

LHDA 1000 IMPACT ASSESSMENT

IMPACT ASSESSMENT REPORT

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degree of Master of Philosophy in environmental science

Department of Environmental and Geographical Sciences

University of Cape Town

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EXECUTIVE SUMMARY

1 PURPOSE OF REPORT

The purpose of this report is to present an impact assessment of two possible access routes to the Mohale Dam in Lesotho, namely the Western Access Road and the Least Cost Alternative Route.

It is an academic work to demonstrate an adequate grasp of principles, methods and techniques appropriate to the assessment, termed LHDA 1000.

2 STUDY BACKGROUND AND SCOPE

2.1 BACKGROUND

The water resources of Lesotho are being exploited to augment the current supply to the PWV industrial area of the Republic of South Africa, in terms of the Lesotho Highlands Water Project. This project is being implemented in phases. Phase 1A, currently being constructed, involves the damming of the Malibamatso River at Katse in the Maluti Mountains (Figure 1), a transfer tunnel through the mountains, a hydroelectric power station at 'Muela in Lesotho, and a delivery tunnel under the Caledon River to the Ash River (a tributary of the Vaal River which feeds the primary PWV impoundment, the Vaal Dam) in the South Africa.

Phase 1B, currently being planned, includes the damming of the Senqunyane River by the Mohale Dam and the necessary advanced infrastructure for this dam. This advanced infrastructure includes the provision of a reliable yet economic access route from the South African

border to the Mohale Dam, for the transportation of South African sourced materials and equipment needed for dam construction.

The Lesotho Highlands Development Authority, the executive organisation of the Government of Lesotho responsible for implementing the LHWP, appointed the Gibbs Bergman-Joint Venture as consulting engineers for the Mohale Dam advanced infrastructure (Contract No. LHDA 1000). Gibbs Bergman contracted the Environmental Evaluation Unit of the University of Cape Town to conduct an environmental impact assessment of *inter alia* the possible access routes to the Mohale Dam.

Masters students of the Department of Environmental and Geographical Science of the University of Cape Town undertook the impact assessment under the guidance of the Environmental Evaluation Unit as part of the academic requirements of the M.Phil.(Environmental Science) course.

2.2 SCOPE

This report assesses only two components of Contract No. LHDA 1000, namely the Western Access Road and the Least Cost Access Route, possible access routes to the Mohale Dam.

3 APPROACH TO THE ASSESSMENT

The study was conducted according to the broad principles of Integrated Environmental Management, the process is shown in Figure 3, using an open, participatory approach, and including consultation with interested and affected parties (I&APs). Chapter 2 of the report discusses the theoretical aspects of Integrated Environmental Management with its

application to LHDA 1000, together with an account of the Framework Approach to assessment.

Significant positive and negative impacts of the Western Access Road and the Least Cost Alternative Route, and relevant optimisation or mitigation measures were identified. Guidelines for rehabilitation, erosion control and other environmental concerns were compiled for inclusion in contractor tender documents. Individual, stand-alone, impact assessment reports produced included ones for the: WAR; Maseru Bypass (an element of the Western Access Road), and the Least Cost Alternative Route.

4 THE PROJECT PROPOSAL AND THE AFFECTED ENVIRONMENT

4.1 THE PROJECT PROPOSAL

After an initial assessment of access routes other than the Western Access Route, the Least Cost Alternative Route (least cost of alternatives to the WAR) was selected by the Lesotho Highlands Development Authority to be compared with the Western Access Road. The impact assessment of this comparison forms the content of this report.

The WAR comprises existing (apart from the proposed bypass of the Maseru CBD) roads from Maseru to Patiseng (Figure 2), the village closest to the site of the Mohale Dam. The roads run from Maseru to Mazenod, and thence to St.Michaels. From St.Michaels through Nazareth to Patiseng the road is part of the cross country road to Thaba-Tseka called the Mountain Road. If selected as the access to the Mohale Dam, these portions of road will be upgraded, with major reconstruction of the St.Michaels - Patiseng

section. Only the Maseru bypass and the Mountain Road to Patiseng were assessed, by the LHDA 1000 team.

The Least Cost Alternative Route, if selected, will require the construction of a new road from Ha Mateka to Patiseng, crossing the Maluti Mountains and traversing the Jorodane River valley, and upgrading of existing roads from Ha Mateka to Maputsoe on the Lesotho side of the border with South Africa. Only the proposed new link was assessed.

Assessment of the Western Access Road took place in the preliminary design stage, with a fixed road centre-line, whereas the Least Cost Alternative Route was only in the planning stage, with a more flexible alignment. If selected as the preferred access, all design of the Western Access Route will cease and the Least Cost Alternative Route and other alternative routes will be assessed before engineering studies enter the design stage.

4.2 THE AFFECTED ENVIRONMENT

Both accesses traverse first the more densely populated and intensively farmed lowlands of Lesotho and second the mountain region. The local communities along the Western Access Road have been exposed to the advantages and disadvantages of the Mountain Road for over 40 years, whilst those affected by the assessed portion of the Least Cost Alternative Route have had no roads. Whilst the Western Access Road passes through a mainly semi-urban and intensely modified natural environment, the Least Cost Alternative Route will traverse a more rural area with more significant natural resources.

Table 1: Framework Table of Major Impacts on User Groups

WAR		LCAR		
USER GROUP	SIGNIFICANCE	COMMENT	SIGNIFICANCE	
NATIONAL/REG. PLANNING AUTHORITIES	+ Moderate	Reinforces national planning objectives Accords with national road plans Maseru bypass will alleviate congestion	- High	Contradicts national road plans Contradicts national settlement plan Detracts from existing tourist facility
	+ High		- Moderate	
LOCAL COMMUNITIES	+ High	Improved transport, access to services Increased employment/business chances Reduced dust and mud Improved road safety Interference with potable water supply Inconvenience/risks to people/livestock Loss of agricultural resources Cost of living increase Loss of houses, businesses and facilities Social disruption	+ High	Improved transport, access to services Disruption of local economy Social disruption Loss of agricultural resources Loss of houses, businesses and facilities
	+ Moderate		- High	
	+ Moderate		- High	
	+ Moderate		- Moderate	
	- Moderate		- Moderate	
	- Moderate		- Moderate	
	- High		- Moderate	
CONSERVATIONIST	- Moderate	Destruction of Spiral Aloe populations	- Moderate	Increased sediment loading of watercours Impacts on wetlands and bogs Impacts on rare & endangered aquafauna Destruction of Spiral Aloe populations Impacts on Bushman cave paintings
THE PROPONENT	- Moderate	Compensation cost M 811, 014 more than for LCAR	+ Moderate	Compensation cost M 811, 014 less than for WAR

5 ASSESSMENT OF MAJOR IMPACTS

Table 1 on the following page presents the major impacts which have been identified.

Impacts of the Western Access Road and the Least Cost Alternative Route were identified during LHDA 1000 using checklists, literature reviews, social surveys, and consultations with authorities and interested and affected parties (I&APs), with significance determined by the study team, in consultation with appropriate specialists.

The selection of major impacts from the above set of 54 identified impacts was carried out to reduce the amount of information for decision-making, whilst an assignment of probability of optimisation or mitigation measures being implemented was undertaken. Optimisation or mitigation measures by agencies other than LHDA have been discounted as these agencies' institutional capacity is lacking.

The major impacts selected were then discussed in terms of four user groups, namely: Authorities concerned with national and regional planning and development; Local communities; Conservationists, and the Proponent.

6 CONCLUSIONS AND RECOMMENDATIONS

The WAR, excepting the Maseru Bypass, does not introduce new infrastructure to Lesotho, whilst the LCAR introduces new infrastructure which contradicts national planning and development policies and plans.

Both sets of local communities would welcome the relevant access to the Mohale Dam, even though each will have, or are perceived to have, major negative impacts on these communities.

The negative impacts of the LCAR are considered too great. If the LCAR is preferred to the WAR, it is recommended that the new impact assessment considers alternative routes and construction methods to reduce the impacts presented in this report.

If information regarding the resettlement and development plans for the major component of LHWP Phase 1B, namely the Mohale Dam construction and flooding, had been known, the significance ratings accorded to the LCAR

The selection of major impacts from the above set of 54 identified impacts was carried out to reduce the amount of information for decision-making, whilst an assignment of the probability of optimisation or mitigation measures being implemented was undertaken. Optimisation or mitigation measures by agencies other than the Lesotho Highlands Development Authority have been discounted as these agencies' institutional capacity is lacking.

The major impacts selected are then discussed in terms of four user groups, namely: Authorities concerned with national and regional planning and development; Local communities; Conservationists, and the Proponent.

6 CONCLUSIONS AND RECOMMENDATIONS

The Western Access Road, excepting the Maseru Bypass, does not introduce new infrastructure to Lesotho, whilst the Least Cost Alternative Route introduces new infrastructure which contradicts national planning and development policies and plans.

