman with a source of income; fishing has a positive influence (generates income) on the local economies (Epalela, Eunda and Onesi) and the regional economy of the Omusati region.

Optimisation:

* People should be warned about the health risks associated with standing in the dam for long periods of time. This should be a joint effort between DWA and the health

services in the area.

* To ensure that the fish resources are not over-exploited an appropriate management plan should be developed. This should be done through the joint consultation of relevant government departments, traditional and political authorities within the area and the local fisherman.
* Preceding the implementation of the management plan, an educational programme should be initiated to advise the local people of the need for the management of the fish resources, as well as to what the guidelines of the management plan are.

Significance with optimisation: **HIGH positive**

Reasons: Benefits to the fisherman (and households engaged in fishing) would be maximised, while ensuring that fishing is carried out on a sustainable basis.

Scenario 2

Discussion of impacts

As discussed under the impact description of Scenario 1, the dam provides people with an opportunity to fish for both economic and subsistence purposes. These benefits would also be derived from the dam when it is at **full capacity**. An additional benefit of filling the dam is that when the volume of water level is increased there will be newly inundated areas that will result in an initial bloom in fish production, after which it will decrease and reach equilibrium again (Hay, 1995). Hay (1995) recommends that advantage be taken of the fish production bloom through harvesting. This could result in a temporary increase in earnings for fisherman as well as an increased supply of fish to local and regional areas, during this period.

The impact of drawing the dam down to **dead storage level** (5% capacity) may however have a negative effect on the fish resources and therefore on fishing. If the dam is kept at dead storage for a long period of time it may result in a large number of fish dying. However, the recovery times of the various fish species are not known and further investigations will have to be done to establish what these are, in order to mitigate the impacts of fluctuating the level of the dam.

In the event of a depletion in the fish resources, due to drawing the dam down, the amount and quality of fish that is caught will be affected and could thus influence the income generated through fishing, and affect the people who are dependant on fishing for subsistence. This may in turn have a negative effect on the local economies such as Epalela, Onesi and Eunda, and the regional economy of Omusati, as fish is sold in centres such as Ombalantu. However, these will not be a long-term impact as the dam will not be kept at dead storage for extended periods of time.

Affected parties: Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local settlements (Onesi, Epalela and Eunda) and regional centres (Ombalantu).

Significance without optimisation/mitigation:

Full capacity: MODERATE positive

Fishing provides people in the study area and in regional centres such as Ombalantu with a protein source; provides the fisherman and a with a source of income; fishing has a positive influence (generates income) on the local economies (Epalela, Eunda and Onesi) and the regional economy of the Omusati region; initial fish bloom after raising the water level.

Dead Storage Level: MODERATE to HIGH negative

Reasons: Uncertain impact; may result in a decline in fish stocks which could affect the fisherman (loss of income) and households who fish for subsistence purposes; short- to medium-term impact.

*Optimisation at **full capacity**:*

* Advantage should be taken of the initial fish production bloom after filling the dam. See Hay (1995) for more specific recommendations regarding the fish resources of Olushandja Dam.
* People should be warned about the health risks associated with standing in the dam for long periods of time. This should be a joint effort between DWA and the health services in the area.
* To ensure that the fish resources are not over-exploited an appropriate management

plan should be developed. This should be done through the joint consultation of relevant government departments, traditional and political authorities within the area and the local fisherman.

* Preceding the implementation of the management plan an educational programme should be initiated to advise the local people of the need for the management of the fish resources, as well as to what the guidelines of the management plan are.

Mitigation at dead storage level:

* Investigations would have to be done by DWA, in conjunction with the Ministry of Fisheries and Marine Resources, to establish the effects of maintaining the dam at dead storage level for different periods of time, on the various fish species.
* Recovery time of the different fish species should also be investigated.
* Affected parties (fisherman; households who fish for subsistence purposes) should be advised if the dam is to be drawn down to dead storage level.

Significance with optimisation/mitigation:

Full capacity: HIGH positive

Reasons: Benefits to the fisherman (and households engaged in fishing) would be maximised while ensuring that fishing is carried out on a sustainable basis.

Dead storage level: UNCERTAIN,

Further investigations into the effects of fluctuating water levels, and maintaining the dam at dead storage for different periods of time, on the fish resources, are required.

Scenario 3

Discussion of impact:

The no dam scenario involves the decommissioning of the dam and hence, the removal of the fishing activities associated with it. Fishing could be undertaken in the *oshanas* during the wet season, however the *oshanas* are a seasonal phenomenon and do not contain the same abundance of fish as the Olushandja Dam. This will also have a severe impact on those people who are dependant on fishing as a source of income, as well as on those for whom fishing forms a part of their subsistence. It would also affect the people who buy fish from

the fisherman at the local settlements of Eunda, Onesi and Epalela, as fish constitutes an important part of their diets. (45 households out of 80 indicated that they purchased fish from the fisherman at Olushandja Dam).

Fishing is a central component of the economic base of Epalela township, hence if fishing declines there may be a gradual disintegration of this informal settlement which is an important social and economic centre in the Omusati region. (This issue is discussed in greater detail under Impact 1 - Scenario 3).

Affected parties: Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local settlements (Onesi, Epalela and Eunda) and regional centres (Ombalantu).

Significance without mitigation: **HIGH negative**
Reasons: The overall well-being of the people who are dependant on the dam for fishing would be affected; the effect of the disintegration of Epalela township and the loss of fishing as an economic activity in the area could result in the decline of the local economy of Epalela and its surroundings and may also have an effect on the regional economy of the Omusati region, as Epalela serves as an important business centre within the region (cumulative impact).

Mitigation:

* The creation of appropriate economic opportunities, such as brick making and the establishment of earth dams, which could be stocked with fish, could supplement the economic base of Epalela and provide alternative opportunities for the fisherman. However, the creation of new economic opportunities requires further investigation to determine what the most acceptable and appropriate economic opportunities would be for the fisherman.
* Ensure that fish, and other forms of protein, can be purchased at stores in Eunda, Onesi and Epalela.

Significance with mitigation: **MODERATE negative**

Reasons: The establishment of new economic opportunities would take time to implement; the acceptability of presenting the fisherman with alternative opportunities is uncertain and needs further research; although fish would be available in the villages, there would be a loss of a free food resource.

IMPACT 4: The Elao and Epalela market gardens, which are situated on the immediate banks of the dam, are directly dependant on the dam for irrigation purposes. A rise in the water level of the dam will result in the inundation of the market gardens, while the decommissioning of the dam could affect their access to water.

Scenario 1

Discussion of impact:

At present the Epalela and Elao market gardens are directly dependent on the dam for irrigation purposes. This management scenario thus affects the market gardens positively, as it serves as their primary water source. The benefits derived from the market gardens are discussed below.

* The gardens create employment opportunities. At present there are 20 people involved in the Elao project and 25 people working at Epalela. In the interview with a representative from the Elao project, mention was made of plans to expand the garden to include both irrigated and dry land crops. This may result in the creation of more employment positions at Elao, although this was not established in the interview.
* The market gardens produce a source of food which benefits the local and regional areas. The fresh produce gets sold at the local settlements of Eunda, Onesi and Epalela and regional centres including Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi.
* The income generated by the market gardens has an influence on the local and regional economies where their produce is sold (these centres are named above). The sale proceeds of Elao range between N$ 5000 - 6000 per month, while Epalela makes approximately N$ 300 per week.

The problems experienced by both market gardens concern the solar driven pumps and storage tanks which they use to irrigate their crops. The pumps and storage tanks do not respectively generate and store enough water to effectively irrigate their entire gardens particularly in the dry season. Another problem experienced by both gardens is the partial inundation of the lower sections of the gardens. This occurs during the wet season when there are heavy rain falls and the level of the dam rises. Both the market gardens are situated very close to the edge of the dam (at its present capacity) and are thus affected by even slight changes in the water level. Inundation of sections of the gardens prohibits cultivation in these areas and causes rotting of vegetables.

Affected parties: People working at Epalela and Elao market gardens; local communities (particularly in Eunda, Onesi and Epalela) and regional communities (in Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi) who buy the gardens produce.

Significance without optimisation: **HIGH positive**
Reasons: Creates employment for 45 people; potential for the creation of more employment positions; supplies local settlements and regional centres with fresh produce.

Optimisation:

* Problems associated with the pumping and water storage facilities at both gardens could be addressed, so that the entire gardens can be irrigated. However, both the representatives from the market gardens indicated that the financial constraints they face, make it impossible for them to upgrade the pumping facilities. Upgrading would thus require funding.

Significance with optimisation: **HIGH positive**
Reasons: As given above.

Scenario 2

Discussion of impacts:

The fluctuating water levels would result in a number of negative consequences for the market gardens.

At **full capacity** both market gardens would be inundated, as they are situated on the immediate banks of the dam (See Figure 3, Appendix 2), and this would give rise to various impacts which are discussed below.

* Loss of productive land (Epalela is approximately 1ha in size. Elao is the bigger of the two gardens, however the size of the land was not established in the interview with the representative from Elao).
* Loss of a food source to local settlements (Eunda, Onesi and Epalela) and regional centres (Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi).
* Loss of 45 jobs and potential employment opportunities (Elao has plans to expand its garden, which may result in more job opportunities).
* A decline in this economic activity could have an effect on the local and regional economies, as the produce is sold at various local settlements and regional centres.

At **dead storage level** the impacts on the market gardens could include:

* shortage of water for irrigation purposes;
* decline in production during periods when the dam is at dead storage level;
* a decline in production, which may lead to a decline in income generation.

Affected parties: People working at Epalela and Elao market gardens; local communities (particularly in Eunda, Onesi and Epalela) and regional communities (Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi) who buy their produce.

Significance without mitigation:

Full capacity: HIGH negative

Reasons: Irreversible impact; loss of productive land and jobs created by the market gardens; loss of a food source to the local and regional settlements where the fresh produce is sold.

Dead storage level: MODERATE negative

Reasons: Short- to medium-term impacts on production and income generation.

Mitigation:

Full capacity:

* Market gardens should be relocated to a new site above the high water level mark.
* The gardens should be compensated for production losses during the translocation period and all infrastructure should be replaced at the new site.
* The physical characteristics of the site, (ie. slope, soils, drainage and so forth), should closely resemble that of the original market garden, so that the quality of the produce does not decline.

Dead storage level:

* Market gardens should be forewarned by DWA extension officers, at least two weeks in advance, if the dam is to be drawn down to dead storage.
* DWA could supply the market gardens with an alternative water source, such as an off-take from a canal or a pipeline, which could be utilised during the time when the dam is at dead storage level.

Significance with mitigation:

Full capacity: MODERATE negative

Reasons: Careful consideration of all the issues associated with the relocation market gardens could reduce the severity of the impacts; however the process of relocation and compensation may be financially costly for DWA.

Dead storage: LOW negative

Reasons: Impacts can be allayed through the mitigatory measures.

Scenario 3

Discussion of impacts:

This management scenario would result in the demise of the market gardens as they are directly dependant on the dam for water. The impacts arising from this include:

* loss of a food source to local settlements (Eunda, Onesi and Epalela) and regional centres (Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi);
* loss of 45 jobs and potential employment opportunities (Elao has plans to expand its garden, which may result in more job opportunities).
* a decline in this economic activity could have an effect on the local and regional

economies as the produce is sold at various local settlements and regional centres.

Affected parties: People working at Epalela and Elao market gardens; local communities (particularly in Eunda, Onesi and Epalela) and regional communities (in Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi), who buy the gardens' produce.

Significance without mitigation: **HIGH negative**

Reasons: Loss of employment created by the market gardens; loss of a food source to the local and regional settlements, where the fresh produce is sold.

Mitigation:

* The market gardens could be supplied with an alternative water source, such as an off-take from a canal. However, a number of residual impacts could emerge: due to water being a scarce resource the market gardens may only be granted a certain rate of abstraction, which may not be enough for irrigation purposes. Furthermore, a limited supply of water could limit Eloa's plans to expand their garden.
* Appropriate compensation should be paid for all losses incurred.

Significance with mitigation: **UNCERTAIN**

As the feasibility of the mitigatory measures is not certain, and if implemented, residual impacts may emerge (however the possibility of these occurring is also uncertain).

IMPACT 5: A rise in the water level of the dam will result in the inundation of productive land used for subsistence agriculture.

Scenario 1

There will be **no impact,** as the present water level does not inundate any productive land.

Scenario 2

Discussion of impacts:

At full capacity the dam will inundate the agricultural land of 30 households. Pearl millet, known locally as *mahangu,* is the principal crop and the staple diet of the people (all 80

households interviewed grow *mahangu* as their principal crop). Hence, a loss of productive land would result in decreased (or no) crop production and therefore a decrease in the food produced for subsistence purposes.

Affected parties: 30 households where agricultural land would be inundated.

Significance without mitigation: **HIGH negative**
Reasons: Long-term impacts; impact on the primary subsistence crop, which may affect the overall well-being of these 30 households.

Mitigation:

* Where fields are only partly inundated compensation must be paid for land and produce lost, and where possible, extra land should be acquired (the same size as that which is inundated) bordering on the existing property.
* In cases where fields are largely inundated, relocation will have to take place.
* With regard to relocation, the physical characteristics of the new agricultural land, (ie. slope, soils, drainage and so forth), must be conducive to agriculture, so that the quality of the produce does not decline.

Significance with mitigation: **MODERATE to LOW negative**
Reasons: Careful consideration of the issues associated with compensation and relocation, could reduce the severity of the impacts associated with the inundation of agricultural fields.

Scenario 3

There will be **no impact** on subsistence agriculture in terms of inundation or otherwise, as crops are solely rain-fed (79 out of 80 households reported that they do not use the dam to irrigate their crops).

IMPACT 6: The decommissioning of the dam may result in the loss of the Pila occidantalis species (freshwater snails) which would eliminate a potential economic and subsistence opportunity.

Scenario 1

Discussion of impact:

This species, which has the ability to withstand long, dry periods by aestivating in dry mud, is found in the Olushandja Dam and is indigenous to the ephemeral *oshana* system. It is a snail which can attain a size of 40mm and can be eaten (Curtis, 1995). It could therefore be of importance to the people living near the dam, for subsistence and economic purposes. However, in the study done by Curtis (1995), on the distribution of freshwater snails associated with the Calueque-Olushandja supply network, only a few of Pila occidantalis were found in the dam.

Affected parties: People who utilise the dam.