Both sets of local communities would welcome the relevant road to the Mohale Dam, even though each will have, or are perceived to have, major negative impacts on these communities.

This report shows the negative impacts of the Least Cost Alternative Route to be great. If the Least Cost Alternative Route is preferred to the Western Access Road, it is recommended that a new impact assessment consider variations of the routes and of construction methods, to reduce the impacts presented in this report.

If information regarding the resettlement and development plans for the major component of the Lesotho Highlands Water Project Phase 1B, namely the Mohale Dam construction and flooding, had been known, the significance ratings accorded to the Least Cost Alternative Route may well have been different. It is recommended that an integrated development plan be compiled as a matter of urgency.

Whilst for the purposes of this report optimisation and mitigation measures to be applied by agencies other than the Lesotho Highlands Development Authority have been discounted, they should not be ignored. It is recommended that the Government of Lesotho, particularly, implements optimisation and mitigation measures.

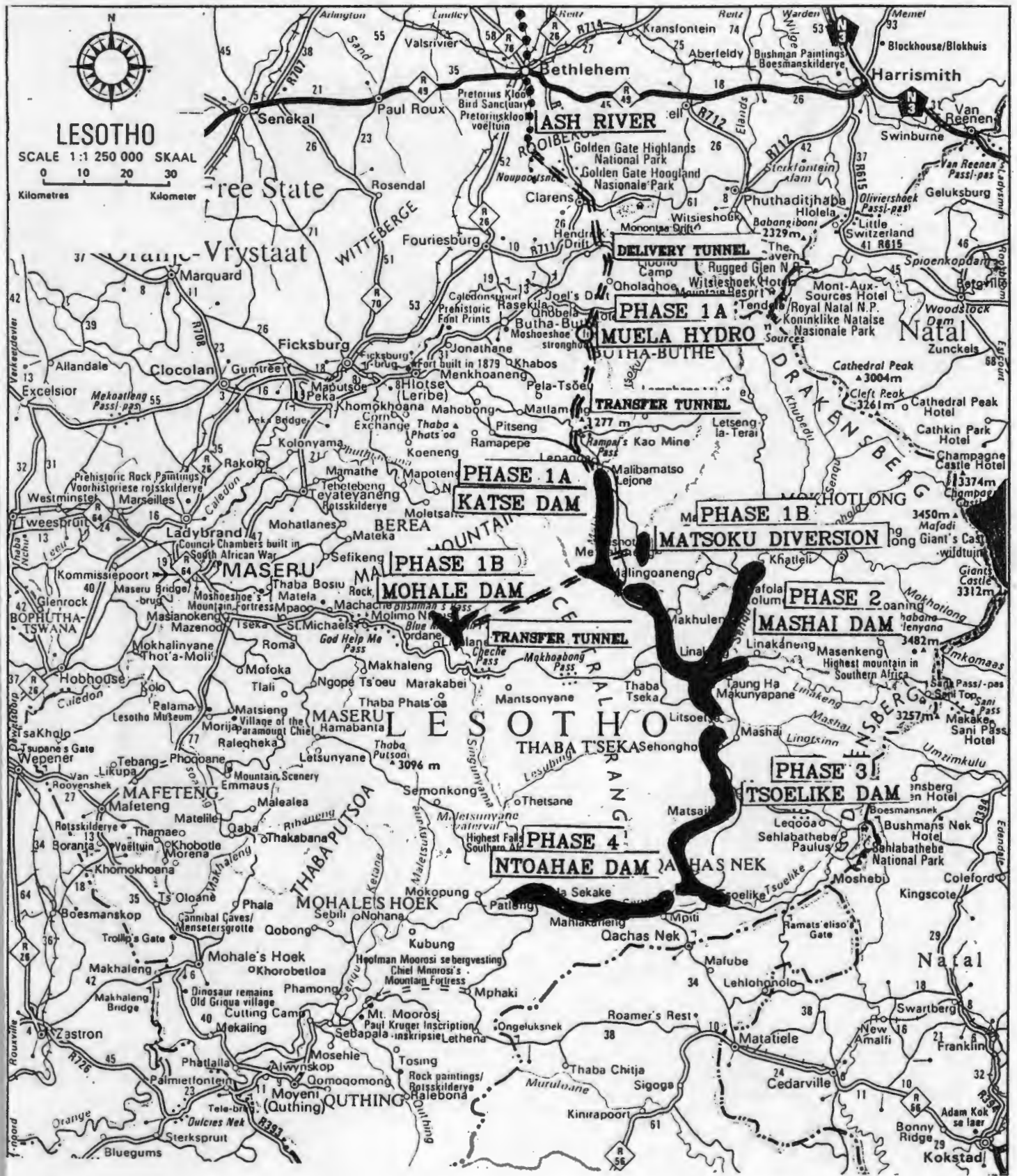


Figure 1: The Lesotho Highlands Water Project

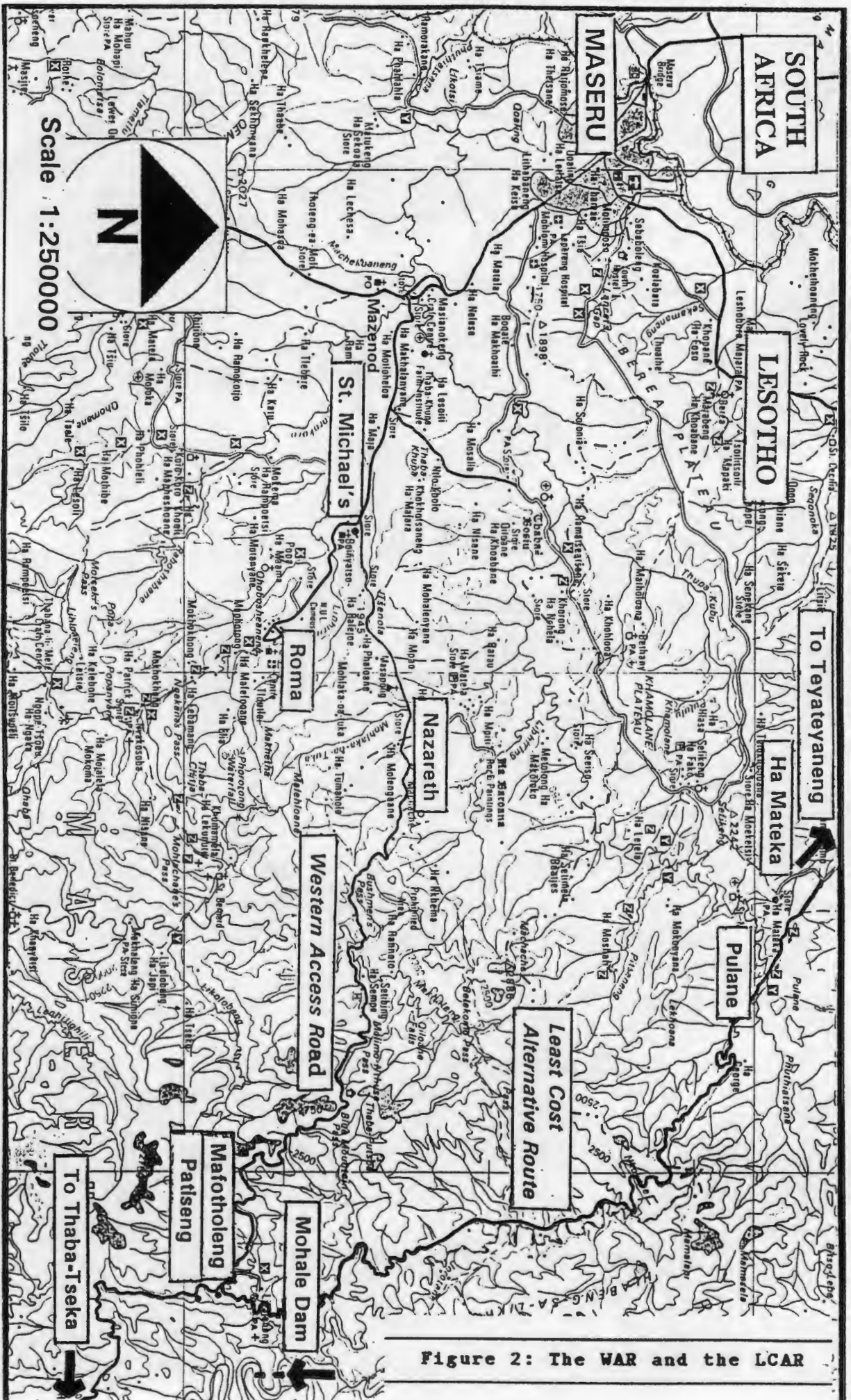


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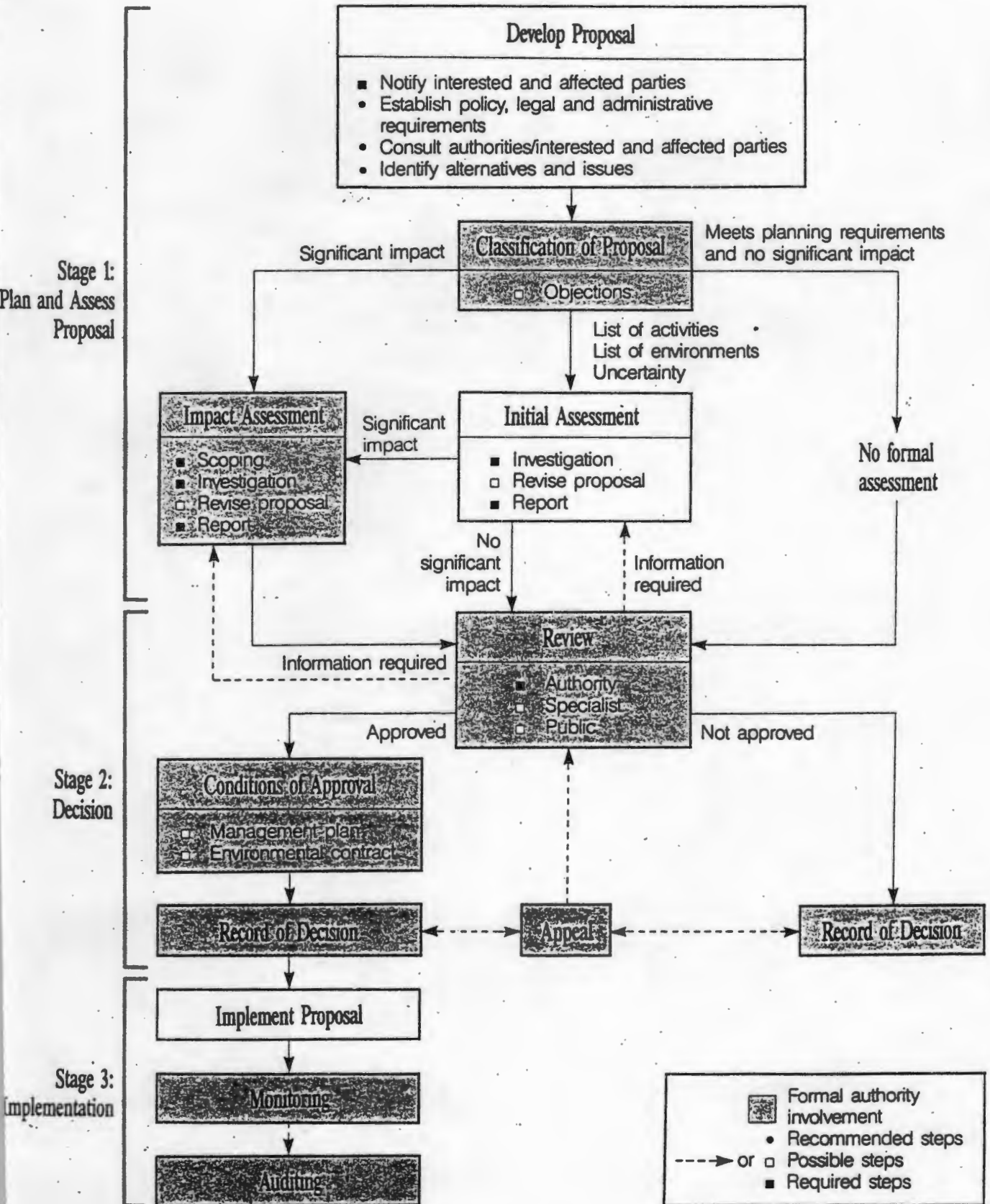


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LIST OF ABBREVIATIONS

The following abbreviations are used regularly throughout this report

BIR	Baseline Information Report
CBD	Central Business District
DEA	Department of Environment Affairs (RSA)
EEU	Environmental Evaluation Unit, University of Cape Town
GBJV	Gibbs Bergman-Joint Venture
GOL	Government of the Kingdom of Lesotho
I&AP's	Interested and Affected Parties
JPTC	Joint Permanent Technical Commission
KOL	Kingdom of Lesotho
LCAR	Least Cost Alternative Route
LHDA	Lesotho Highlands Development Authority
LHDA 1000	LHDA Contract No. 1000 - the title given to the impact assessment
NSP	National Settlement Policy
PWV	Pretoria - Witwatersrand - Vereeniging area
RSA	Republic of South Africa
VIP	Ventilated Improved Pit latrine
VWP	Village Water Project
WAR	Western Access Road

CHAPTER 1
INTRODUCTION

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1 INTRODUCTION

1.1 BACKGROUND TO STUDY

The water resources of the upper Orange River system in Lesotho have long been looked at to possibly augment the supply to the industrial PWV region of the Republic of South Africa (RSA). The Lesotho Highlands Water Project (LHWP) is currently being implemented in phases to achieve that objective.

The LHWP Phase 1 consists of two sub-phases:

Phase 1A now under construction involves the damming of the Malibamatso River, a tributary of the Orange River (Senqu River in Lesotho) at Katse; tunnelling through the Maluti Mountains; a hydroelectric power station in Lesotho at 'Muela, and delivery of water to the RSA via a tunnel under the Caledon River. This river is the international boundary between the Kingdom of Lesotho and the RSA. The water will eventually discharge into the Ash River, which feeds the Vaal Dam, the primary reservoir for the PWV.

Phase 1B, including the damming of another Senqu River tributary, the Senqunyane River at a site designated as Mohale. The water from the Mohale Dam will be gravity fed to the Katse dam by means of a tunnel. (Figure 1.1)

Prior to the construction of Mohale Dam, the executive organisation in Lesotho responsible for implementing the LHWP, the Lesotho Highland Development Authority (LHDA), requires a reliable yet economic access route for the transportation of RSA sourced materials and equipment to the Mohale Dam construction site. To identify such a route, the LHDA appointed the Gibbs Bergman-Joint Venture (GBJV) as consulting engineers, who in turn

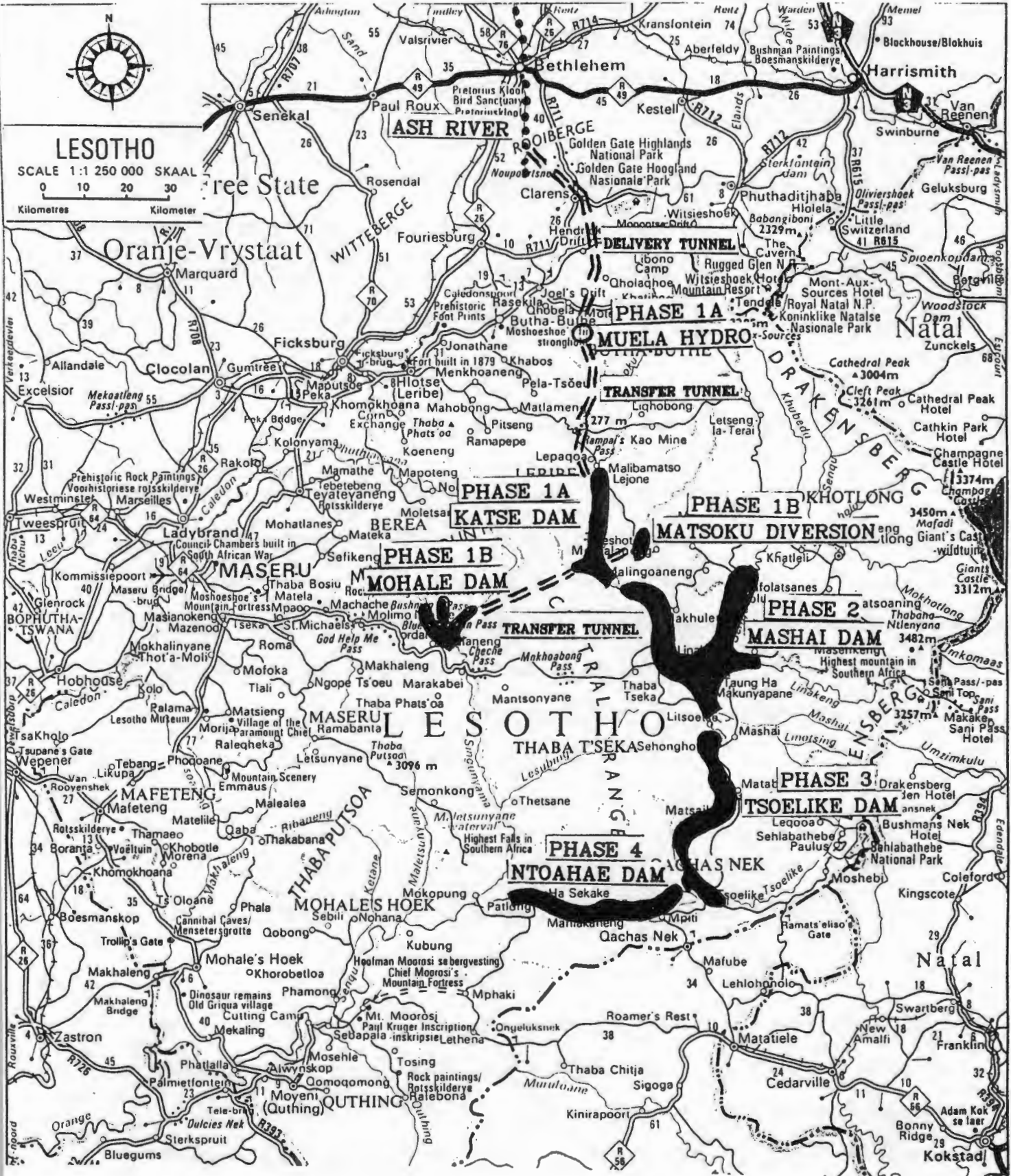


Figure 1.1 The Lesotho Highlands Water Project

contracted the Environmental Evaluation Unit (EEU) of the University of Cape Town (UCT) to conduct an environmental impact assessment (EIA). The identification and EIA form part of Contract No. LHDA 1000.