Significance without optimisation: **LOW positive**

Reasons: Potential economic opportunity and food source; the snail is not found in abundance, so the benefits would be limited; it is uncertain whether the local people would consider eating this snail.

Optimisation:

* The potential of this resource should be investigated further and the acceptability of eating this snail, to the local people, will have to be established.

Significance with optimisation: **UNCERTAIN**

Further investigation into the potential of this resource is required.

Scenario 2

Discussion of impacts:

The fluctuating levels associated with this alternative would not impact negatively on the Pila occidantalis, as these snails have the ability to withstand long, dry periods by aestivating in dry mud. Therefore, as discussed under Scenario 1, there is a potential to utilise these snails for subsistence and economic purposes, however, they do not occur in abundance in the dam (Curtis, 1995).

Affected parties: People who utilise to the dam.

Significance without optimisation: **LOW positive**

Reasons: Potential economic opportunity and food source; the snail is not found in abundance so the benefits would be limited; it is uncertain whether the local people would consider eating this snail.

Optimisation:

* The potential of this resource should be investigated further and the acceptability of eating this snail, to the local people, will have to be established.

Significance with optimisation: **UNCERTAIN**

Further investigation into the potential of this resource is required.

Scenario 3

Discussion of impacts:

The fact that the Pila occidantalis species is indigenous to the ephemeral *oshanas* means that this resource could be maintained *if* the natural flow of the Etaka Oshana (within which Olushandja Dam is located) is re-established after the decommissioning of the dam. However, the re-establishment of the Etaka Oshana is uncertain (as the flow of the *oshana* may have been altered due to the presence of the dam). Thus the impacts associated with the decommissioning of the dam, on this snail species, can not be determined with certainty.

Affected parties: People who utilise the dam.

Significance without optimisation: **LOW negative**

Reasons: The re-establishment of the Etaka Oshana is uncertain and thus the impacts associated with the decommissioning of the dam on the Pila occidantalis species can not be determined with certainty; but there is a possibility that this species would be lost.

Mitigation:

* Further investigation into the possible impacts of decommissioning on these species, is required.

Significance with optimisation: **UNCERTAIN**

Further investigation is required.

IMPACT 7: The economic opportunities associated with the dam may result in the influx of non-local labour. This may have associated social effects, such as competition for economic opportunities and conflicts between the local population and non-local labour.

Scenario 1

Discussion of impacts:

The economic opportunities associated with the dam include: fishing, the market gardens and the potential utilisation of the snail species, Biia occidantalis. At present a number of the fisherman who use the dam are from Angola. The interviews with the two headman (in Zone B), as well as two interviews with households in Zone A, revealed that these people are concerned about the influx of people, from Angola, using Olushandja Dams' fish resources. Their objection was that the Angolans have their own fish resources and have no right to use Namibia's resources. The market gardens employ people from the local as well as the regional areas (such as Uukwambi and Ngandjera), but no concerns were raised in the household interviews regarding the employment of people from other regions. There is the potential for a greater influx of non-locals, to take advantage of the fishing opportunities presented by the dam and perceived opportunities presented by the market gardens, (there may not be employment opportunities but people may respond to the possibility of employment opportunities). The influx of non-locals to these opportunities, may result in a cumulative impact of conflict and competition between the new comers and the local residents.

Affected parties: Local people who are dependant on the economic opportunities presented by the dam; non-local labour.

Significance without mitigation: **MODERATE negative**

Reasons: Potential to hinder local interests; could affect the well-being of the people who are dependant on the economic opportunities presented by the dam.

Mitigation:

* A fishing licensing system could be implemented to control influx of non-Namibian fisherman.
* In the event of the utilisation of the snail species, a similar licensing system could be adopted.
* If the market gardens should employ more people, a number of employment positions could be reserved for local residents.

Significance with mitigation: **LOW negative**

Reasons: Management and control could prevent impacts associated with an influx of non-locals.

Scenario 2

This alternative would be the same as for Scenario 1, because the economic opportunities, namely fishing, the market gardens and the potential utilisation of the snail species, are associated with both scenarios.

Scenario 3

There would be **no impact,** as the economic opportunities associated with the dam would no longer be undertaken.

IMPACT 8: A change in the water level of the dam may have a negative impact on the grazing land adjacent to the dam.

Scenario 1

There will be **no impact,** as the present level of the dam does not affect the grazing adjacent to the dam. However, with the construction of the dam in 1971, valuable grazing was lost but people have adapted to the present situation. Cattle are taken to alternative grazing lands

of better quality (to the west of the study area) while goats, donkeys and a number of cattle (old or injured cattle) still graze on available grazing land around the dam, and within the local vicinity.

Scenario 2

Discussion of impacts:

As discussed under Scenario 1, the area around the dam is utilised for grazing by goats, donkeys and a number of cattle, owned by people in Zones A and B. (The household interviews showed that none of the livestock owned by people in Zone C graze at Olushandja Dam). The household interviews further indicated that during the wet season the livestock also graze around the *oshanas* (there are edible grasses which grow in, and on in the edges of the *oshanas*). In general, the available grazing area adjacent to the dam is overgrazed and is indicated by the abundance of toxic and aromatic weedy species in the area (Burke, 1995). However, fluctuating dam levels would result in the inundation of the remaining grazing land around the dam, while at periods when the dam is at dead storage there will be a "dead zone" in which vegetation will not proliferate. The impact of the loss of grazing around the dam could also increase the pressure placed on alternative grazing land within Zones A and B and may exacerbate the existing overgrazing problems.

Affected parties: People within Zones A and B who own livestock.

Significance without mitigation: **MODERATE negative**

Reasons: Potentially long-term effect on the grazing resources found within Zones A and B.

Mitigation:

* Mitigation of overgrazing problems is a difficult task, as a system of communal land tenure exists. This poses difficulties for the management of grazing practises or for establishing rotational grazing methods. Measures to mitigate and combat overgrazing, need further investigation.

Significance with mitigation: **UNCERTAIN**

Measures to mitigate overgrazing should be investigated.

Scenario 3

Discussion of impacts:

The decommissioning of the Olushandja Dam may lead to the re-establishment of grazing land within this area. This would mean an increase in the amount of grazing within the vicinity. However, this impact is not certain and studies would have to be undertaken to provide information regarding the re-establishment of vegetation.

Affected parties: Households within Zones A and B who own livestock.

Significance without optimisation: **LOW to MODERATE positive**

Reasons: Uncertain impact; potential benefits (increase in grazing for their livestock) to households in Zone A and B who own livestock.

Optimisation:

* The re-establishment of vegetation after the decommissioning of the dam, should be investigated and recommendations for optimisation given.

Significance with optimisation: **UNCERTAIN**

Further investigation into the re-establishment of vegetation is required.

IMPACT 9: Various freshwater snails are found in the dam. The management scenarios may affect the distribution of the freshwater snails, which will have an associated impact on the incidence of snail-borne diseases, such as bilharzia in humans and liverfluke in cattle.

Scenario 1

Discussion of impacts:

The study done by Curtis (1995), on the distribution of freshwater snails and snail-borne diseases associated with the Calueque-Olushandja water supply network, drew the following conclusions regarding the situation at Olushandja Dam at present:

* Two species of medical and veterinary importance have become established in the dam, namely: Bulinus globosus, an intermediate host for urinary bilharzia in humans and, Lymnaea natalensis, and intermediate host for liverfluke in cattle.
* Four specimens of the intermediate host for intestinal bilharzia, Biomphalaria pfeifferi, were found 1km north of the Olushandja Dam's north wall, in the Calueque-Olushandja canal. Intestinal bilharzia is not a problem at present but could be if the snails are brought to Olushandja via the canal.
* The incidence of urinary bilharzia has steadily increased since the impoundment of the dam in 1975. (However, exact figures are lacking as no detailed and systematic studies of bilharzia in this area have been undertaken. In the household interviews 10 out of 24 households in interviewed in Zone A who utilise water from the dam, indicated that at least one member of their household passed blood in their urine).
* At present, the liverfluke parasites are not causing clinical problems, but cases of liverfluke infestations have been found in livestock slaughtered in the area (Odihao, pers. comm., 1995).
* If an increased volume of water is transferred from the Cunene, the risk of translocating snails and parasites also increases.

Affected parties: Households who utilise the dam for drinking, household and livestock purposes; health services in the area (Mahanene, Eunda, Onesi and Oshaala clinics).

Significance without mitigation: **HIGH negative**

Reasons: Affects the health and overall well-being of the people who use the dam; long-term health effects; potential for an increase in the incidence of disease; potential to introduce intestinal bilharzia.

Mitigation:

The mitigatory measures are based on the recommendations given by Curtis (1995).

* The snails are concentrated at the north wall of the dam, thus Curtis suggests that the vegetation along the dam and 500m along the margins of the dam should be treated with molluscicide, and to prevent recolonisation, all vegetation along the north wall

should be removed. However, Curtis does not indicate what effects the molluscicide may have on the quality of the water for drinking purposes, or what precautions must be taken when it is applied. This will have to be established before this measure is implemented.

* People and livestock should be prevented from using the dam within 500m from the dam wall.
* People and livestock should be denied access to the water in the Calueque-Olushandja canal or the water should be chlorinated and allowed to stand for 48 hours before use.
* The water level of the dam could be allowed to fluctuate to prevent the establishment of rooted marginal vegetation.
* More pipelines and treated water should be provided for the people in the area, in order to lessen human and animal contact with the dam.
* An educational programme is urgently required. The programme should strive to inform people of the health hazards associated with the dam, as well as developing a sound understanding of ways in which they can contribute to the control and prevention of disease.

See Curtis (1995) for more detailed mitigation and recommendations.

Significance with mitigation: **MODERATE negative**

Reasons: Mitigation could decrease the distribution of freshwater snails in the dam as well as contribute to the prevention of the contraction of snail-borne diseases; however, mitigation would be costly for DWA to implement.

Scenario 2

Discussion of impacts:

The impacts would be the same as for Scenario 1 but in addition, Curtis (1995) identifies a problem related to the inundation of a greater area of land. A greater inundated area with an extended shoreline of shallow water could create more habitats suitable for the establishment of plants and snails. Although, fluctuating the water level could prevent the establishment of rooted marginal vegetation. Therefore, if the dam is kept at full capacity for periods long enough to allow the establishment of plants, this alternative would create

habitats more suitable for snails. If the level of the dam fluctuates on a regular basis, the growth of marginal vegetation would be curbed and hence re/colonisation of snails and parasites would be curtailed. However, it is unsure as to how often the level of the dam will change.

Affected parties: Households who utilise the dam for drinking, household and livestock purposes; health services in the area (Mahanene, Eunda, Onesi and Oshaala clinics).

Significance without mitigation: **HIGH negative**

Reasons: Uncertain projects actions; affects the health and overall well-being of the people who use the dam; long-term health effects; potential for an increase in the incidence of disease; and potential to introduce intestinal bilharzia.

Mitigation:

As for Scenario 1, but in addition:

* The water levels should be varied so as to prevent the establishment of rooted marginal vegetation.

Significance with mitigation: **MODERATE negative**

Reasons: Mitigation could decrease the distribution of freshwater snails in the dam as well as contribute to the prevention of the contraction of snail-borne diseases; however, mitigation would be costly for DWA to implement.

Scenario 3

There would be **no impact,** as the water-borne diseases are related to the dam.

IMPACT 10: **The poor quality water in Olushandja Dam has a negative impact on the health of the people who drink the water, causing diseases such as diarrhoea and gastritis.**

Scenario 1

Discussion of impacts:

The quality of the water in Olushandja Dam is affected by a number factors including:

* fisherman dragging their fishing nets which causes mud to be stirred up;
* people washing their clothes and bathing in the dam;
* livestock grazing on the edges of the dam causes mud to be stirred up; and,
* faecal matter from humans and livestock washes into the dam, due to run-off.

The limnological study done on the Olushandja Dam by Roberts (1995) found evidence of bacteriological contamination at certain points close to homesteads. These factors result in poor quality water which has a negative effect on the health of those who drink water from the dam. Drinking the water results in complaints such as gastritis and diarrhoea. During the course of the household interviews, 10 households (out of 24 households who permanently use the dam for drinking purposes) complained that they often experienced gastritis and diarrhoea. The clinics said they treated many people for the above mentioned complaints which they identified as being a result of people not boiling the water before drinking it. A large majority of the people interviewed in Zone A (22 households out of 30) have been told by the clinics to boil the water however many households do not comply with this advice (15 households in Zone A never boil the water, 5 households sometimes do while, only 4 households always boil the water before drinking it). The reasons generally given for not boiling the water is that they do not have the time, they lack containers in which they can store water and they are not used to boiling water before drinking it.

Affected parties: People who are dependant on the dam for drinking water; health services in the study area (the Mahanene, Eunda, Onesi and Oshaala clinics).

Significance without mitigation: **HIGH negative**

Reasons: Affects the health and overall well-being of the people who depend on the dam for drinking purposes (32 out of 80 households interviewed are dependant on Olushandja for water, the majority of these households (24) are situated in Zone A).

Mitigation:

* People should be supplied with alternative water sources, which contain purified water. This is particularly important on the eastern side of the dam where there is no pipeline carrying clean water (as there is on the western side of the dam).
* An educational programme should be implemented in conjunction with the local clinics, warning people of the health hazards associated with the dam, as well as pointing out ways in which people can contribute to improving the quality of the water and preventing disease.
* The clinics should continually encourage people to boil the water from the dam before drinking it, so as to familiarise people with the concept of boiling water and to make them realise how important it is to do so.
* A recommendation made in the Limnological Report on the Olushandja Dam (Roberts, 1995), states that sites close to homesteads used by people (for washing and water collection) should be regularly monitored for bacteriological contamination, by DWA's Water Quality Division. Furthermore, Rural Water Supply extension personnel should be involved in implementing simple water filtering devices, such as, sand filters for drinking water at these homesteads.

Significance with mitigation: **LOW negative**

Reasons: Mitigation would substantially reduce the incidence of disease associated with the poor quality water in the dam.

Scenario 2

The impacts on health related to the poor quality water in Olushandja Dam for this scenario would be the same as for Scenario 1.

Scenario 3

There will be **no impact,** as the health problems are related to the water from the dam.

IMPACT 11: The presence of the dam obstructs access to community services and facilities.

Scenario 1

Discussion of impacts:

The dam obstructs the movement of people from one side of the dam to the other, as access around the dam can be gained only at the north and south walls of the dam. On the eastern side of the dam (within the study area), there are few services and facilities, with only one small clinic (Oshaala), no churches and no significant business centres. People must therefore use the facilities provided at Eunda and Onesi which are situated on the western side of the dam. There have been cases of people drowning while attempting to cross the dam. In both the household and key-informant interviews, as well as the community meeting, people complained of the difficulties associated with access from one side of the dam to the other. The only solution suggested was the construction of a bridge, at a point which is more or less mid-way between the north and south walls. The need for a bridge was expressed by many households in Zone A (14 out of 30 households, of which 10 of the 14 households are situated on the eastern side of the dam).

Affected parties: Households who require access to the other side of the dam, but particularly the households on the eastern side of the dam.

Significance without mitigation: **HIGH negative**

Reasons: Affects peoples' access to community services such as clinics (makes it difficult for people to reach the clinics in times of medical emergencies), churches and schools; poses a potential safety hazard if people attempt to wade through the dam to gain access to the other side.

Mitigation:

* The feasibility of constructing a bridge, or providing some form of transport, such as a ferry service across the dam, should be investigated.
* An alternative means of getting across the dam should be provided as soon as possible.

* Facilities and services on the eastern side of the dam should be improved or established. This will ensure that people on this side of the dam have the same access to facilities and services, as the communities on the western side.

Significance with mitigation: **MODERATE to LOW negative**

Reasons: Mitigation will ensure that people have better access to the opposite side of the dam; improved/established services on the eastern side will reduce peoples' need of attending the services on the western side of the dam; however mitigatory measures may only take place over a medium- to long-term.

Scenario 2

The impacts associated with this alternative will be the same as those in Scenario 1, as the dam at a capacity between the present level and full capacity, will obstruct peoples' access to facilities and services.

Scenario 3

There would be **no impact**, as the dam would no longer obstruct peoples' access to facilities and services.

IMPACT 12: The presence of the dam interferes with inter- and intra-community contact.

Scenario 1

Discussion of impacts:

In cases where families and friends within a community are separated by the dam, interaction between these families/friends, is affected. Out of the 14 households in Zone A who mentioned the need for a bridge, 8 households said that a bridge would allow them to visit their families and friends again on a more regular basis. Inter-community contact is similarly affected. As mentioned under Impact 11, there have been a number of cases where people have drowned in an attempt to cross the dam.

Affected parties: People who have family or friends on the opposite side of the dam; communities on opposite sides of the dam.

Significance without mitigation: **HIGH negative**

Reasons: Affects overall well-being of the affected people; poses potential safety hazard; affects the social interaction between people living on opposite sides of the dam.

Mitigation:

* The feasibility of constructing a bridge, or providing some form of transport, such as a ferry service across the dam, should be investigated.
* An alternative means of getting across the dam should be provided as soon as possible.

Significance with mitigation: **MODERATE to LOW negative**

Reasons: Mitigation will ensure that people have better access to the family, friends and other communities, on the opposite side of the dam; however mitigatory measures may only take place over a medium- to long-term.

Scenario 2

The impacts associated with this alternative will be the same as those in Scenario 1, as the dam at a capacity between the present level and full capacity will obstruct peoples' access to family, friends and communities, on the opposite side of the dam.

Scenario 3

There would be **no impact**, as the dam would no longer obstruct access to family, friends and other communities.

IMPACT 13: **The incidence of water related diseases associated with the dam, places pressure on the health services in the area, who have to attend to these problems.**

Scenario 1

Discussion of impacts:

As discussed under Impacts 9 and 10, there are various diseases related to the water quality in Olushandja Dam (gastritis and diarrhoea) and water-borne parasites harboured in the dam (bilharzia and malaria). The impact of this is that pressure is placed on the four day clinics (Eunda, Onesi, Mahanene and Oshaala) in the study area to attend to these problems. Of most concern is the Oshaala clinic, which is located on the eastern side of the dam. This clinic is not well equipped and people complained that it could not deal with the more serious health complaints, such as bilharzia and malaria. (At the community meeting the inadequacy of the Oshaala clinic was stated as one of the main reasons for requiring a bridge across the dam, while 3 households on the eastern side of the dam in Zone A also spoke of the problems associated with the Oshaala clinic). In these cases, people have to attend one of the other clinics in the area. For people living on the eastern side of the dam it is long way to get to the other clinics and most people do not have access to transport. Furthermore, in the interview with the matron at the Eunda clinic, it was stated that there is a need for more health facilities in the area as the clinic (Eunda) is already under great pressure, serving a population of approximately 20 000 people.

Affected parties: Health services in the study area (Eunda, Onesi, Mahanene and Oshaala clinics); people who depend on these health services.

Significance without mitigation: **MODERATE negative**

Reasons: Affects community services; potential to affect public health; medium to long-term effect.

Mitigation:

* Health facilities in the area should be equipped with the necessary resources to deal with the potential increase in health problems related to the dam, paying particular attention to the Oshaala clinic.
* Where feasible, smaller clinics should be built in areas where access to the existing clinics are constrained by distance. Possible locations for clinics include: Ombome Eenkalashie; Epalela and Iishaanapata. (Refer to Fig. 6, Appendix 2. This is a copy

of one of the land-use maps drawn by the participants in the community meeting. These were the locations identified by the participants as needing health services).

* A preventative measure, which would be in the long-term interests of the area, would be the provision of purified water to communities on the eastern side of the dam and to the far western side of the study area, who do not have access to clean water. (Refer to Fig.5, Appendix 2, for household water utilisation).

Significance without mitigation: **LOW negative**

Reasons: With mitigation this impact can be successfully curbed.

Scenario 2

The impacts related to this scenario will be as for Scenario 1, because these scenario's have the same health implications.

Scenario 3

There will be **no impact,** as the health problems are associated with the dam.

IMPACT 14: The various management scenarios will provide different degrees of surety of water supply to the regions of northern Namibia.

Scenario 1

Description of impacts:

At the present level, the dam can serve as a reserve supply, so it does offer a measure of surety. However, maintaining the dam at its present level of storage will not increase the surety of supply, as there will not be an increase in the amount of water stored in the dam.

The aim of upgrading the Calueque-Olushandja water supply scheme is to increase the volume of water transferred from the Cunene River, as well as increasing the surety of the water supply to the regions of northern Namibia. The upgrading of Olushandja Dam entails the installation of pumps with greater pumping capacities to cope with an the increased rate of abstraction from the Cunene River. Furthermore, the management of the Olushandja Dam will have an effect on the surety of the water supply as it acts as a balancing dam which

stores a reserve supply of perennial water closer to the consumer points. DWA's objective is to secure a supply of water, in order to meet the demands of the rural and bulk water supply users, as well as the irrigation needs in the region (Etunda Irrigation Project). A back-up supply of water may be required if there is a threat to the security of the supply from Calueque, (for instance if technical problems are experienced at Calueque or on the Calueque-Olushandja canal), at times of low-flow in the Cunene, or in the case of political upheavals in Angola. Furthermore, if the demand along the regional networks increases, there must be a reserve supply to accommodate the increased demand.

Affected parties: DWA; regional users of the water supply network; Etunda Irrigation Project.

Significance without mitigation: **MODERATE to HIGH positive**
Reasons: Furthers local and regional interests; however it does not optimise the surety of water supply.

Optimisation:
Optimisation would include raising the level of the dam to improve surety, however this option is considered in Scenario 2.

Scenario 2
Discussion of impacts:
This alternative would result in an improved surety of water supply, as the storage capacity of the dam will be increased from its present level to full capacity. At times when security of supply is jeopardised and/or the demand along the regional networks increase, Olushandja can serve as a back-up supply until such time as the dam reaches dead storage level. The period of time that Olushandja Dam will be able to act as a reserve supply depends on the regional water demands and the irrigation needs of the Etunda Irrigation Project. This alternative would allow Olushandja to act as a back-up supply for longer periods of time than if it was maintained at the present level (Scenario 1).

Affected parties: DWA; regional users of the water supply network; Etunda Irrigation Project.

Significance without optimisation: **HIGH positive**

Reasons: Furthers local and regional interests; has the potential to optimise surety of water supply.

Optimisation: This alternative would be optimising the surety of supply to the region.

Scenario 3

Discussion of impacts:

The no dam alternative would not allow for the provision of a reserve supply of water and would therefore, negatively affect the surety of supply within the water supply system. This would furthermore, not fulfil DWA's objective of securing a supply of water to the regional water supply networks and for the agricultural needs in the area.

Affected parties: DWA; regional users of the water supply networks; Etunda Irrigation Project.

Significance without mitigation: **HIGH negative**

Reasons: Fails to ensure a security of water supply; contradicts local and regional interests; has the potential to affect the overall well-being of people.

Mitigation:

* Ensure a greater surety of supply from the Calueque Dam. This would require the construction and repair of the uncompleted and damaged components of the dam, making provision for water storage. Furthermore, the plans to modify and improve the pumping facilities at Calueque would have to be implemented. Additional pump sets, which will be provided once the pumping facilities have been improved, will serve as a standby unit should there be technical problems and will take a minimum period of one week to replace. The surety of $6m^3/s$ supply from Calueque will thus be 50% (Lund, 1992).

Significance with mitigation: **MODERATE negative**

Reasons: The implementation of the mitigatory measures would improve the surety of supply but surety would not be optimised.

IMPACT 15: The proposed commercialisation of the bulk water supply function of DWA may have a negative impact on peoples' land rights and rights to water use.

Scenario 1

Discussion of impacts:

At present an Act is being drafted with the objective of establishing a Namibian Water Corporation which will take control of the bulk water supply function from DWA. As Olushandja Dam constitutes a component of the bulk water supply system, it will also fall under the control of the Corporation. However, it has not been established whether the Corporation will be bound to plans initiated by DWA and what the Corporations' approach to the management of the Olushandja Dam will be. The Corporation will aim to cover the costs of supplying bulk water to the regional networks and will implement measures to get regional water users to pay for water supplied by the bulk water system (DWA, 1994a). This raises a number of uncertainties regarding the effect of the commercialisation on land rights and rights to water use. It may affect peoples' present rights to freely utilise the water from Olushandja Dam. It may also mean that the livestock presently grazing at the dam will not be allowed access to it or will be allowed access at a price.

Land rights could also be affected if the Corporation decide to insist on the removal of homesteads which are situated below the recommended limit of settlement (1107,5 m.a.s.l), which was proposed at the time when the dam was designed (refer to Fig. 3, Appendix 2). If this is the case, 71 households as well as the two market gardens, would have to relocate. According to the draft Act regarding the commercialisation, the Corporation is afforded the powers of expropriation, which includes the right to expropriate movable and immovable property in the public interest, subject to the payment of fair and reasonable compensation (Namibian Government, 1994a).

The proposed commercialisation thus poses potentially significant negative impacts however, these are highly uncertain as the Corporations' approach to the management of Olushandja Dam has not yet been established.

Affected parties: 71 households and market gardens located below the recommended limit of settlement (1107.5 m.a.s.l); people who utilise the dam for themselves and their livestock; the future Namibian Water Corporation; DWA.

Significance without mitigation: **HIGH negative**

Reasons: The actions and associated impacts are highly uncertain and may have potentially significant impacts on the overall well-being of people.

Mitigation:

* The Corporations proposed plans and policies regarding Olushandja Dam should be established prior to commercialisation taking place.
* Any impacts pertaining to land rights or rights to water use from Olushandja Dam, should be assessed immediately.
* Negotiations should be set up between the Corporation and the affected population, so that an arrangement can be established, which would be mutually beneficial.
* In the event of relocation or payment of compensation, a full investigation of the related impacts must be undertaken and mitigation should be suggested.

Significance with mitigation: **UNCERTAIN**

As actions associated with commercialisation are uncertain, and should be established.

Scenario 2

Discussion of impacts:

The potential impacts associated with the commercialisation will be the same as those discussed under Scenario 1 but the matter of land claims may be more of an issue if this management scenario was adopted by the Corporation as it would result in the inundation of 30 homesteads as well as the two market gardens.

Affected parties: 71 households and market gardens located below the recommended limit of settlement (1107.5 m.a.s.l); people who utilise the dam for themselves and their livestock; the future Namibian Water Corporation; DWA.

Significance without mitigation: **HIGH negative**
Reasons: The actions and associated impacts are highly uncertain and may have potentially significant impacts on the overall well-being of people.

Mitigation:
Mitigation will be the same as for Scenario 1.

Significance with mitigation: **UNCERTAIN**
As actions associated with commercialisation are uncertain, and should be established.

Scenario 3
Discussion of impacts:
In the no dam scenario, the issue of land claims would not present a problem as there would be no need for the Corporation to control the land bordering on the dam. However, if the Corporation opted for the no dam alternative the issue of rights to water use could be affected, as a valuable source of water would be lost, leaving many people with no access to an alternative water supply. Thus, the Corporation would have to supply some form of water to the communities who are dependant on the dam. This may still mean that people must pay for the water which they and their cattle use.

Affected parties: People who utilise the dam for themselves and their livestock; the future Namibian Water Corporation; DWA.

Significance without mitigation: **HIGH negative**
Reasons: The actions and associated impacts are highly uncertain; but may have potentially significant impacts on the overall well-being of people.

Mitigation:

* The Corporation must supply an alternative source of water to the communities who are dependant on the dam.
* Negotiations should be set up between the Corporation and the affected population to establish fair and reasonable arrangements regarding payment for the use of water from the supplied water source.

Significance with mitigation: **UNCERTAIN**

As actions associated with commercialisation are uncertain, and should be established.

IMPACT 16: The rate of evaporation from the dam decreases its overall efficiency.

Scenario 1

Discussion of impacts:

High evaporation losses (1.7m/year) are experienced due to the poor surface area to volume of water stored ratio (Lund, 1992; Haussler; 1995c). This indicates that the efficiency of the dam at present level, due to evaporation, is low.

Affected parties: DWA, SWAWEK.

Significance without mitigation: **HIGH negative**

Reasons: Low efficiency; long-term effects.

Mitigation:

* Ideally the surface area of the dam should be reduced but there would be high costs associated with such reconstruction (Lund, 1992).

Significance with mitigation: **HIGH negative.**

Reasons: Mitigation would be financially costly for DWA and thus reduces the chances of of mitigation being implemented.