Masters students of the Department of Environmental and Geographical Science of UCT undertook the EIA study under guidance of the EEU as part of the academic requirements of their M.Phil.(Environmental Science) course. Extensive fieldwork in Lesotho and involvement with the production of several reports to the client, LHDA, was an exposure to the application of theory to real life environmental planning and impact assessment. A list of study team members is furnished in Appendix C.

1.2 TERMS OF REFERENCE

The EEU was appointed by GBJV to conduct an environmental impact assessment of, inter alia:

- * the upgrading of an existing access to Mohale Dam from Maseru (termed the Western Access Road [WAR]);
- * the construction of a new access to Mohale Dam from supply points in the RSA, not using the WAR; and
- * the construction of certain local access roads around the dam and a resident engineer's camp site

The upgrading of the existing access from Maseru entailed a possible bypass of the Maseru central business district (CBD) and the upgrading of the Maseru - Thaba Tseka road (also known as the Mountain Road) between St.Michaels and Patiseng village near the dam site.

The construction of a new access route from RSA supply points and not using the WAR entailed first identifying, through a desk top study, a least cost alternative to the WAR. The preferred option was thereafter termed the Least Cost Alternative Route (LCAR), and required a new section of road to be constructed between Ha Mateka and the dam site, with Ficksburg being the RSA supply point (Figure 1.2).

A comparative study of the WAR and the LCAR followed, to enable the client, LHDA, to select the final preferred route, with GBJV producing the final report.

1.3 PURPOSE AND SCOPE OF THIS REPORT

1.3.1 PURPOSE

This report is an academic work serving to demonstrate an adequate grasp of principles, methods and techniques appropriate to the study, LHDA 1000, comprising a logical and coherent account of the study and demonstrating ability to deal with problems of an interdisciplinary nature. (Hill, 1992)

This report serves no direct purpose for LHDA, as the EEU has, through GBJV, already supplied the contracted environmental impact report (EIR).

1.3.2 SCOPE

This report deals with only two components of the LHDA 1000 project, namely with the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR), and an evaluation of them.

The last part of the respective road/route titles gives an indication of their relative positions in the project planning cycle for Phase 1B of the LHWP. The WAR is in the preliminary design stage, with a virtually fixed alignment, whereas the LCAR is only in the planning stage with only a chosen corridor, it will be subject to detailed alignment studies only if it is chosen above WAR.

This report addresses the socio-economic and biophysical impacts associated with both accesses, and was compiled in general accordance with the procedures and guidelines recommended in Integrated Environmental Management, a South African initiative to guide the planning and implementation of development proposals. The principles of IEM and the extent to which the LHDA 1000 study is in accordance with them is discussed in chapter 2.

1.4 ASSUMPTIONS AND LIMITATIONS

1.4.1 ASSUMPTIONS OF THIS STUDY

- * Any construction of a road to the Mohale Dam should serve the interests of the local people, regional development, and of the national economy.
- * A Maseru bypass will be built if the WAR is selected as the preferred access to the Mohale Dam.
- * The LCAR has only been subject to an initial environmental impact assessment. Should the LCAR be selected as the preferred access to the Mohale Dam, a full environmental impact assessment will be commissioned to evaluate the LCAR and alternatives apart from the WAR.

- * A distance of 10 m from centre line as a standard to identify compensation requirements, is used to facilitate comparison of the WAR with the LCAR. Actual compensation based on specific requirements and merits will only be known at a later stage.

1.4.2 LIMITATIONS OF THIS STUDY

- * Details of the siting of quarries, borrow pits, blasting areas and road construction camps were not available at the time of this study.
- * Recent aerial photography of the study area was unavailable.
- * There is no integrated development plan for the Mohale section of LHWP Phase 1B which indicates how the various component projects are inter-related. The project components include the dam itself, access roads, and developments such as resettlement villages, tourist facilities and feeder roads.
- * The method of dam construction (rockfill or concrete) was not known at the time of the study, and consequently dam construction traffic loads could only be roughly estimated.

1.5 APPROACH TO STUDY

The study was conducted according to the broad principles of Integrated Environmental Management, as set out in 2.2, using an open, participatory approach, and including consultation with interested and affected parties (I&APs).

Significant negative impacts, both socio-economic and biophysical, were identified for the WAR (including the Maseru Bypass) and the LCAR, and

actions necessary to minimise or mitigate these impacts are recommended. The study also considers the optimisation of positive impacts, in accordance with LHDA's stated policy of development of the region.

The following tasks were carried out:

Initial contact with I&APs was undertaken by means of meetings with as many parties as possible. A chain referral system was used to identify further parties.

Regular discussions were held with the client, LHDA, regarding the scope of and approach to the study.

Impacts were identified by means of literature reviews, discussion with I&APs and specialists in the fields of rehabilitation, hydrology, ecology, road engineering and archaeology, field visits, and social surveys conducted along the St. Michaels - Patiseng section of the WAR; along the Jorodane River valley section of the LCAR; and along the recently constructed Katse road (Phase 1A).

Appropriate measures to mitigate negative and enhance positive impacts were determined by reference to the LHDA's Compensation Plan (LHDA, 1990) and from consultations with the above mentioned specialists.

Guidelines for rehabilitation, erosion control and other environmental concerns were compiled for recommended inclusion in contractor tender documents.

Individual environmental impact assessment reports for the WAR, LCAR and the Maseru Bypass (as well as for the Resident Engineer's Camp and two related access roads) were compiled. LHDA will select the preferred access

to the Mohale Dam based on the GBJV comparative report, which will draw from these individual reports.

1.6 STRUCTURE OF THIS REPORT

Chapter 2 introduces the theoretical aspects of Integrated Environmental Management and the Framework approach, and the application of these concepts to the LHDA 1000 project is also discussed.

Chapter 3 deals with a description of the LHDA 1000 project, followed by a brief description of the socio-economic and biophysical environment of the study area.

Chapter 4 describes and assesses the impacts of an access to the Mohale Dam, in accordance with established criteria. The alternative access routes are compared and discussed in terms of the various groups of interested and affected parties. These parties include local communities, conservation interests, national/regional interests, and the proponent.

Chapter 5 outlines conclusions and recommendations.

CHAPTER 2

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2 THEORETICAL ASPECTS OF IMPACT ASSESSMENTS

2.1 INTRODUCTION

This study of the assessment of impacts associated with the provision of an access to the Mohale Dam, fits into the procedure of Integrated Environmental Management (IEM) (DEA, 1992a). The various studied components of an access, namely the Western Access Road (WAR), including the Maseru Bypass, and the Least Cost Alternative Route (LCAR), are discussed in terms of IEM.

The principles pertaining to IEM are outlined, as well as the theoretical aspects of the Framework Approach (Lievesly, 1985) for appraisal of trunk road proposals. In each subsection, the application of the theory to LHDA 1000 is discussed.

2.2 PRINCIPLES OF INTEGRATED ENVIRONMENTAL MANAGEMENT

2.2.1 PRINCIPLES

Integrated Environmental Management is a *procedure* designed to ensure that the environmental consequences of development proposals are understood and adequately considered in the planning process. The purpose of IEM is to resolve or mitigate negative impacts and to enhance positive impacts of development proposals (DEA, 1992a). There are a number of principles underpinning IEM, which include the need for:

- * informed decision making;
- * accountability for information on which decisions are taken;
- * accountability for decisions taken;

- * a broad meaning given to the term *environment* (ie. one that includes physical, biological, social, economic, cultural, historical and political components);
- * an open, participatory approach in the planning of proposals;
- * consultation with interested and affected parties;
- * due consideration of alternative options;
- * an attempt to mitigate negative impacts and enhance positive aspects of proposals;
- * an attempt to ensure that the 'social costs' of development proposals (those borne by society, rather than the developers) be outweighed by the 'social benefits' (benefits to society as a result of the actions of the developers);
- * democratic regard for individual rights and obligations;
- * compliance with these principles during all stages of the planning, implementation and decommissioning of proposals, and
- * the opportunity for public and specialist input in the decision making process.

2.2.2 LHDA 1000 AND THE IEM PRINCIPLES

In a successful response to a tender call from LHDA, GBJV included, in its tender for the Planning and Design and Supervision of Construction of LHWP Phase 1B Access Roads (GBJV, 1992), and to satisfy LHDA's Scope of Works, an acknowledgment that in the second stage of the Planning Study, "The study is not to be limited to comparing capital costs but must take all factors into account including environmental considerations, social

impact and other benefits ...together with the disbenefits." The Second stage of the Planning Study includes "... a detailed comparative study of the western access route and the most viable alternative access corridor...".

IEM procedures have been followed throughout the Plan and Assess Proposal Stage (Figure 2.1).

2.3 THE IEM PROCEDURE AND THE POSITION OF LHDA 1000 WITHIN THE PROCEDURE.

The Planning and Assessment of the proposal is dealt with in Stage 1, Decisions are taken in Stage 2 and the proposal as decided is Implemented in Stage 3.

LHDA 1000 is placed in Stage 1: Plan and Assess proposal, with the following components being:

- * The Maseru Bypass study being an Initial Environmental Impact Assessment (EEU, 1993a).
- * The Western Access Road study being an Environmental Impact Assessment (EEU, 1993b).
- * The Least Cost Alternative Route being an Environmental Impact Assessment (EEU, 1993c).

An Environmental Assessment Report, incorporating the findings of the above, to the client, LHDA, was expected of the EEU, to assist the decision maker, the Joint Permanent Technical Commission (JPTC) in deciding which access should be constructed. (The JPTC is a binational body to ensure that the International Treaty between the GOL and RSA are fulfilled, and

provides an approval and monitoring function on behalf of the respective governments).

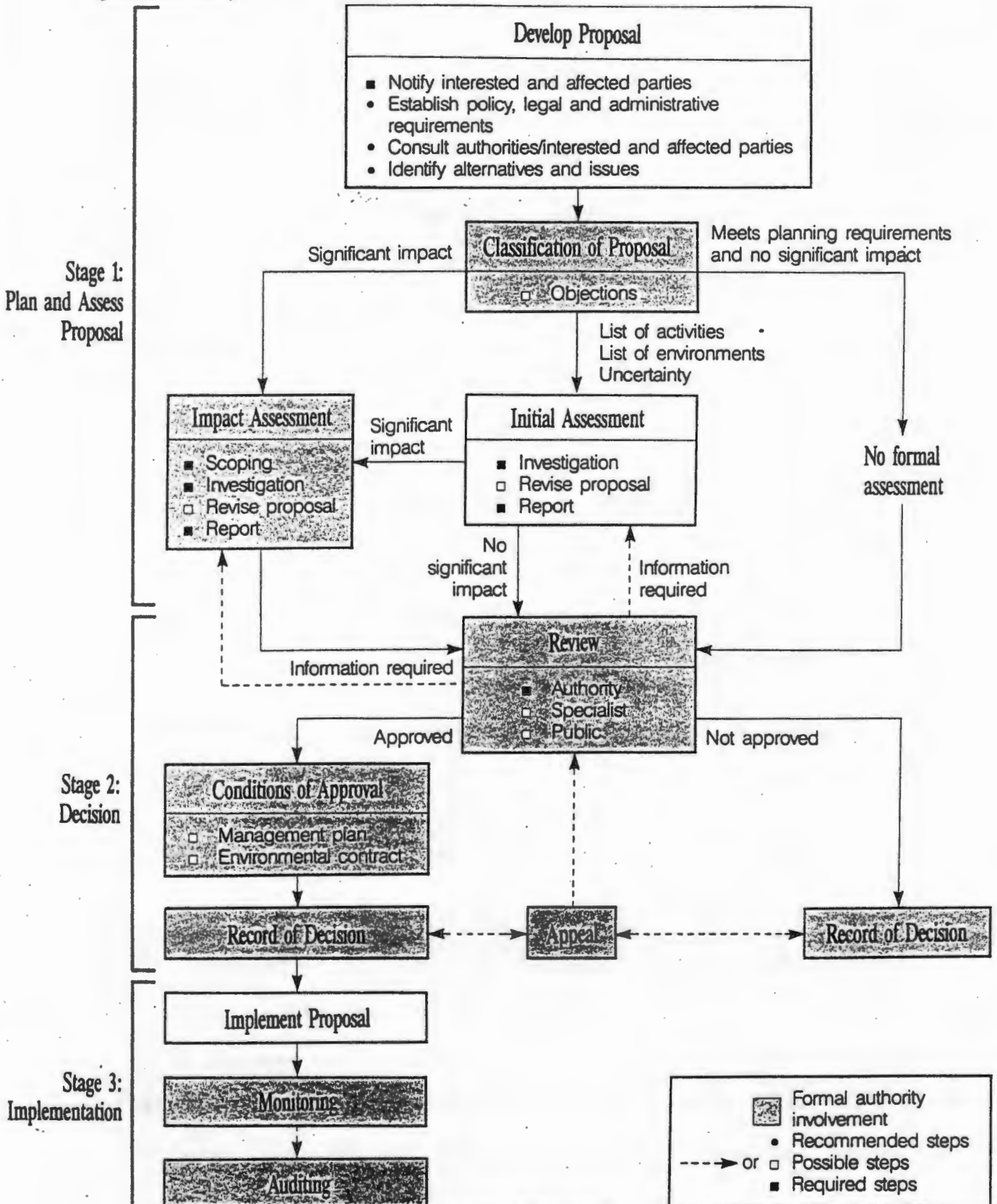


Figure 2.1: THE IEM PROCEDURE (DEA, 1992a)

2.4 THE COMPONENTS OF AN IMPACT ASSESSMENT

Whenever it has become apparent that significant impacts will occur as a result of a development proposal, either at the Develop Proposal Phase (Fig 2.1) or as a result of the findings of an initial environmental impact assessment, IEM requires an environmental impact assessment, or impact assessment, to be conducted (DEA, 1992a). Such impact assessment consists of four major components: Scoping, Investigation, Reporting and , if required, Revision of proposal.

2.4.1 THE SCOPING PROCEDURE

(a) *Theoretical Aspects of Scoping*

Scoping is defined as a procedure to determine the extent of and approach to an impact assessment (DEA, 1992b). The main purpose of scoping is to focus the impact assessment, ensuring that only significant issues and reasonable alternatives are examined in the investigation. Scoping is an ongoing, open and iterative process.

Scoping involves:

- * involvement of relevant authorities and I&APs;
- * identification and selection of alternatives;
- * identification of significant issues, and
- * determination of the terms of reference for the impact assessment (DEA, 1992b).

The aims of scoping are firstly to provide the proponent and consultants, relevant authorities and I&APs with an opportunity to exchange

information and express their concerns regarding the proposal prior to the commencement of an impact assessment; secondly, to ensure that the impact assessment is useful to the decision maker, that concerns of I&APs are addressed, and that the study focuses on relevant issues and reasonable alternatives; and thirdly to facilitate an efficient assessment process.

The proponent and consultants are finally responsible for scoping, whilst I&APs must be placed in an informed position by being provided with sufficient and appropriate background information regarding the proposal, including need, actions, timing and methods.

(b) The Scoping process in LHDA 1000

A record of scoping is presented in Appendix 2 of the Baseline Information Report (BIR) (EEU, 1993b, c).

During Stage 1 of LHDA 1000, a desktop study to identify a least cost alternative route to the WAR was undertaken. Time constraints limited the scoping procedure and I&APs were not involved. The key issues identified were: number and groups of people affected, sub-regional development, agricultural potential, distance above snow line, and sensitive ecological areas or components.

During Stage 2 of LHDA 1000, the remainder of the study, where the WAR (including the Maseru Bypass) and LCAR were assessed, a comprehensive array of relevant authorities and I&APs were consulted. Initial identification of I&APs was achieved by consulting directories and business reviews, as well as speaking to persons knowledgeable about social networks in the study area. Further I&APs were identified by chain referral.

Individual interviews or small group meetings/workshops were the preferred contacts with I&APs, but telephonic interviews were held when necessary. The above contacts elicited information relevant to the assessments and, especially, ascertained the I&APs concerns regarding the issues to be addressed. A background information document including the terms of reference, project proposal outline and major issues then identified was compiled and provided to I&APs.

Meetings with LHDA and GBJV were held to clarify specific guidelines and terms of reference for the assessments. Position papers were produced to clarify details and may be found as Appendices in the BIR.

To obtain the views of the communities living along the accesses, social surveys, which included supervised questionnaires and informal interviews, were conducted along the WAR and Jorodane River valley section of the LCAR, and along the recently constructed Katse Road. Further issues generated by this process were incorporated into the assessments.