Scenario 2

Discussion of impacts:

If the dam was kept at full capacity for long periods of time the efficiency of the dam would be very low. Due to the large surface area, this alternative would be even less efficient than maintaining the dam at its present level. Evaporation could be reduced by continuously fluctuating the water levels, so that the dam is not maintained at full capacity, however this would defeat the object of keeping the dam full for the purposes of having a surety of water supply.

Affected parties: DWA, SWAWEK.

Significance without mitigation: **HIGH negative**
Reasons: Very low efficiency; long-term effects.

No mitigation possible.

Scenario 3

Evaporation is not associated with this alternative thus there will be **no impact.**

IMPACT 17: Changing the water level or decommissioning the dam could result, respectively, in a decline or a loss of natural resources of conservation value.

Scenario 1

Discussion of impacts:

The environmental components associated with the dam which are of conservation value, are the endemic aquatic and wetland associated floral species which have colonised the dam (Burke, 1995). The biological diversity of the aquatic and wetland species found in the dam is noteworthy and is hence worth protecting (Burke, 1995).

The birdlife which is supported by the dam is of potential conservation value. The Department of Nature Conservation has mentioned the possible establishment of a bird

sanctuary at Olushandja Dam, with the aim of conserving the birdlife which is currently threatened by poaching. However, no more information regarding this issue was obtained, and investigations into the birdlife associated with the dam is required.

Affected parties: Department of Nature Conservation; DWA; people who utilise the dam who may be affected (in terms of access to and, utilisation of the dam) by the establishment of conservancies.

Significance without mitigation: **LOW to MODERATE positive**
Reasons: The natural resources of conservation value are not negatively affected; there is a potential to enhance the protection of resources of conservation value.

Optimisation:

* The conservation value of the birdlife associated with the dam, should be investigated in conjunction with the Ministry of Environment and Tourism.
* The present diversity of aquatic and wetland habitats and associated floral species should be maintained. This could be achieved by establishing a sanctuary for rare and endemic wetland species (Burke, 1995).
* The establishment of any form of conservancy would have to be accompanied by an educational programme, which would inform the local people of the aims of the conservancy, as well as the role that the people can play in conserving these resources.
* Negotiations between local people and Nature Conservation should be set up to negotiate an arrangement which would ensure that the establishment of the conservancies would be mutually beneficial.

Significance with optimisation: **HIGH positive**
Reasons: Protection of resources of conservation value; opportunity for environmental education.

Scenario 2

Discussion of impacts:

A rise in the water level of the dam will not have negative effects on the aquatic and wetland associated plant communities, however, Burke (1995) recommends that care should be taken to raise the water level slowly to give plant communities a chance to adapt and recolonise new areas. The regional endemic and protected stem-succulent *Hoodia* species, found on the terrestrial fringes of the dam, would be affected by a rise in water level and should be transplanted in advance (Burke, 1995).

Lowering of the water level will not negatively affect the aquatic and wetland communities, as they are naturally adapted to seasonal changes in water level (Burke, 1995). However, as with a rise in the water level, the dam should be drawn down slowly to give the plant communities a chance to adapt.

The birdlife associated with the dam is not expected to be negatively affected by fluctuating water levels. However, as discussed under Scenario 1, the conservation value of the birdlife is uncertain and needs further investigation.

Affected parties: Department of Nature Conservation; DWA; people who utilise the dam who may be affected (in terms of access to and, utilisation of the dam) by the establishment of conservancies.

Significance without mitigation: **LOW positive**

Reasons: Resources of potential conservation value would not be affected, with the exception of the regional endemic and protected stem-succulent *Hoodia* species (which would be affected by a rise in water level); potential to enhance the protection of resources of potential conservation value.

Mitigation:

As for Scenario 1, but in addition:

* The level of the water must be raised and lowered slowly, to give plant and animal communities a chance to adapt and recolonise new areas.

* The regional endemic and protected stem-succulent *Hoodia* species, found on the terrestrial fringes of the dam, should be transplanted prior to the initial rise in water level (Burke, 1995).

Significance with optimisation: **MODERATE positive**

Reasons: Protection of resources of conservation value; opportunity for environmental education; however transplanting the *Hoodia* may be a financially costly and time consuming task for DWA to undertake.

Scenario 3

Discussion of impacts:

If the dam was decommissioned the natural resources of conservation value, namely the aquatic and wetland associated plant communities, would not survive. Therefore, the opportunity to conserve these resources would also be lost.

Affected parties: Department of Nature Conservation.

Significance without mitigation: **MODERATE to HIGH negative**

Reasons: This alternative would result in the loss of natural resources of conservation value; the opportunity to conserve these resources would be lost.

Mitigation: No mitigation is possible.

CHAPTER 6
COMPARATIVE EVALUATION OF ALTERNATIVE MANAGEMENT SCENARIOS

However, it is insufficient to assume that all the impacts are of equal weight and, hence, a second evaluation is required which will ensure that the alternative selected is in the overall best interest of society. The alternatives are thus evaluated against Stauth's (1989) criteria of *equity, efficiency and sustainability*. The definitions of these concepts are given below.

Equity concerns the fair distribution of costs and benefits, arising out of a development alternative, among the individuals and groups constituting society.

Efficiency is measured by the degree to which the overall benefits of a development alternative outweigh its overall costs.

Sustainability refers to development that meets the needs of the present generation without compromising the needs of future generations.

For the alternative to be unequivocally acceptable it must meet all three of the above criteria.

6.3 EVALUATION OF ALTERNATIVE MANAGEMENT SCENARIOS

6.3.1 Decision-Making Framework

The decision-making framework (p113) contains the impacts assigned moderate to high or high positive and moderate to high or high negative significance ratings in the impact assessment. The impacts with low significance for all three alternatives were excluded from the decision-making framework, as they are not considered as important criteria for decision-making. Impact 15, which concerns the commercialisation of DWAs' bulk water supply function, was assigned a high negative significance rating for all three scenarios, as the impact of commercialisation is uncertain in all three cases. Impact 15 was excluded from the decision-making framework because the impact for each of the scenarios was the same and was therefore not considered as a criteria for choosing the best management alternative. The decision-making framework serves to visually present the impacts of high significance for each of the scenarios. The scenarios are thereafter evaluated against the criteria of equity, efficiency and sustainability.

CHAPTER 6

COMPARATIVE EVALUATION OF ALTERNATIVE MANAGEMENT SCENARIOS

6.1 INTRODUCTION

This chapter contains a comparative evaluation of the alternative management scenarios assessed in Chapter 5. The first section describes the method of evaluation adopted. This is followed by a decision-making framework, which presents the most significant impacts related to each of the alternatives. The alternative management scenarios are then evaluated according to the criteria of equity, efficiency and sustainability, so as to determine which of the alternatives is in the best overall interest of society.

6.2 METHOD OF EVALUATION

Evaluation involves weighing up the available information and, based on this, determining which alternative is in the best interest of the community at large (DEA, 1992). The method of evaluation adopted in this study is qualitative. This implies that the evaluation is based on informed value judgements, which requires that the person carrying out the evaluation understands the trade-offs which are necessary in the selection of an alternative. Judgements should be articulated clearly and systematically, so that the rationale behind the conclusions drawn can be understood by the decision-maker and all interested and affected parties.

The following evaluation involves two steps. Firstly, those impacts assigned moderate to high or high positive, and moderate to high or high negative significance ratings in the assessment, are summarised in a decision-making framework. The impacts of high positive significance either with or without optimisation, are shaded green while the high negative impacts, with or without mitigation, are shaded red. The decision-making framework facilitates the comparison of the costs and benefits of the alternatives and visually displays the alternative with the most benefits (high positive impacts in green) and the one with the most costs (high negative impacts in red).

Table 2 (cont)

Interest Group	Impact Statement	Scenario 1 Present Level	Scenario 2 Fluctuating Water Levels	Scenario 3 No Dam Scenario
People in Zones A and B who own livestock.	*IMPACT 8: A change in the level of the dam may impact on the grazing land adjacent to the dam.*	**No impact**	*Without mitigation:* **MODERATE negative** Potentially long-term effect on the grazing resources found in Zones A and B due to a inundation of grazing land around the dam and overgrazing of alternative resources. *With mitigation:* **UNCERTAIN** Mitigatory measures should be investigated.	*Without optimisation:* **LOW to MODERATE positive** Potential increase in grazing but impact is not certain. *With Optimisation:* **UNCERTAIN** Further investigation into the re-establishment of grazing is required
Households who utilise the dam for drinking, household and livestock purposes; health services in the area.	*IMPACT 9: Various freshwater snails are found in the dam. The management scenarios may affect the distribution of the freshwater snails, which will have an associated impact on the incidence of snail-borne diseases such as bilharzia in humans and liverfluke in cattle.*	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **MODERATE negative** Mitigation could decrease the distribution of snails and help to prevent the contraction of disease.	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people *With mitigation:* **MODERATE negative** Mitigation could decrease the distribution of snails and help to prevent the contraction of disease.	**No impact**
People who are dependant on the dam for drinking water; health services in the area.	*IMPACT 10: The poor quality water in Olushandja Dam has a negative impact on the health of the people who drink the water, causing diseases such as diarrhoea and gastritis.*	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **LOW negative** Mitigation would contribute to the reduction and prevention of disease.	*Without mitigation:* **HIGH negative** Affects health and overall well-being of people. *With mitigation:* **LOW negative** Mitigation would contribute to the reduction and prevention of disease.	**No impact**
Households who require access to the other side of the dam, but particularly households on the eastern side of the dam.	*IMPACT 11: The presence of the dam obstructs access to community services and facilities.*	*Without mitigation:* **HIGH negative** Affects access to services; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	*Without mitigation:* **HIGH negative** Affects access to services; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	**No impact**
People who have family or friends on the opposite side of the dam; communities on opposite sides of the dam.	*IMPACT 12: The presence of the dam interferes with inter- and intra-community contact.*	*Without mitigation:* **HIGH negative** Affects access; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	*Without mitigation:* **HIGH negative** Affects access; potential safety hazard (people wading through the dam). *With mitigation:* **MODERATE to LOW negative** Mitigation would ensure better access but may take place over medium- to long-term.	**No impact**
Health services in the study area; people who depend on these health services.	*IMPACT 13: The incidence of water related diseases associated with the dam puts pressure on the health services in the area who have to attend to these problems.*	*Without mitigation:* **MODERATE negative** Potential pressure on health services; potential to affect public health. *With mitigation:* **LOW negative** With mitigation the impacts can be successfully curbed.	*Without mitigation:* **MODERATE negative** Potential pressure on health services; potential to affect public health. *With mitigation:* **LOW negative** With mitigation the impacts can be successfully curbed.	**No impact**
DWA; regional users of the water supply network; Etunda Irrigation Project.	*IMPACT 14: The various management scenarios will provide different degrees of surety of water supply to the regions of northern Namibia.*	*Without optimisation:* **MODERATE to HIGH positive** Provides a measure of surety; but does not optimise surety of supply. *No optimisation:* This scenario does not include raising the level of the dam.	*Without optimisation:* **HIGH positive** Optimises the surety of supply. *With optimisation:* Surety is optimised.	*Without mitigation:* **HIGH negative** Fails to ensure a security of supply. *With mitigation:* **MODERATE negative** Mitigation would improve surety of supply but it would not be optimised.
71 households and market gardens located below the recommended limit of settlement; people who utilise the dam; future Water Corporation; DWA.	*IMPACT 15: The proposed commercialisation of the bulk water supply function may have a negative impact on people's land rights and rights to water use.*	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain andshould be established.	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people . *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain and should be established.	*Without mitigation:* **HIGH negative** Uncertain impact; potentially affect overall well-being of people . *With mitigation:* **UNCERTAIN** Actions and associated impacts of commercialisation are uncertain and should be established.
DWA, SWAWEK.	*IMPACT 16: The rate of evaporation from the dam decreases its overall efficiency.*	*Without mitigation:* **HIGH negative** Low efficiency. *With mitigation:* **HIGH negative** Mitigation would be financially costly for DWA and reduces the chance of it being implemented.	Full Capacity *Without mitigation:* **HIGH negative** Very low efficiency. *No mitigation.*	**No impact**
Department of Nature Conservation; DWA; people who utilise the dam who may be affected by the establishment of conservancies.	*IMPACT 17: Changing the water level or decommissioning the dam could result, respectively, in a decline or a loss of natural resources of conservation value.*	*Without optimisation:* **LOW to MODERATE positive** Resources are not negatively affected; potential to conserve resources. *With optimisation:* **HIGH positive** Protection of resources; environmental education.	*Without optimisation:* **LOW positive** Resources would not be affected with the exeption of a certain *Hoodia* species; potential to conserve resources. *With optimisation:* **MODERATE positive** Protection of resources; environmental education; costs associated with transplanting *Hoodia* species.	*Without mitigation:* **MODERATE to HIGH negative** Loss of resources; opportunity to conserve resources would be lost. *No mitigation.*

Table 3: Summary Table of Interested and Affected Parties

Interested or Affected Party	Description of the Party	Issues and Concerns
Department of Water Affairs (DWA)	The bulk water supply division of DWA is the proponent of the upgrading project. The aim of upgrading the Olushandja Dam is to improve surety of water supply to the regional water networks.	* Directly concerned with all aspects of the project. * DWA's particular interest is to improve the surety of water supply to the regions of northern Namibia.
30 Households located within the full capacity level of the dam	These homesteads (dwelling and the agricultural field) are located either partially or completely within the level of full capacity level (1106 m.a.s.l).	* A rise in the water level would partially or completely inundate these homesteads. * These households would have to be relocated and/or compensated.
Elao and Epalela market gardens	These gardens grow fresh produce which is sold in the local settlements and in some of the regional centres. The gardens are situated on the immediate banks of the dam and are entirely dependant on the dam for water to irrigate their crops.	* A rise in the water level would result in the inundation of the gardens. * A decrease in the water level or the decommissioning of the dam, would affect their access to water.
Households who utilise the dam for drinking, household and livestock purposes	These households are situated primarily in Zones A but also in Zones B and C on the eastern side of the dam. (Refer to Fig. 3).	* The poor quality water in the dam negatively affects the health of these people. * If the dam is decommissioned they would lose their primary source of water.
People who are dependant on the dam for fishing	People fish for subsistence and income generating purposes. The fisherman residing at Epalela township are generally involved in commercial fishing while the households are involved in subsistence fishing.	* Changes in the water level may affect the fish populations, which would affect peoples' fishing activities. * Decommissioning of the dam would result in the loss of a food source and the loss of a source of income.
Local and regional communities affected by impacts on the market gardens and fishing activities	Local communities obtain fish and fresh produce from Eunda, Onesi and Epalela. Regional communities buy their fresh produce at Oshakati, Ruacana, Ondangwa, Ombalantu and Tsandi.	* A decline in supplies and fresh produce to these centres will result in a decrease/loss of a food source to the people who buy these supplies.
People who require access to the opposite side of the dam	People living on both sides of the dam, but particularly those who do not live close to the access points (north and south walls) and those the people living on the eastern side of the dam (facilities and services are limited).	* The dam obstructs access to facilities and services provided at Eunda and Onesi. * Interaction between family and friends living on opposite sides of the dam is constrained.
Regional users of the bulk water supply system	People utilising the water from the Etaka and Olushandja-Ogongo canal networks for domestic consumption and livestock watering.	* The regional users are dependant on a surety of water supply in the bulk water supply network. * Changes in the operation of Olushandja Dam may have associated implications for the bulk water supply network, and thus for the users of this network.
Health services in the area	There are four day clinics in the study area namely the Mahanene, Eunda, Onesi and Oshaala clinics.	* These clinics have to attend to the water related diseases associated with Olushandja Dam. * An increase in the incidence of disease may put added pressure on the clinics.
Etunda Irrigation Project	Etunda is a large scale agricultural project which is dependant on the bulk water supply system for irrigation purposes.	* In time, the project will utilise up to $2m^3/s$ (from the total of $6m^3/s$ abstracted from Calueque). This may have implications for water supply in the bulk water supply network. * Etunda would benefit from an increase in the surety of supply offered by Olushandja Dam.
Department of Nature Conservation	The Department of Nature Conservation is housed within the Ministry of Environment and Tourism.	* Nature Conservations' interest is the protection and management of the birdlife found at Olushandja Dam.
SWAWEK (South West African Water and Electricity Commission)	SWAWEK is legally responsible for the operation of the Calueque Dam.	* SWAWEK argues that both the Calueque and Olushandja Dams are inefficient because of the great evaporation losses. * SWAWEK feels that the water would be better used for the purposes of generating electricity.

: Decision-Making Framework: Comparative Evaluation of Scenarios 1,2 and 3

* The significance ratings for each impact, with and without mitigation/optimisation, is presented for all three scenarios.
* For Scenario 2, when the significance rating relates to full capacity or dead storage level, this is indicated. No indication of a specific water level means that the rating refers to a fluctuating water level.

*** Positive impacts of high significance are shaded green; Negative impacts of high significance are shaded red.**

Interest Group	Impact Statement	Scenario 1 Present Level	Scenario 2 Fluctuating Levels	Scenario 3 No Dam Option
		30% Capacity (1104 m.a.s.l)	**Between Full Capacity (1106 m.a.s.l) and Dead Storage Level (1103,7 m.a.s.l)**	**No Dam**
Elao and Epalela market gardens; 30 households that will be inundated; residents and fisherman of Epalela; people living in areas in which people resettle.	*IMPACT 1: The various management scenarios could affect the local settlement patterns and may also have an influence on the sub-regional settlement distribution (as a result of people relocating due to a rise in the water level or due to the decommissioning of the dam).*	**No impact**	At full capacity: *Without mitigation:* **MODERATE negative** *With mitigation:* **LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
DWA; 30 households that will be inundated; market gardens; communities that buy produce grown by the market gardens.	*IMPACT 2: If the dam was filled to its full capacity it would result in the inundation of 30 homesteads and the Epalela and Elao market gardens.*	**No impact**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to HIGH negative**	**No impact**
Fisherman who fish for income generating purposes; households who fish for subsistence purposes; people who buy fish from the fisherman at local and regional settlements.	*IMPACT 3: A decline in the fish resources of the dam will have a negative effect on the fishing activities associated with the dam, which may in turn alter the economic profile of the area.*	*Without optimisation:* **MODERATE positive** *With optimisation:* **HIGH positive**	Full Capacity *Without optimisation:* **MODERATE positive** *With optimisation:* **HIGH positive**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
			Dead Storage Level *Without mitigation:* **MODERATE to HIGH negative** *With mitigation:* **Uncertain**	
People employed at Epalela and Elao; local and regional communities who buy produce grown by the gardens.	*IMPACT 4: The Elao and Epalela market gardens, which are situated on the immediate banks of the dam, are directly dependant on the dam for irrigation. A rise in the water level will result in the inundation of the gardens while the decommissioning of the dam could affect their access to water.*	*Without optimisation:* **HIGH positive** *With Optimisation:* **HIGH positive**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **Uncertain**
30 households where agricultural land would be inundated.	*IMPACT 5: A rise in the water level of the dam will result in the inundation of productive land used for subsistence agriculture.*	**No impact**	Full capacity: *Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
Households who utilise the dam for drinking, household and livestock purposes; health services in the area.	*IMPACT 9: Various freshwater snails are found in the dam. The management scenarios may affect the distribution of the freshwater snails, which will have an associated impact on the incidence of snail-borne diseases such as bilharzia in humans and liverfluke in cattle.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**	**No impact**
People who are dependant on the dam for drinking water; health services in the area.	*IMPACT 10: The poor quality water in Olushandja Dam has a negative impact on the health of the people who drink the water, causing diseases such as diarrhoea and gastritis.*	*Without mitigation:* **HIGH negative** *With mitigation:* **LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **LOW negative**	**No impact**
Households who require access to the other side of the dam, but particularly households on the eastern side of the dam.	*IMPACT 11: The presence of the dam obstructs access to community services and facilities.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
People who have family or friends on the opposite side of the dam; communities on opposite sides of the dam.	*IMPACT 12: The presence of the dam interferes with inter- and intra-community contact.*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE to LOW negative**	**No impact**
DWA; regional users of the water supply network; Etunda Irrigation Project.	*IMPACT 14: The various management scenarios will provide different degrees of surety of water supply to the regions of northern Namibia.*	*Without optimisation:* **MODERATE to HIGH positive** *No optimisation:*	*Without optimisation:* **HIGH positive** *No optimisation:*	*Without mitigation:* **HIGH negative** *With mitigation:* **MODERATE negative**
DWA, SWAWEK.	*IMPACT 16: The rate of evaporation from the dam decreases its overall efficiency.*	*Without mitigation:* **HIGH negative** *With mitigation:* **HIGH negative**	Full Capacity *Without mitigation:* **HIGH negative** *No mitigation*	**No impact**
Department of Nature Conservation; DWA; people who utilise the dam who may be affected by the establishment of conservancies.	*IMPACT 17: Changing the water level or decommissioning the dam could result, respectively, in a decline or a loss of natural resources of conservation value.*	*Without optimisation:* **LOW to MODERATE positive** *With optimisation:* **HIGH positive**	*Without optimisation:* **LOW positive** *With optimisation:* **MODERATE positive**	*Without mitigation:* **MODERATE to HIGH negative** *No mitigation*

6.3.2 Evaluation according to the Criteria of Equity, Efficiency and Sustainability

In the following evaluation, Scenarios 1, (maintaining the dam at its present water level of 30%); 2, (fluctuating the water level between full capacity and dead storage level) and; 3, (the no-dam scenario), will be evaluated against the three criteria, in each case bringing to light the costs and benefits associated with each alternative. After considering each of the scenarios in relation to the criteria in question, a brief conclusion regarding the preferred alternative, will be drawn.

6.3.2.1 Equity

EQUITY: *An action is equitable if its costs and benefits are distributed fairly among the individuals and groups constituting society.*

Scenario 1

Potential benefits:

* The benefits provided by the subsistence and economic opportunities associated with the dam, (fishing and market gardens), contributes to improved standards of living of the people who are directly involved in these activities and also benefits the people who depend on the products of these activities, (people can purchase fish and fresh produce). These activities also increase the flow of money into the local and regional economy.
* Local and regional communities benefit from the provision of water. Local communities have access to a permanent source of water for themselves and their livestock, while regional communities benefit from the security of water supply provided by Olushandja Dam.
* DWA benefits from the surety of water supply to the regional water networks, offered by Olushandja Dam.
* There is potential to protect the natural resources associated with the dam. This would further the interests of the Department of Nature Conservation.

Potential costs:

* The dam has negative health implications for those communities who directly utilise the water from the dam. However, these health implications can be successfully curbed through the implementation of the suggested mitigatory measures.
* The dam constrains the mobility and movement patterns of the communities living in the vicinity of the dam. Although, the implementation of the suggested mitigatory actions would reduce these impacts substantially.

Scenario 2

Potential benefits:

* Local and regional communities benefit from the provision of water. Local communities have access to a permanent source of water for themselves and their livestock, while regional communities benefit from the increased security of water supply provided by Olushandja Dam at full capacity.
* DWA would achieve its goal of increasing surety of water supply to the regional water networks.
* There is potential to protect the natural resources associated with the dam. This would further the interests of the Department of Nature Conservation.

Potential costs:

* At full capacity the dam would inundate 30 homesteads and both the market gardens. The quality of life of these households would be negatively affected. The loss of the market gardens would affect the local and regional economy and would also mean a loss of a food source for local and regional communities. Although the severity of the impacts associated with inundation and relocation can be reduced through mitigation, there is a possibility that residual impacts such as the psychological stress of relocation and disturbed social networks, are still likely to occur.
* The dam has negative health implications for those communities who directly utilise the water from the dam. However, these health implications can be successfully curbed by the implementation of the suggested mitigatory measures.
* The dam constrains the mobility and movement patterns of the communities living in

the vicinity of the dam. Although, the implementation of the suggested mitigatory actions would reduce these impacts substantially.

Scenario 3

Potential benefits:

* The health implications associated with the dam would be eradicated, which would benefit the people who suffer from these diseases as a result of drinking this water.
* There would no longer be an obstruction to peoples mobility and movement patterns.

Potential costs:

* Loss of a water source to the people who depend on the dam for drinking, household and livestock purposes. However, this could be mitigated by supplying these communities with an alternative water source.
* Loss of economic opportunities associated with the dam. This could affect the standard of living of those who are dependant on these activities and the local and regional economy.
* A decline in the surety of water supply to the regional water networks, which would affect the communities who depend on these networks for water.
* A decline in the surety of water supply would be contrary to DWA's goal of increasing the surety of supply to the regional water networks.
* A potential loss of natural resources of conservation value associated with the dam, would be contrary to the interests of the Department of Nature Conservation.

Summary

Scenarios 1 and 2 distribute benefits equitably among local and regional communities and would also benefit DWA and the Department of Nature Conservation. Scenario 3 includes benefits for the local communities in terms of eradicating the health implications and disturbed movement patterns associated with the dam. However, Scenario 3 does not provide any of the other interested and affected parties with benefits. The costs associated with Scenario 1 and 2, (health implications and disturbed movement patterns), will be borne by

the local communities. However, the implementation of the suggested mitigatory measures would successfully curb these impacts. The costs connected to Scenario 2, in terms of inundation, will have serious consequences for those people affected by this action. With regard to the costs of Scenario 3, the loss of an important water source will affect the local communities who depend on this water, while a decline in the surety of water supply will contradict DWA's aim of increasing surety of supply and may also affect the regional communities who utilise the regional water networks.

Scenario 1 is thus considered the most equitable alternative, as it has the most tangible benefits for all the interested and affected parties. It also has the least social costs of the three alternatives, and these impacts can be mitigated through the implementation of the suggested mitigatory measures.

6.3.2.1 Efficiency

EFFICIENCY: An action is efficient if its total benefits outweigh its total costs.

Scenario 1

Potential benefits:

* Olushandja Dam serves as an important source of water to local communities and provides a surety of water supply to regional water users.
* Although this alternative does not achieve DWA's goal of increasing the surety of water supply, it does offer a measure of security of supply to the regional water networks
* The dam presents long-term subsistence and economic opportunities, which will contribute to improved standards of living and an increased flow of money into the local and regional economy.
* Certain natural resources, associated with the dam, have conservation value. These resources would not be affected negatively. Furthermore, there is potential to conserve these resources.

Potential costs:

* The high evaporation losses decrease the efficiency of the functioning of the dam.
* The dam has negative health implications for those communities who directly utilise the water from the dam. This may increase the pressure of the health services in the area in the long-term. However, implementation of the suggested mitigatory measures will reduce these negative impacts.
* The dam constrains the mobility and movement patterns of the communities living in the vicinity of the dam. The implementation of the suggested mitigatory measures would, however, alleviate these impacts.

Scenario 2

Potential benefits:

* At full capacity the surety of water supply to the region will be optimised. It also serves as an important water source for the local communities.

Potential costs:

* When maintained at full capacity, the evaporation losses will be very high and thus the overall efficiency of the dam will be very low.
* The costs associated with inundation will be high, both financially and socially. In financial terms there will be relocation and compensation costs, while the social costs will include factors such as the effect on the social patterns and behaviours; adaptation to new surroundings and psychological impacts of relocation and a possible increase in settlement density in the areas in which households resettle.
* The dam has negative health implications for those communities who directly utilise the water from the dam. This may increase the pressure of the health services in the area in the long-term. However, implementation of the suggested mitigatory measures will reduce these negative impacts.
* The dam constrains the mobility and movement patterns of the communities living in the vicinity of the dam. The implementation of the suggested mitigatory measures would however alleviate these impacts.

Scenario 3

Potential benefits:

* The water related diseases associated with the dam would be eradicated.

Potential costs:

* Loss of a water source locally and a decline in the surety of water supply regionally.
* Loss of economic and subsistence opportunities associated with the dam. This could affect the standard of living of those who are dependant on these activities and the local and regional economy.
* Natural resources of conservation value would be lost.

Summary

Although Scenario 1 offers less security of supply than Scenario 2, the dam would be more efficient at its present capacity in terms of its associated evaporation losses. Scenario 3 would not lose water to evaporation but would not offer any surety of supply to the regional networks. Scenario 1 and 2 would also include benefits such as long-term economic and subsistence opportunities and the potential to preserve resources of conservation value, which Scenario 3 will not provide. The negative implications of Scenario 1 and 2, namely, the obstruction of movement patterns and the health implications of the water related diseases associated with the dam, are not connected to Scenario 3. Although these impacts could be successfully curbed through the implementation of the suggested mitigatory measures, which reduces the significance of these costs. Scenario 2 also includes the associated costs with the inundation and relocation of the 30 households and both the market gardens. Scenario 2 is considered to be inefficient, as its costs outweigh its benefits and Scenario 3 does not offer the same benefits as Scenario 1 and 2.