2.4.2 IMPACT INVESTIGATION

(a) *Theoretical aspects of impact investigation*

Guided by the scoping process, the investigation should provide enough relevant information on the positive and negative aspects of the proposal, and feasible alternatives, to allow the decision maker to arrive at a decision (DEA, 1993a). A clear distinction between assessment and evaluation is useful throughout the study, firstly to emphasize who is responsible for decision making, and secondly to avoid information presented being distorted by the investigators' own value judgments. Staath (1989), defines assessment and evaluation as:

- * Assessment is the process of collecting, organizing, analysing, interpreting and communicating data that is relevant to some decision, and
- * Evaluation is the process of weighing information...the act of making value judgments or ascribing values to data in order to reach a decision.

Impacts may be identified by the use of checklists, literature reviews, and the scoping procedure amongst others. Whether an impact is considered significant or not, depends (DEA, 1993c) on its context and intensity. Context is both spatial and temporal, in that an impact may be considered to be of slight significance on a national level yet highly significant at a local level, and similarly, judged to be highly significant in the short term yet of slight significance in the long term. Intensity refers to the severity of an impact, as judged either by the people affected or by a knowledgeable authority. Intensity would include, among others, the degree to which:

- * the proposed action affects public health and safety;
- * the possible effects on the human environment are highly uncertain or involve unique or unknown risks;
- * the action or impact is irreversible;
- * the action affects the sustainability of life support systems, natural amenities, cultural resources and other environmental goods, services and conditions which are considered to be of a special or unique character, in limited supply, or essentially irreplaceable;

- * the action is related to other actions or proposed actions which individually may have insignificant impacts but which cumulatively could result in significant impacts, and
- * social costs have been absorbed as private costs (of the proponent).

(b) Impact investigation in LHDA 1000

Impacts were initially identified and listed by using the IEM checklist of environmental characteristics (DEA, 1992d) and a literature review, prior to fieldwork in Lesotho. Subsequently this list was refined by consultation with relevant authorities and I&APs during the scoping process.

Some quantifiable impacts were measured during field traverses of the WAR and the LCAR, and included elements requiring compensation and some biophysical elements, such as sizes of marshes and erosion areas.

The criteria for assessing significance of impacts were adapted, as set out in section 7.3 of the BIR, from the Scottish Transportation Environmental Appraisal Manual, 1986, the Draft Transportation Environmental Assessment Manual (RSA), 1992, and the DEA IEM, 1992 documents. Significance has been determined by the degree to which the proposed action:

- * affects or furthers national goals or local interests;
- * involves impacts which are irreversible;
- * will have effects over a long period;
- * affects public health or safety;

- * affects the overall well-being of people, and the number of people;
- * affects the availability or functioning of key resources;
- * affects environmental qualities, goods or services which are of special or unique character, in limited supply and/or essentially irreplaceable;
- * may establish a precedent for future actions;
- * results in cumulative or synergistic impacts, and/or
- * has the potential to optimise existing conditions.

The above criteria have been applied to the impacts identified in the study, to determine significance in terms of magnitude and duration of effect. After consultation with the relevant field specialists and consulting environmental researchers, the impacts, positive and negative, have been assigned significance ratings of high, medium or low significance.

2.4.3 THE ASSESSMENT REPORT

(a) Theoretical aspects of assessment reports

The purpose of an assessment report (Fuggle and Rabie, 1992) is to communicate the findings of an environmental assessment to the decision maker. The essential requirements of the report are:

- * integrated and accurate information;
- * concise writing, and

- * accessibility to non-specialists.

Information in the report should be organised (Hill, 1992a) to:

- * emphasize the information that is useful to the decision maker;
- * clearly show how the impacts affect various groups in the community;
- * show how outcomes change with different assumptions, and
- * ensure focus on linkages rather than description.

(b) The LHDA 1000 report

Impacts on different groups are shown, with reasons given for the selection of significant impacts.

Due to the length of the three relevant Baseline Information Reports (BIR), background information has been reduced.

Assumptions have been made clear throughout the report.

2.5 THE FRAMEWORK APPROACH TO ASSESSMENT

2.5.1 THE BACKGROUND TO THE FRAMEWORK APPROACH

The Framework Approach (Lievesly, 1985), was designed in Britain during the 1970's by the Advisory Committee on Trunk Road Assessment (ACTRA), and refined by the Standing Advisory Committee on Trunk Road Assessment (SACTRA), primarily to reduce often acrimonious, lengthy and costly public enquiries resulting in delays in building new trunk roads. It was recognized that the public had little confidence in the methodology then taken to assess road options, and subsequent decisions.

Departmental Standard 12/83 (cited in Lievesly, 1985) defines a Framework as " a tabular presentation of data summarising the main likely direct and indirect impacts on people of the alternative options for a proposed highway scheme. Each option that is technically feasible and thought to represent an acceptable and clearly separate solution will, in principle, have a separate column in the framework."

The main objectives of using an assessment framework are, firstly to ensure that all relevant effects on people and the environment are considered so that all necessary data may be presented concisely, or omitted as being unimportant to decisions. Secondly to provide a balanced set of comparative data helpful for taking informed decisions. Thirdly to show that the proponent has fairly considered all relevant facts prior to reaching a decision, and fourthly to enable the public to contribute opinions with full knowledge of the implications of the schemes.

The framework is a decision making aid, and the information presented can be either quantitative or qualitative.

A key concept of the Framework Approach is that comparisons of road options should be arranged so that the relevant impacts on disparate interest groups may be highlighted (SACTRA, 1979). Lievesly (1985) points out that the same people can occur in more than one interest group representing different aspects of their lives. The 6 interest groups identified in the above methodology are: Travellers, Occupiers, Users of facilities, Those involved with conserving or enhancing the area, Those involved with transport, development and economic policies, and Those involved with financial implications. The framework for analysis is prepared at the scoping stage (Ministerie van Volksgezondheid en Milieuhygiene, 1981), and is an important element in the linkage between

the assessment and the decision process, as it determines what environmental information is to be presented for decision making.

2.5.2 THE FRAMEWORK APPROACH IN LHDA 1000

The Framework Approach as discussed above was amended during the scoping stage, with data collected and information presented in the BIR in terms of four groups, namely: impacts affecting national or regional policies or plans; impacts affecting the socio-economic environment; impacts affecting the biophysical environment, and impacts affecting the archaeological/palaeontological environment. Chapter 4. 2 of this report presents the major impacts according to this framework, whilst Chapter 4.3 deals with a comparison of the two accesses according to major impacts presented in an amended form to show how the following user groups are affected, namely: those involved with national and regional planning; local communities; conservationists, and the proponent.

CHAPTER 3

THE PROJECT PROPOSAL AND THE AFFECTED ENVIRONMENT

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3 THE PROJECT PROPOSAL AND THE AFFECTED ENVIRONMENT

3.1 THE PROJECT PROPOSAL

As discussed in Chapter 1.1, the Lesotho Highlands Development Authority (LHDA) requires a reliable yet economic access route to the Mohale Dam construction site for the transportation of RSA sourced materials and equipment. The construction of the Mohale Dam forms part of Phase 1B of the Lesotho Highlands Water Project, with the provision of advanced infrastructure, including the provision of the access route, forming part of Contract No. LHDA 1000.

As part of the determination of the most economic access route to the Mohale Dam, a pair of comparative impact assessments were commissioned by LHDA, the first a desktop study initial assessment comparing several (8) possible access routes from the RSA to the Mohale Dam other than that from Maseru via the road to Thaba Tseka (Mountain Road), and the second to compare the least cost access route selected from the first, termed the Least Cost Alternative Route (LCAR), with the access from Maseru via the road to Thaba Tseka (Mountain Road), termed the Western Access Road (WAR)

The WAR runs from Maseru via Mazenod, St. Michaels, and Nazareth to Patiseng near the Mohale Dam construction site, whereas the LCAR runs from Maputsoe (across the Caledon River, which forms the international boundary between the RSA and the KOL, from Ficksburg) via Teyateyaneng (TY), Ha Mateka, and the Jorodane River valley to Patiseng. (Figure 1.2).

The WAR requires a bypass of the Maseru central business district, minor upgrading of the road from Mazenod to St. Michaels, and major upgrading, and in places realignment, of the road from St. Michaels to Patiseng.

The LCAR requires upgrading of the road from Maputsoe to TY, a bypass of TY, upgrading of the road from TY to Ha Mateka, and construction of a new road from Ha Mateka to Patiseng.

Elements common to both the WAR and the LCAR are the provision of an access routes from Patiseng to the Mohale Dam construction site and to the Mohale Dam intake adit, and the provision of a resident engineer's camp.