Scenario 1 is thus considered the most efficient alternative as its total benefits outweigh its total costs.

6.3.2.3 Sustainability

SUSTAINABILITY: An action is sustainable if its costs and benefits are distributed fairly between different generations.

Scenario 1

Potential benefits:

* There is a potential to maintain the natural resources associated with the dam which are of potential conservation value.
* The opportunities offered by the dam, (such as subsistence and economic opportunities, and a reasonable surety of water supply), present long-term benefits to local and regional communities.

Potential costs:

* The water lost through evaporation, does not contribute to the sustainable utilisation of resources.

Scenario 2

Potential benefits:

* There is a potential to maintain the natural resources associated with the dam which are of potential conservation value.
* The opportunities offered by the dam, (such as subsistence and economic opportunities, and an optimised surety of water supply), present long-term benefits to local and regional communities.

Potential costs:

* The water lost through evaporation does not contribute to the sustainable utilisation of resources.
* There may be long-term social and financial costs associated with the relocation of the households and market gardens, which would be affected by inundation due to a

rise in the water level of the dam.

Scenario 3

Potential benefits:

* Water will not be lost to evaporation thus making it more environmentally sustainable than the other two scenarios.

Potential costs:

* Failure to benefit communities through long-term economic and subsistence opportunities.
* Does not offer a long-term surety of water supply to regional water users.
* Loss of opportunity to preserve natural resources with potential conservation value.

Summary

Scenario 2 would be less environmentally sustainable than Scenario 1 because at full capacity the dam will have higher rates of evaporation than if it was maintained at 30% capacity. Scenario 2 would also incur long-term social and financial costs due to relocation, which would make it less socially and economically sustainable than Scenario 1. Although Scenario 3 would be the most environmentally sustainable in terms of conserving water, the opportunity of conserving natural resources, associated with the dam, would be lost. Furthermore, Scenario 3 fails to provide the long-term social benefits, such as those provided by Scenario 1 and 2, (such as economic and subsistence opportunities and a surety of water supply).

Scenario 1 is considered to be the most socially, environmentally and economically sustainable alternative.

6.4 DECISION REGARDING THE PREFERRED MANAGEMENT SCENARIO

As can be seen from the decision-making framework, Scenario 2 has the most negative impacts of the three scenarios and is thus the least preferred alternative in terms of the

decision-making framework. Scenarios 1 and 3 have the same number of high negative impacts (five). However, Scenario 3 does not have any associated high positive effects, while Scenario 1 presents four impacts of high positive significance. Thus, in terms of the overall costs and benefits of the three alternative management scenarios, Scenario 1 is the preferred alternative.

The evaluation of the three scenarios according to the criteria of equity, efficiency and sustainability, showed that Scenario 1 was the preferred alternative in each case. Thus Scenario 1 is selected as the alternative which is in the overall best interest of society and is unequivocally the most acceptable of the three management scenarios.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The aim of this chapter is to summarise the key conclusions reached in this study. The most important conclusions reached, concerning the process of the environmental impact assessment of the upgrading of the Olushandja Dam and the social impact assessment presented in this report, will be highlighted. The central findings regarding the evaluation of the influence of water provision on the social environment will then be presented, followed by a brief summary of the key impacts associated with each of the alternative management scenarios. The preferred management scenario will then be stated. Finally, the recommendations for the appropriate management of the Olushandja Dam, will be considered.

7.2 CONCLUSIONS

7.2.1 Conclusions regarding the Process of the Olushandja Dam EIA

The main conclusions reached in the review of the EIA, in the light of the IEM procedure and Namibia's Environmental Assessment Policy (EA), are listed below.

- → The reason for conducting an impact assessment was due to the donors' requirement for an EIA. The upgrading proposal was not classified (as either requiring or not requiring an EIA), on the basis of the potential environmental effects of the project, as recommended in the IEM and EA guidelines.
- → There was a failure to identify alternative project actions at the stage when the proposal was being developed. This is recommended in the IEM and EA guidelines.
- → There was limited scoping in terms of consulting interested and affected parties, at the proposal development stage.
- → The decision to upgrade the dam has already been taken. Hence, the EIA can only act as a basis for recommending mitigatory measures to minimise the negative impacts

of the upgrading project and to recommend an appropriate management strategy for the operation of the Olushandja Dam. In terms of the IEM and EA procedures, the decision on the environmental acceptability of a proposal should follow after the environmental assessment.

The EIA has therefore not complied with a number of the recommendations in both the IEM and EA guidelines.

7.2.2 Conclusions regarding the SIA

The SIA presented in this report, was evaluated according to Burdge and Robertsons' (1990) five features of SIA and Burdge's (1990) suggestions for SIA in developing countries.

This SIA is not characteristic of the general features of SIA listed by Burdge and Robertson. The reasons are stated briefly below.

- → SIAs should identify, analyse and evaluate impacts in advance of decision-making. The decision to upgrade Olushandja Dam has already been taken and thus the SIA can influence decision-making in terms of recommendations for the mitigation of impacts and the suggestion of an appropriate management strategy for the dam.
- → Alternatives to the proposed course of action (the upgrading) were not developed prior to the assessment.
- → Although the SIA will provide DWA with knowledge regarding the predicted impacts of the project, much of the data collection was extractive rather than fulfilling the objective of building knowledge within the affected population.
- → The SIA did not raise the consciousness of the affected population on the broader implications of the upgrading project. However, the study did contribute to increasing peoples' awareness of their dependence on the Olushandja Dam and other aspects of their environment.

The SIA accorded with eight of the eleven suggestions given by Burdge (1990) for SIA in developing countries. The three suggestions not fulfilled in this SIA were as follows:

- → the social characteristics and impacts assessed were not always quantified;
- → the existing sources of anthropological literature concerning Ovamboland were not reviewed; and,
- → the decision to upgrade the dam has already been taken, thus it may be that the SIA (as part of the EIA) will be used to justify the decision made and to receive the funding from the donors.

7.2.3 Conclusions regarding the Influence of Water Provision on the Social Environment

The main influences of the construction of Olushandja Dam on the social environment are listed below.

- → Olushandja Dam serves as a permanent water source for the people and their livestock, where once they relied on the ephemeral *oshanas* and hand-dug wells.
- → The presence of the dam has lessened the burden of collecting water from sources which are a long distance away.
- → The dam has introduced the opportunity for the development of economic and subsistence activities in the area, such as fishing and market gardens.
- → The dam has influenced the health profile of the area, as there are water related diseases such as bilharzia, malaria, gastritis and diarrhoea, associated with the dam.
- → The grazing lands were affected with the construction of the dam, as the grasses, which are adapted to grow in the ephemeral *oshanas,* do not grow in a perennial water body.
- → The dam has disrupted the mobility and movement patterns of people in the study area. Peoples' access to community facilities and services is obstructed and it also interferes with the interaction between family and friends located on opposite sides of the dam.

In general, the Olushandja Dam has had both positive and negative effects on the social environment.

7.2.4 Key Issues Associated with the Alternative Management Scenarios

7.2.4.1 Scenario 1: Maintaining the present level of the dam

The most significant costs and benefits of this scenario are listed below.

Benefits

* Olushandja Dam forms an important component of the everyday existence of the people who live in close proximity to the dam. These people depend on the water for drinking and household purposes, as well as for the drinking needs of their livestock.

* The dam provides the potential for opportunities, such as fishing and the market gardens, which are important for both economic and subsistence purposes. These activities also benefit the people in the local and regional centres where the fish and fresh produce is sold.

* The biological diversity of the endemic aquatic and wetland associated floral species, which is present in the dam, is noteworthy and is worth conserving.

* The dam, at its present level, provides surety of water supply. This benefits the regional users of the bulk water supply network, who are dependant on this water. Although, this scenario does not fulfil DWA's objective of increasing the surety of supply to the regional water networks. However, this scenario, coupled with the upgrading of the Calueque Dam, will improve the surety of water supply.

Costs

* There are a number of water related diseases associated with the dam, which has negative health effects on the people and livestock who utilise the dam. The poor water quality gives rise to diseases such as gastritis and diarrhoea, while the water-

borne diseases include bilharzia in humans and liverfluke in livestock. The implementation of the suggested mitigatory measures, given in the assessment, would successfully reduce the above mentioned health impacts.

* The dam impedes the mobility and movement patterns of the people in the area. Access to community facilities and services is obstructed and interaction between family and friends who live on opposite sides of the dam is hindered. The implementation of the suggested mitigatory measures would greatly alleviate these effects.

* The efficiency of the dam is low due to the high evaporation rates as a result of the poor surface area to volume of water stored ratio. Ideally the surface area of the dam should be reduced but there would be high costs associated with such reconstruction and thus reduces the chance that DWA will implement this mitigatory measure.

7.2.4.2 Scenario 2: Fluctuating water levels (between full capacity and dead storage level)

The most significant costs and benefits of this scenario are listed below.

Benefits

* At full capacity the surety of water supply would be optimised. This would fulfil DWA's objective of increasing the surety of water supply to the regional water networks.

* After filling the dam to its full capacity for the first time, there will be an initial bloom in fish production. This would temporarily benefit the local fisherman and increase the supply of fish locally and regionally during this period.

* The endemic aquatic and wetland associated floral species, which are of conservation value, will not be affected by fluctuating water levels, as these species are naturally adapted to seasonal changes in water level. However care must be taken to raise and

lower the water level slowly to give the plant communities a chance to adapt and recolonise new areas.

Costs

* At full capacity, 30 households and the Elao and Epalela market gardens would be inundated. The consequences of inundation are significant, as the households and market gardens would have to be relocated (which has many associated impacts), and compensated for any production losses and damages incurred.

* As for Scenario 1, there are a number of water related diseases associated with the dam which has negative health effects on the people and livestock who utilise the dam. The poor water quality gives rise to diseases such as gastritis and diarrhoea while the water-borne diseases include bilharzia in humans and liverfluke in livestock. The implementation of the suggested mitigatory measures given in the assessment, would successfully reduce the above mentioned health impacts.

* As Scenario 1, the dam impedes the mobility and movement patterns of the people in the area. Access to community facilities and services is obstructed and interaction between family and friends who live on opposite sides of the dam is hindered. The implementation of the suggested mitigatory measures would alleviate these effects.

* The regional endemic and protected stem-succulent *Hoodia* species, found on the terrestrial fringes of the dam, would be affected by a rise in the water level of the dam. However, this impact can be mitigated by transplanting the species to the initial rise in the water level.

* Drawing the dam down to dead storage level may have a negative impact on the fish resources in the dam, however the effects are uncertain and require further investigation.

* At full capacity the dam would be highly inefficient due to the high evaporation losses as a result of the large surface area of the dam.

7.2.4.3 Scenario 3: The no dam scenario

The most significant costs and benefits of this scenario are listed below.

Benefits

* The mobility and movement patterns of people living around the dam would no longer be hindered.

* The incidence of water related diseases associated with the dam would be reduced.

* Water would not be lost to evaporation making this alternative more resource efficient than the other two alternatives.

Costs

* The benefit of the provision of a permanent source of water for humans and livestock would be lost. However, this can be remedied by the provision of an alternative water source in this area.

* The fishing activities associated with the dam would cease. This will have negative implications for the people who are dependant on this resource for subsistence and economic purposes. Implementation of the mitigatory measures could create alternative opportunities, but there would still be the loss of a free food source.

* The market gardens, which are directly dependant on the dam for irrigation purposes, would be negatively affected by this alternative. The gardens could be supplied with an alternative source of water however, this may mean they would have to pay for the water while at present they freely utilise the water from the dam.

* The endemic aquatic and wetland associated floral species, which are of conservation value, would be lost.

* This alternative would not offer a surety of water supply.

7.2.5 Recommended Management Scenario

On the basis of the decision-making framework and the evaluation according to the criteria of equity, efficiency and sustainability, Scenario 1 was selected as the preferred management alternative for the Olushandja Dam.

7.3 RECOMMENDATIONS FOR THE MANAGEMENT OF THE OLUSHANDJA DAM

The following recommendations are proposed:

- The dam should be maintained at its present water level, (30% capacity at 1104,6 m.a.s.l). The recommendations proposed below should be applied as part of an environmental management plan for the Olushandja Dam.

- The recommendations given in the EIA of the upgrading of the Olushandja Dam, should be implemented and adhered to by the Department of Water Affairs.

- Feedback should be given to the communities in the study area on the results of the EIA. Simplified pamphlets, written in Oshiwambo, with the key findings, should be drawn up and distributed to the community services, such as the schools, clinics and churches in the study area, where people can have access to them. The headmen, namely Sacharias Kananas and Daniel Shoya, and the local councillor, Jonny Ipinge, should be directly informed of the outcome of the study so that they can provide feedback to the communities within their constituencies.

- To improve the surety of water supply, the upgrading of the Calueque Dam should begin as soon as possible, to make provision for water storage at Calueque. Furthermore, standby pumps should be available in the event of technical problems experienced with the pumping facilities.

- To mitigate the health hazards associated with the dam, an educational programme should be implemented as soon as possible. The programme should inform people of the health risks associated with the dam and strive to foster an understanding of the ways in which the people can contribute to the control and prevention of disease.

- Rural Water Supply extension officers should be involved in implementing simple water filtering devices, such as sand filters, to contribute to purifying the water from the dam for drinking purposes.

- People should be provided with alternative water sources supplying purified water. This is particularly needed on the eastern side of the dam where there is no access to clean water. This recommendation should be addressed by the rural water supply division of DWA.

- The health services in the area should be equipped to deal with the health problems related to the dam. Particular attention should be paid to the Oshaala clinic which is situated on the eastern side of the dam, as this clinic is not adequately equipped to deal with diseases such as bilharzia, malaria and gastritis.

- The water at sites close to the homesteads on the edge of the dam, should be monitored regularly, by the Water Quality Division of DWA for bacteriological contamination.

- The feasibility of constructing a bridge across the dam should be investigated. The investigation should involve the local people, so that the most desirable solution is found. In the interim, an alternative means of transport around or across the dam, such as a ferry service, should be provided by DWA in conjunction with the Ministry of Transport.

- To ensure that the fish resources are not over-exploited, an appropriate management plan should be developed. This should be done through the joint consultation of

relevant government departments, traditional and political authorities within the area and the local fishermen.

- Preceding the implementation of a fishing management plan, an educational programme should be initiated to advise the local people of the need for the management of the fish resources, and to inform them of the guidelines of the management plan.

- The endemic aquatic and wetland associated floral species should be maintained. This could be achieved by establishing a sanctuary for rare and endemic species. This would require the collaboration of DWA and the Department of Nature Conservation.

- The establishment of any form of conservancy should be accompanied by an educational programme to advise people of the aims of the conservancy and of the role that they can play in conserving these resources. Furthermore, negotiations between local people and the relevant government departments should be initiated with the aim of ensuring that the conservancies would be mutually beneficial.

- The following aspects require further investigation:
  - the conservation value of the birdlife associated with Olushandja Dam;
  - the economic potential of the Pila occidentalis species (freshwater snail) and the acceptability of eating this snail, to the local people, should be investigated; and,
  - the potential effects of the proposed commercialisation of the bulk water supply function of DWA, on peoples' land rights and rights to water use from the Olushandja Dam.

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APPENDICES

APPENDIX 1: UCT Study Team and Key Specialists Involved in the EIA

UCT STUDY TEAM

Project Manager from the Environmental Evaluation Unit (UCT)

Janet Barker:	MA (Environmental Science)

UCT Environmental Science Masters Students

Kirsten Day:	BSc (Hons), Physical Geography
Esmé Gauché:	BSocSc (Hons), Sociology
Philip Haxen:	BL LLB (Hons), Law
Richard Hunt:	Pr Eng, Professional Engineer
Neeta Sharma:	BA (Hons), Economics
Michelle Yates:	BSc (Hons), Zoology

KEY SPECIALISTS INVOLVED IN THE EIA

Dr Antja Burke:	Aquatic and wetland plants. Biology Department, University of Namibia.
Barbara Curtis:	Distribution of freshwater snails and snail-borne diseases. Care of Research Division, Department of Water Affairs, Windhoek.
Kevin Roberts:	Limnology of the Olushandja Dam. Research Division, Department of Water Affairs, Windhoek.
Clinton Hay:	Fish Resources of the Olushandja Dam. Ministry of Fisheries and Marine Resources, Windhoek.