Design standards for the WAR and the LCAR are:

- * a design life of 20 years, with LHDA responsible for the first 5 years (until completion of the Mohale Dam in mid 2002);
- * road reserves of 20 metres, with the WAR having a bitumen surface of 6,6 m and maximum total shoulder width of 3 m, and the LCAR having a bitumen surface of 6,5 m and maximum total shoulder width of 1,5 m.
- * design speed for the WAR from St.Michaels to Nazareth is generally 75 km/h and from St.Michaels to Patiseng 30 km/h, whilst for the LCAR it varies from 50 km/h to 80 km/h.
- * bridges on the WAR will be replaced, with ARMCO structures used for minor water courses, whilst on the LCAR new bridges and ARMCO structures will be built. For both accesses the normal road width will be increased by 1,5 m over bridges to allow for pedestrian traffic.
- * drainage structures for the WAR and the LCAR are to be designed according to standards adopted by LHDA and based on the LHWP Feasibility Study: Supporting Report G: 1986. An estimated average of 5 culverts per kilometre is envisaged.

- * construction materials for both accesses will be obtained from quarries and borrow pits in the respective areas. Spoil areas for rock and soil will be used, but spoiling principles still have to be agreed to by LHDA (Appendix 5 of the BIR outlines relevant specifications).

- * projected Average Daily Traffic (ADT) flow for dam construction related vehicles ranges from 80 vehicles, if a rockfill dam wall design is chosen, to 200 vehicles if a concrete arch dam wall design is chosen. In both cases an estimated 16% of the traffic will be heavy vehicles.

- * road construction personnel requirements are an estimated maximum of 500 persons for either access. The size and location of road construction camps will be determined by the contractor.

- * the selected access must be completed by mid 1997, with construction commencing in mid 1994. The surveying of the road alignment of the WAR is underway, whereas this will only be done for the LCAR if the LCAR is selected.

It is important to note that, if the LCAR is selected, all planning for the WAR will cease, and alternatives to the LCAR will be compared with the LCAR to select the eventual access route.

3.2 THE AFFECTED ENVIRONMENT

The affected environment of the Western Access Road (WAR) and the Least Cost Alternative Route (LCAR) will be discussed in terms of the national context and the respective local contexts. A major change in environment exists for both accesses as each originates next to the RSA border and traverses first the lowland region (below 1800 m) and then the mountain region (above 1800 m) of Lesotho.

3.2.1 NATIONAL AND REGIONAL PLANNING AND DEVELOPMENT

Any new developments should be considered in the context of other developments, existing and planned, within the affected environment. In Lesotho, cognisance must be taken of five major national elements: the Development Plan; the Road network; the Settlement Policy, the Rural economy, and Tourism.

(a) *National planning objectives*

The primary development objectives outlined in the Fifth Five Year Plan (1991/92 to 1995/96) of the GOL are:

- * the alleviation of poverty;
- * the promotion of equity and social justice;
- * the generation of more productive job opportunities, and
- * achieving an adequate level of sustainable economic growth with the emphasis on economic management.

Democracy and popular participation are also considered essential elements of the development process.

(b) *Lesotho road network*

An obvious contrast exists between the better quality of the road network in the western lowlands and that in the eastern mountainous regions of Lesotho. Major shortcomings in the existing network include: the majority of roads are unpaved and frequently impassable during the wet summer season; many areas, especially in the mountain region, lack access for motor vehicles; linkages to the mountain region are poor, and maintenance of roads is inadequate (in 1990, only 29% of the maintenance requirement was allocated).

The Fifth Five Year Plan of the GOL for 1991/2 to 1995/6 includes, amongst others, the reconstruction of the Mountain Road from St. Michaels to Thaba Tseka, and the construction of a new bridge across the Caledon River at Maseru. Funding still has to be obtained for these activities.

(c) *Settlement planning*

The National Settlement Policy (NSP) (1990) of the GOL sets a framework for settlement development in Lesotho. The aim of the NSP is to promote balanced settlement development and to protect natural resources and the environment affected by settlement development. The NSP calls for the current unbalanced settlement to be influenced so that: the growth of Maseru is controlled; at least one viable centre is developed in each district and that some district centres are developed into regional centres, and that settlement development is promoted in presently underserviced areas, particularly in the mountain region.

The above goals should be achieved, *inter alia*, by harmonizing road plans with the NSP proposals, and promoting the decentralisation of public

administration (to decrease the primacy of Maseru) and the establishment of local authorities in all centres.

(d) The rural economy

The improvement of the rural economy is also a stated priority of the Fifth Five Year Plan of the GOL. The provision of improved transport infrastructure (EEU, 1993c) can facilitate: improved access to agricultural inputs such as fertilizers, seed, insecticides and mechanized ploughing and harvesting; improved access to markets, marketing infrastructures and organisations, and increasing diffusion of agricultural innovation. However, the above can only be expected to increase profitability and production in areas of existing economic dynamism.

(e) Tourism

Tourism in Lesotho has generally been limited by poor infrastructure and minimal marketing. Since the decline in popularity (by South Africans) of the Maseru gambling casinos in the late 1970's, the strategy for tourism has changed to the development of tourism based upon the natural attractions in the interior of Lesotho (BIR), such as historical and archaeological sites, pony trekking, and skiing. Pony trekking routes from the Basutho Pony Project at Molimo Nthuse on the Mountain Road currently make frequent use of the Jorodane River valley. Dam related tourism is envisaged in the LHWP.

Maseru

Maseru is a city with a population of approximately 160 000, administered by a City Council. The city (138 km²) as well as an outer

areas (226 km²) fall within the Maseru Development Plan planning boundary, where attempts are being made to control urban development (EEU, 1993a). The proposed Maseru Bypass will, derived from the costs provided by GBJV in Appendix 2 (which shows that alternative route no. 6 has been chosen), run through suburban and agricultural land.

3.2.2 THE SOCIO-ECONOMIC ENVIRONMENT

Lesotho has a limited natural resource base (BIR), with the two major resources being water and the western grasslands. Mineral and construction material deposits, including cement components, are lacking.

In 1990 65% of the potential labour force was employed, 15% being migrant labour working in the RSA. The Lesotho population growth rate is approximately 2.6% per annum, resulting in an additional 400 000 job market entrants by 2001. The rural sector, comprising 80% of the population, produces 45% of the GNP. However, cash contributions by migrant workers often sustain rural communities, although wreaking havoc on family life.

The Sechaba survey on poverty in Lesotho (BIR), lists the following concerns of the Basutho, in order of importance, of the lack of: food; good water supply; employment; roads and transport; money; medical facilities; household and personal possessions; latrines; good housing and building materials; livestock, and fields. Livestock are an important cultural and economic resource in the rural areas, providing security in the form of wealth; draught power, meat, milk, annual income from the sale of wool and mohair, fuel from dung, and transport.

(a) *The Western Access Road (WAR)*

Although the Mountain Road was constructed over 40 years ago, villages along the road lack higher order services such as banks, filling stations, supermarkets, post offices, police stations, and high schools, and the region as a whole suffers from economic stagnation. Results of the WAR social survey showed that 77% of respondents said that hunger was a problem facing households, 56% lack of clothing and 43% unemployment, whilst 57% of respondents said that stock theft was a key problem facing their village, with 43% citing the shortage of potable water.

The Mountain Road itself is narrow and poorly surfaced. Public transport is limited to four busses a day (Maseru-Thaba Tseka route), operating only during the day. Kombi taxis only operate regularly as far east as Nazareth. Consequently there is still a need for improved transport and better access to clinics, schools and large shops.

Socio-demographic characteristics and trends are detailed in the BIR, but the total population within a 2 km wide corridor which may be affected by the upgrading of the WAR comprises 13 villages of more than 100 inhabitants, and 20 smaller villages. Settlements usually comprise clusters of stone and thatch huts, often situated on hills. Water for drinking and cooking is usually collected from communal springs or taps, with washing being conducted in nearby streams and rivers.

The major source of cash income along the WAR is the remittance of migrant labour wages, whilst there are some owners of small businesses. Fruit (peaches), crafts and Spiral Aloes are offered for sale to passing motorists and bus passengers at bus stops.

The following tourist attractions exist on or serviced by the WAR: pony trekking at Molimo Nthuse and Marakabei (SE of Patiseng); hotels/lodges at Molimo Nthuse and Marakabei; the historical mountain fortress at Thaba Bosiu; rock paintings at Ha Baroana, and the scenic Bushman's Pass.

(b) The Least Cost Alternative Route (LCAR)

Whilst the area along the proposed LCAR from Maputsoe to Ha Mateka is provided with all-weather roads, only a 4-wheel drive track exists from Ha Mateka to Pulane, and thereafter, no road exists to Patiseng. The lowland region north of Pulane is densely populated with intensive agriculture.

The first settlements south of Pulane and all other settlements affected by the new section of the LCAR lie in the Jorodane River and Senqunyane River valleys. Settlements are characterised by small villages, set in an essentially rural economy. Remittances from migrant labourers form an appreciable source of cash, but a thriving national and trans-national informal cash crop exists.