APPENDIX 2: Figures

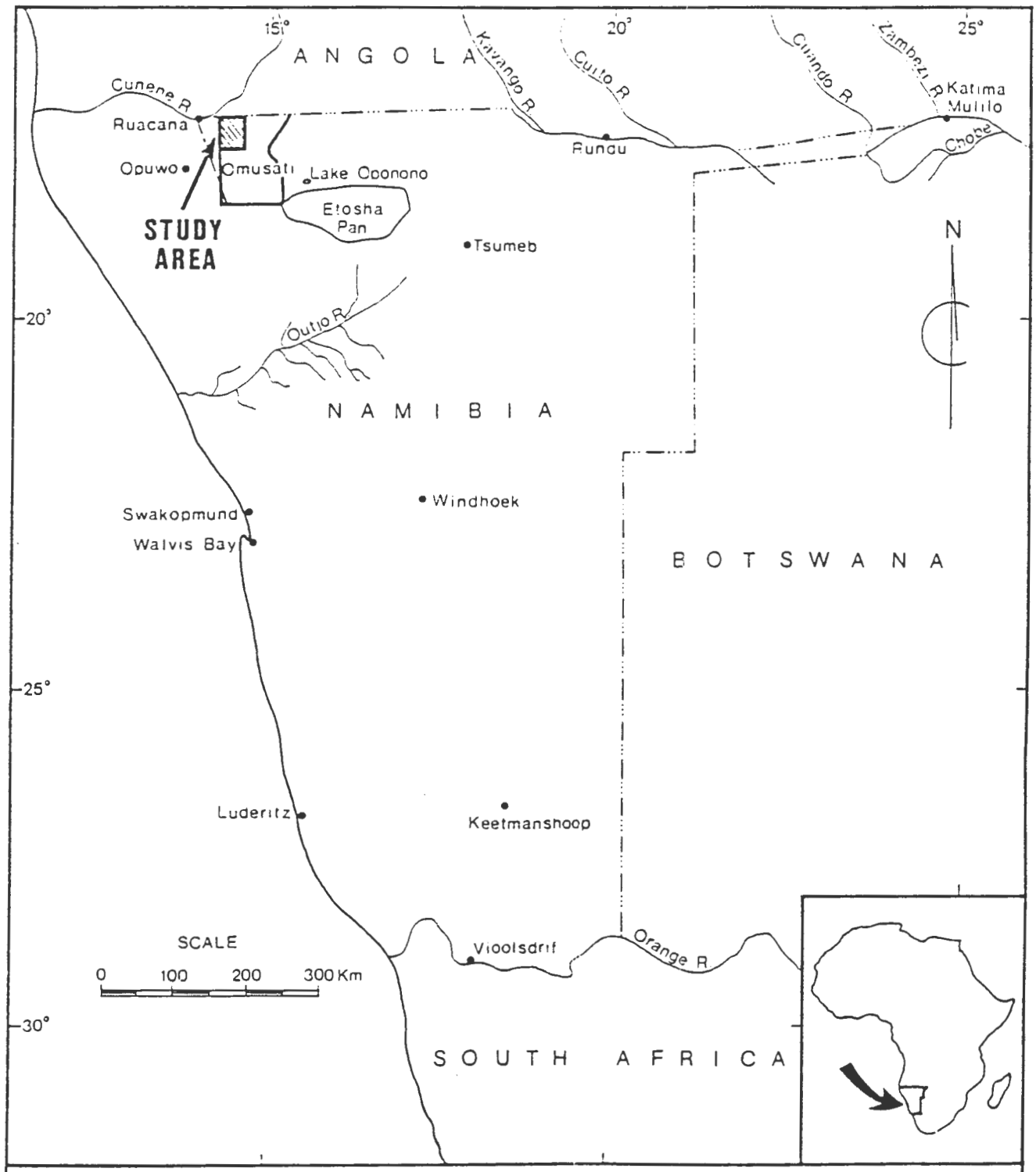

Figure 1

Locality Map

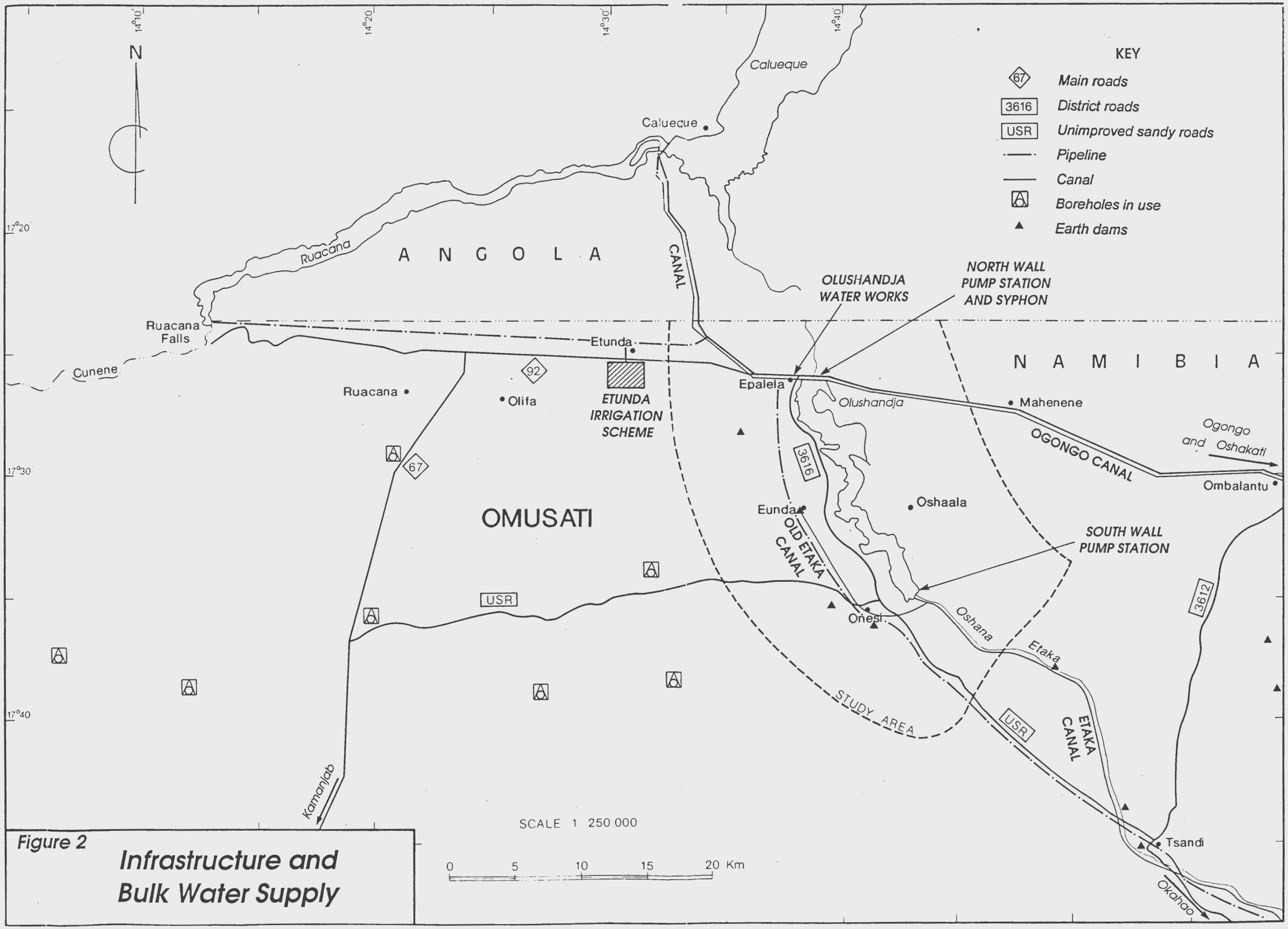

Figure 2

Infrastructure and Bulk Water Supply

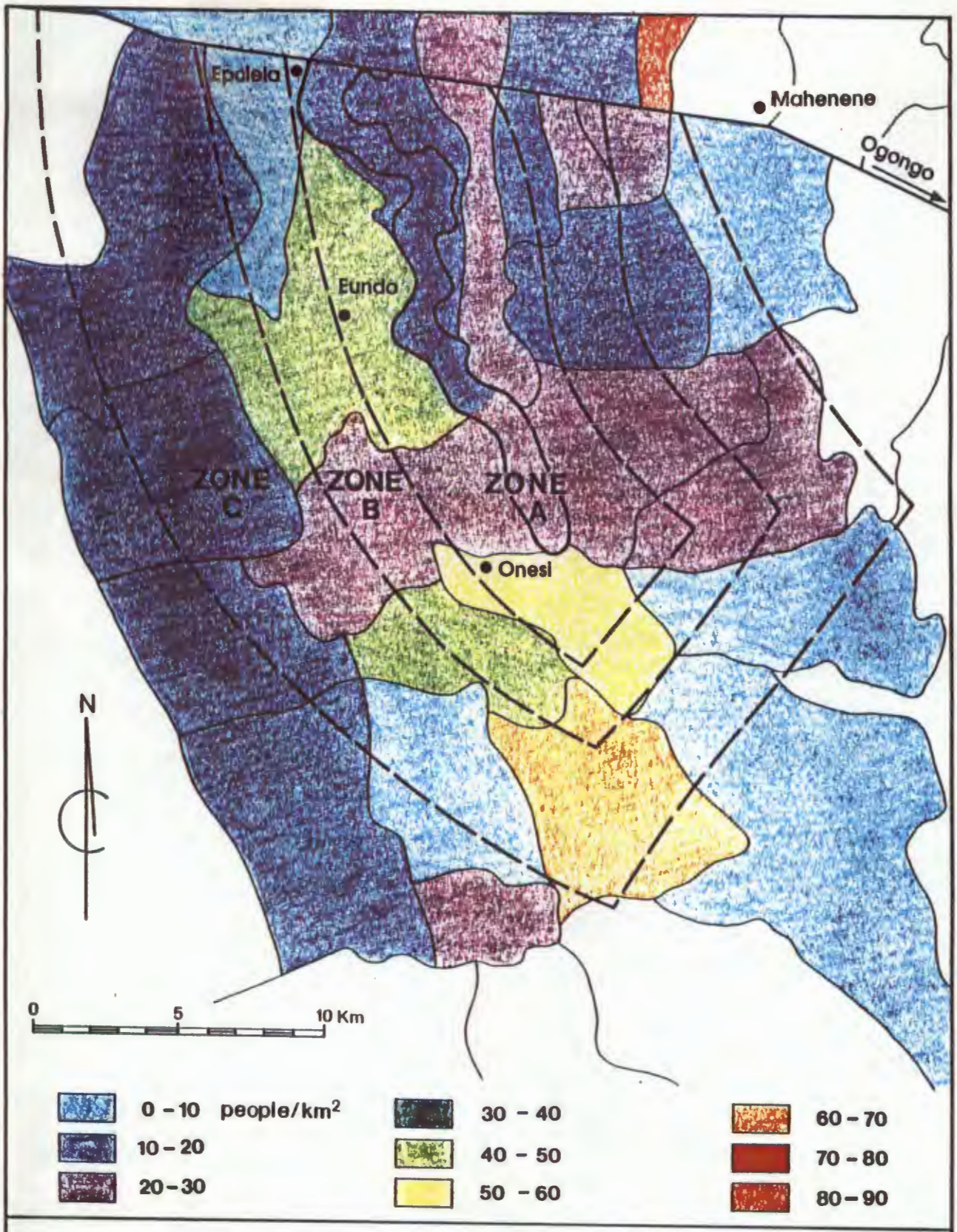

Figure 4

Population Distribution

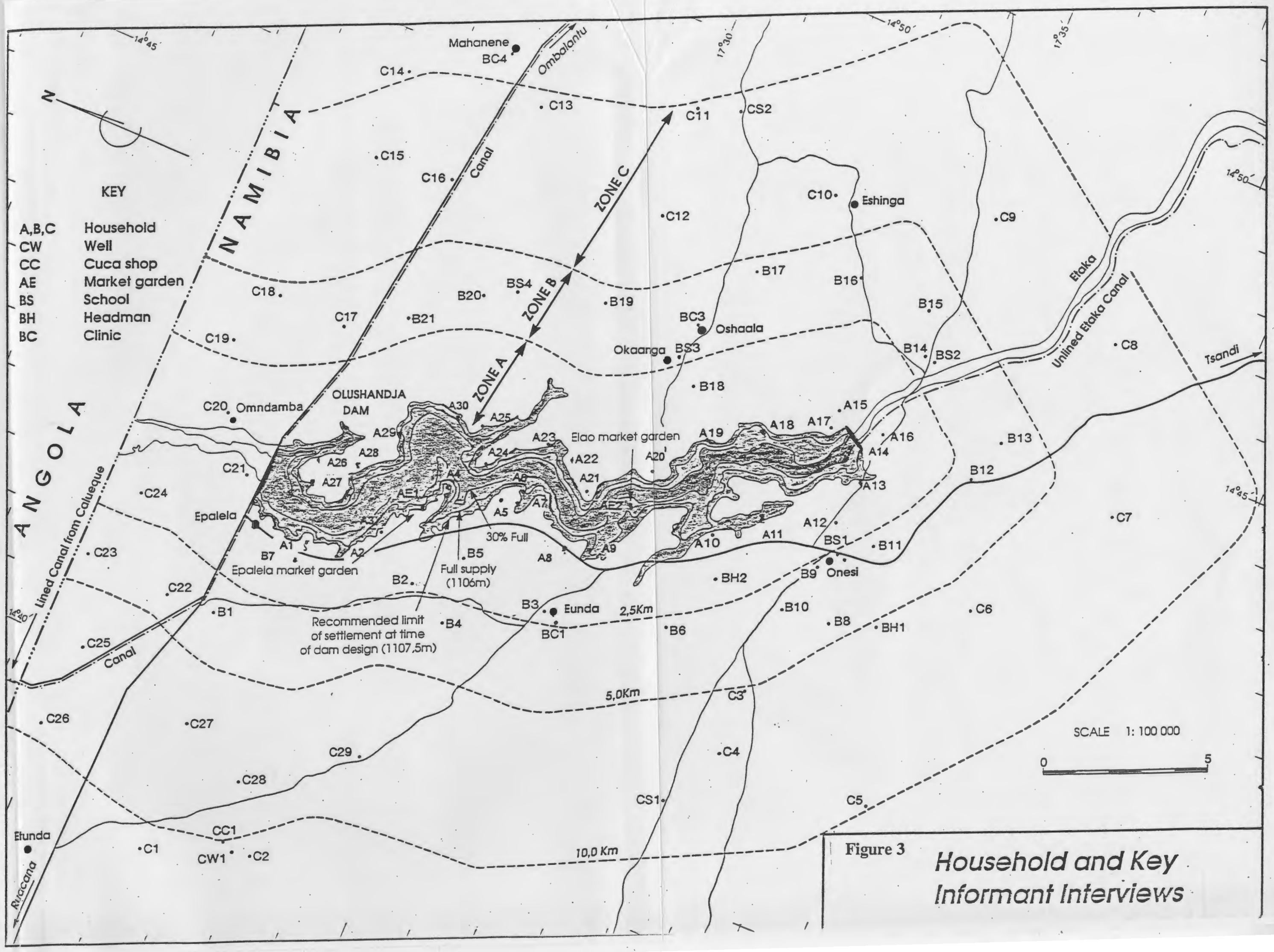

Figure 3

Household and Key Informant Interviews

KEY

Movement of livestock and people

Old Stengel Dams
W Hand dug wells
BH Boreholes

Movement of Cattle

NAMIBIA

ANGOLA

Zone A
Zone B
Zone C

Mahanene

Ogongo

canal

Households in the North rely on the canal for water

Hand dug wells used in the Eastern part of Zone C

Old Stengel dams often used at end of dry season

Oshaala

Most households in Zone A rely on raw water from the dam for domestic and livestock use

OLUSHANDJA DAM

Epaleia

Calueque Dam

Eunda

Onesi

pipeline

Tsandi

High use of water points on pipeline by residents in Zone B

Oshanas pans and Omifimas provide domestic and livestock water during the wet season

SCALE 1: 100 000

0 5

Cattle move to the west during the dry season. To obtain grazing boreholes supply water

Hand dug wells and boreholes used in the western part of Zone C

Etunda

Ruacana

Figure 5

HOUSEHOLD WATER UTILISATION

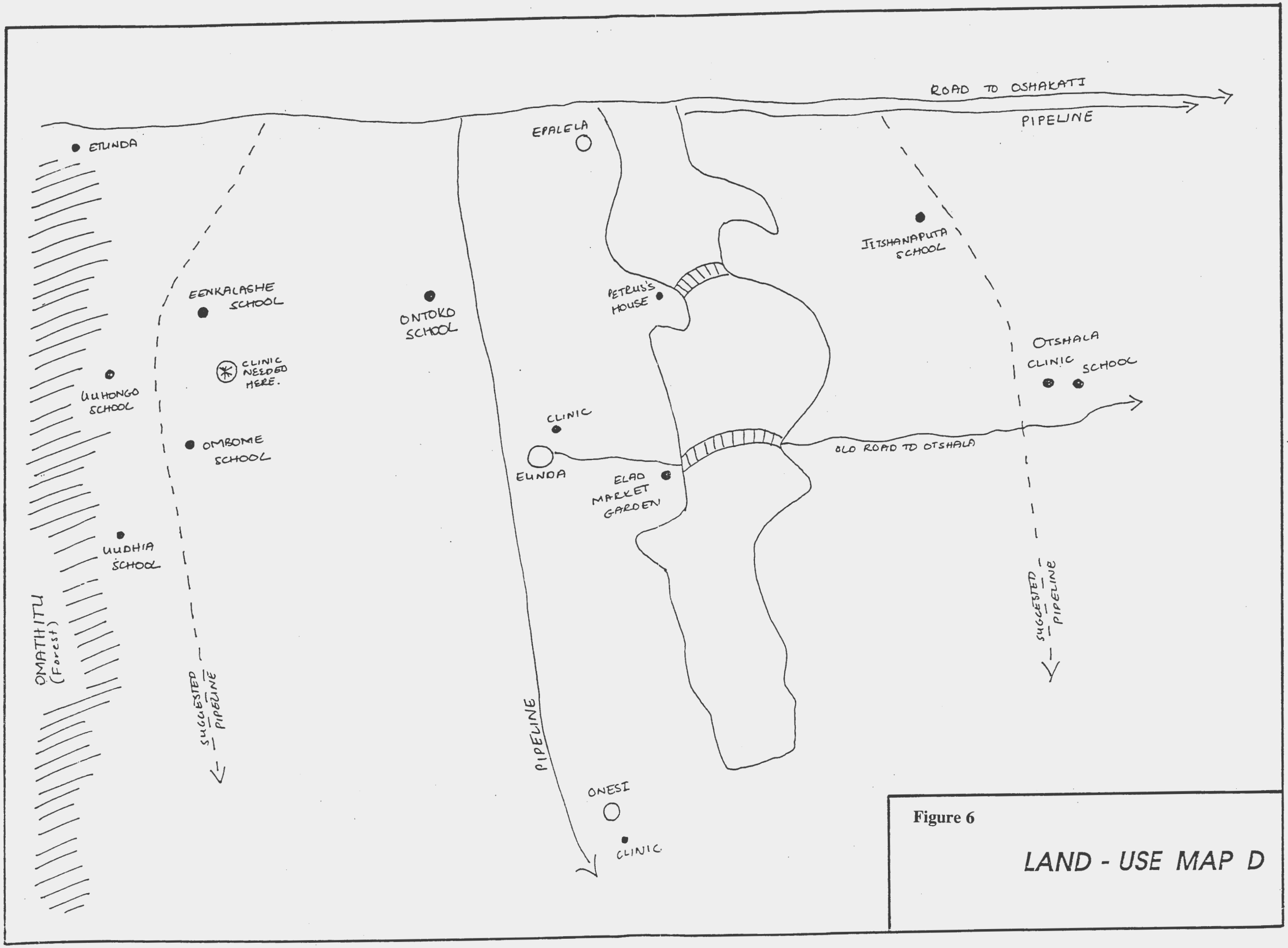

Figure 6

LAND - USE MAP D

APPENDIX 3: List of Consultations

LIST OF INDIVIDUALS AND ORGANISATIONS CONSULTED

1.	Mr. R Fry	DWA, Deputy Permanent Secretary
2.	Dr. S Turner and Dr. S Devereux	Social Sciences Division, University of Namibia
3.	Prof. F Bekker	Geography Department, University of Namibia
4.	Mr. A Vainio-Mattila	Finnish International Development Agency, Ondangwa
5.	Mr. T Kroll	Sustainable Animal and Range Development Aid Programme, Ondangwa
6.	Mr. J Ingram	Rural Development Centre, Ondangwa
7.	Mr. A Nehemia	DWA, Rural Water Supply Division, Oshakati
8.	Mr. B Muifi	Oshakati Human Settlement Improvement Project
9.	Ms. A Dahne	Development Aid from People to People, Oshakati
10.	Mr. S Nghikemba	Social Sciences Division, University of Namibia
11.	Mr. H Ipinge	Regional Administration, Omusati Region, Ombalantu
12.	Mr. Auino	Ministry of Agriculture, Water and Rural Development, Ombalantu
13.	Mr. A Cashman	Parkman Namibia, Windhoek
14.	Mr. R Kressier	Sustainable Animal and Range Development Aid Programme, Windhoek
15.	Prof. C Tapscott	University of the Western Cape
16.	Dr. M Sowman and	Environmental Evaluation Unit (EEU), UCT
17.	Dr. R Hasler	Centre for Applied Social Science, University of Zimbabwe (Campfire Project)
18.	Ms. J Hughes	EEU Consultant, UCT
19.	Mr. J P Brand	SWAWEK, Windhoek
20.	Dr. M Seely	Environmental Evaluation Associates Namibia, Windhoek
21.	Dr. G Odihao	Veterinary Services, Ondangwa
22.	Mr. W Werner	Ministry of Lands, Resettlement and Rehabilitation, Windhoek
23.	Mr. W R Lechner	Mahanene Research Project, Ministry of Agriculture
24.	Mr. H Koch	DWA, Rural Water Supply Division, Windhoek

APPENDIX 4: Table 1, Checklist of Impacts for Scenarios 1,2 and 3

Table 1: Checklist of Impacts for Scenarios 1, 2 and 3

The table indicates the *possible impacts* associated with each of the management scenarios. The table serves as a tool for the preliminary identification of impacts.

* *Yes/No* indicates whether there is a possible impact or not.
* *Positive/Negative (Pos/Neg)* indicates whether the impact is positive or negative.
* A *question-mark (?)* indicates an uncertain impact.

Impact Category	*Impact Description* (impact of scenario on):	*Scenario 1:* Present Level		*Scenario 2:* Fluctuating Water Levels				*Scenario 3:* No Dam Option	
		30% Capacity (1104 m.a.s.l)		Full Capacity (1106 m.a.s.l)		Dead Storage Level (1103,7 m.a.s.l)			
		Yes/ No	Pos/ Neg	Yes/ No	Pos/ Neg	Yes/ No	Pos/ Neg	Yes/ No	Pos/ Neg
Settlement patterns	Location and distribution	no	n/a	yes	neg	no	n/a	yes	neg
	Population pressures	no	n/a	no	n/a	no	n/a	no	n/a
Economic activities/ productive resources	Subsistence agriculture	no	n/a	yes	neg	no	n/a	no	n/a
	Fishing	yes	pos	yes	pos	yes	neg	yes	neg
	Market gardens	yes	pos	yes	neg	yes	neg	yes	neg
Economic profile	Influx of non-local labour	yes	neg	yes	neg	no	n/a	no	n/a
	Enhancement of regional self sufficiency	yes	pos	yes/ no	pos/neg	yes	neg	yes	neg
Health profile	Incidence of water borne diseases	yes	neg	yes	neg	no	n/a	no	n/a
	Impacts on health due to poor quality water	yes	neg	yes	neg	yes	neg	no	n/a
	Pressure on health services	yes	neg	yes	neg	yes	neg	no	n/a
Livestock	Incidence of disease	yes	neg	yes	neg	yes	neg	no	n/a
	Grazing land	no	n/a	yes	neg	no	n/a	no	n/a
Community services and facilities	Health services	yes	neg	yes	neg	yes	neg	no	n/a
	Road networks	yes	neg	yes	neg	no	n/a	no	n/a
Political considerations	Land claims and rights	no	n/a	yes	neg	no	n/a	no	n/a
	Allocation of land	no	n/a	yes	neg	no	n/a	no	n/a
	Water rights	?	?	?	?	?	?	?	?
	Compensation	no	n/a	yes	neg	no	n/a	yes	neg
Plans and policies	Commercialisation of DWA (bulk water supply)	?	?	?	?	?	?	?	?
	Water surety	yes	pos	yes	pos	yes	pos	yes	neg
Social dislocation due to relocation	Dispossession/ impoverishment	no	n/a	yes	neg	no	n/a	no	n/a
	Disruption of movement patterns	no	n/a	yes	neg	no	n/a	no	n/a
	Household instability	no	n/a	yes	neg	no	n/a	no	n/a
	Social mobility	no	n/a	yes	neg	no	n/a	no	n/a
	Community conflict	no	n/a	yes	neg	no	n/a	no	n/a
Mobility and movement patterns	Access to services and facilities	yes	neg	yes	neg	no	n/a	no	n/a
	Inter- and intra- community contact	yes	neg	yes	neg	no	n/a	no	n/a
Risks and hazards	Health hazards	yes	neg	yes	neg	yes	neg	no	n/a
	Drowning	yes	neg	yes	neg	yes?	neg?	no	n/a
Conservation potential	Loss of resources of conservation value	no	n/a	yes/ no	pos/neg	yes	neg	yes	neg
	Potential to conserve resources	yes	pos	yes	pos	no	n/a	yes	neg
Cultural resources	Sites of religious significance	no	n/a	no	n/a	no	n/a	no	n/a
Physical characteristic of the site and surroundings	Evaporation	yes	neg	yes	neg	yes	neg	no	n/a
	Salinisation	?	?	?	?	?	?	no	n/a
	Siltation	?	?	?	?	?	?	no	n/a
Intrinsic value of the dam	Value to local communities (water source)	yes	pos	yes	pos	yes	neg	yes	neg
	Value to regional communities (water surety)	yes	pos	yes	pos	yes	neg/ pos	yes	neg
	Value to DWA (water surety for northern Namibia)	yes	pos	yes	pos	yes	neg/ pos	yes	neg