Isolation of the valleys from services and markets (EEU, 1993c) has resulted in a marginalised community, results of the LCAR social survey showing that 80.5% of respondents said that hunger was a problem facing households, 59.2% lack of clothing and 28.8% unemployment, whilst 60% of respondents said that poor access to clinics was a key problem facing their village, no transport or roads cited by 59.5%, with 43% citing the shortage of potable water.

There are 15 villages of more than 100 inhabitants, with 33 smaller villages within 2 km of the proposed alignment of, and likely to be affected by, the LCAR.

The Jorodane valley is extensively cultivated, along the river bottom on high grade soils as well as by terraces up the mountain slopes. Non-cultivated areas used for grazing, over-grazing being attributed to lowlanders. Firewood and paraffin is scarce, with dung used for fuel and therefore unavailable for fertilizing fields.

The informal cash crop contributes 64.9% of cash income, migrant labour remittances contributes 33.1%, whilst 10% of respondents to the LCAR social survey claimed to have no source of cash income.

Pony trekking through these valleys from Molimo Nthuse contributes cash income for overnight accommodation to 15 households, whilst 6 households rent out ponies, and 12 households sell crafts or food to tourists.

3.3.3 THE BIOPHYSICAL ENVIRONMENT

(a) *The Western Access Road (WAR)*

The lowland section of the WAR between St. Michaels and Nazareth has a gently undulating topography, with highly eroded shale and mudstone soils, except where the existing Mountain Road ascends the Cave sandstone escarpment. From Nazareth to Patiseng the terrain is mountainous, containing mainly basaltic soils, with the road climbing over three passes: the Bushman's (Lekhalong-la-Baroa) at 2268 m; the God Help Me (Lekhalong-la-Molimo-Nthuse at 2318 m), and the Blue Mountain (Lekhalong-la-Thaba Putsoa) at 2650 m.

Most streams and wetlands on the WAR are spanned by ARMCO structures or standard cross-flow culverts.

Little natural vegetation still exists in the lowland section, as this area is highly cultivated, whilst the mountain region is typified by montane grassland with small patches of *Leucosidea sericea* woodland found on steep, south facing slopes. Less cultivated than the lowland section, the mountain section of the WAR is, however, severely overgrazed.

Little indigenous fauna exists in the lowlands as a result of human pressures, whilst in the mountain region, only rock hyrax, clawless otter and grey rhebuck of the larger diurnal mammals remain, and large birds of prey under severe threat.

Due to the gentle topography of the lowlands, and more fertile soils, intensive cultivation is practiced, mainly with maize and sorghum. In the mountain region, on a lesser scale, maize, sorghum, wheat, barley and oats are cultivated. Vegetables are grown predominantly on a household scale in both regions.

(b) *The Least Cost Alternative Route (LCAR)*

The account given above for the WAR is also applicable to the LCAR, as this access also passes through lowlands and mountains. The Maluti Mountains are crossed by the proposed alignment at the Lekhalong-la-Lekhaebaneng Pass at 2 600 m. The Jorodane River flows in large regular meanders spaced approximately 300 m apart. Two species listed in the IUCN Red Data Book are found in the Jorodane-Senqunyane river system, namely the Maluti Minnow (fish) (*Pseudobarbus quathlambae*) and the Aquatic River Frog (*Rana vertebralis*). Relatively undisturbed bogs and marshes are to be found, especially in the upper reaches of the Jorodane River valley.

3.3.4 ARCHAEOLOGY AND PALAEOLOGY

(a) *The Western Access Road (WAR)*

Only two insignificant archaeological sites were found. A specialist report is to be found in the BIR.

(b) *The Least Cost Alternative Route (LCAR)*

Although the proposed alignment of the LCAR along the Jorodane River valley was not walked by a trained archaeologist, the Pulane Basin to the north is known to be extremely rich in archaeological sites due to the extensive exposures of Cave Sandstone which provide large rock shelters, often with deep deposits and cave paintings.

CHAPTER 4

ASSESSMENT OF IMPACTS

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4 ASSESSMENT OF IMPACTS

4.1 METHODOLOGY

The methodology employed in LHDA 1000 for the identification and assessment of impacts has been fully discussed in Chapter 2.4.2. To recapitulate, impacts were identified using checklists, literature reviews, and consultations with authorities and I&APs, whereas significance has been accorded to impacts in terms of context (spatial and temporal) and intensity, with a significance rating of high, moderate or low accorded by the LHDA 1000 study team, in consultation with appropriate specialists.

4.1.1 SELECTION OF IMPACTS FOR REPORT

The BIR contains full accounts of all impacts identified during LHDA 1000. For the purposes of this report, the 54 impacts identified and discussed in the BIR (WAR and LCAR assessments) have been reduced to 25, by examining the likelihood (or not) of the suggested mitigatory/optimisation measures, contained in the BIR, being implemented. Only where the suggested measures are within the powers of LHDA to implement are the 'impact with mitigation/optimisation' significance ratings used. Further, where either the 'impact with mitigation/optimisation' significance rating or the 'impact without mitigation/optimisation' significance rating is low or zero, such impacts are excluded. A list of all discarded impacts, with reasons given for their exclusion from the comparison of the WAR and the LCAR, is attached as Appendix A of this report. (An additional 2 moderate negative impacts, for the LCAR, have been selected as there is no justification given in the BIR for a lower significance).

TABLE 4.1 : COMPARISON OF THE POSITIVE IMPACTS OF THE WAR AND THE LCAR

INTEREST GROUP	SIGNIFICANCE	WAR COMMENT	SIGNIFICANCE	LCAR COMMENT
NATIONAL/ REGIONAL	Moderate	Reinforces national planning objectives		
	High	Accords with national road plans		
	High	Maseru bypass will alleviate congestion		
SOCIO-ECONOMIC	High	Improved transport, access to services	High	Improved transport and access to services
	Moderate	Increased employment/business chances		
	Moderate	Reduced dust and mud		
	Moderate	Improved road safety		
BIOPHYSICAL				
ARCHAEOLOGICAL				

TABLE 4.2 : COMPARISON OF THE NEGATIVE IMPACTS OF THE WAR AND THE LCAR

INTEREST GROUP	SIGNIFICANCE	WAR COMMENT	SIGNIFICANCE	LCAR COMMENT
NATIONAL/ REGIONAL			High	Contradicts national road plans
			Moderate	Contradicts national settlement plan
			Moderate	Detracts from existing tourist facility
SOCIO-ECONOMIC	Moderate	Interference with potable water supply	High	Disruption of local economy
	Moderate	Inconvenience/risks to people/livestock	High	Social disruption of local communities
	Moderate	Loss of agricultural resources	Moderate	Loss of agricultural resources
	Moderate	Cost of living increase	Moderate	Loss of houses, businesses and facilities
	Moderate	Loss of houses, businesses and facilities		
	High	Social disruption of local communities		
BIOPHYSICAL	Moderate	Destruction of Spiral Aloe populations	Moderate	Increased sediment loading of streams
			Moderate	Impacts on wetlands and bogs
			High	Impacts on endangered aquafauna
			High	Destruction of Spiral Aloe populations
ARCHAEOLOGICAL			Moderate	Impacts on Bushmen paintings

4.1.2 LAYOUT OF IMPACTS

Groups of impacts are presented under the interest group headings of National/Regional Planning and Development, Socio-economic Environment, Biophysical Environment, and Archaeological/Palaeological Remains. Impacts within each group are discussed firstly for the Western Access Road (WAR) and secondly for the Least Cost Alternative Route (LCAR). Although the respective researchers for the alternative accesses chose broadly similar categories and appellations, not all impacts are strictly comparable.

Within the layout outline above, each selected impact is presented in the following format:

Impact Statement: A highlighted statement of the nature of the impact that can be expected;

Discussion of Impact: An expanded explanation of the type of impact, its causes, frequency, duration and linkages to other impacts. This includes an estimation of impact magnitude and likelihood of occurrence;

Affected Parties: The identification of groups of people or ecosystems affected by the impact;

Mitigation/Optimisation: A statement of proposed measures to limit negative or enhance the positive consequences of the impact, and

Significance: A rating is given of the significance of the impact, indicating whether this is with or without mitigation/optimisation.

4.2 IDENTIFIED MAJOR IMPACTS

4.2.1 IMPACTS ON NATIONAL AND REGIONAL PLANNING AND DEVELOPMENT

(a) *The Western Access Road (WAR)*

(i) Reinforcement of the national planning objectives of economic growth, employment creation and democratisation.

Discussion of impact: The WAR will provide access to the Mohale Dam, which is an important component of the LHWP. The export of water to the RSA will provide revenue to the KOL of from M50-100 million per annum at 1985 prices (LHDA, 1988), with hydro-electric power generation resulting in a saving to the KOL of about M20 million per annum. The road thus serves to reinforce the objective of economic growth identified in the Fifth Five Year Plan (Ministry of Planning, Economics and Manpower Development, 1993).

Upgrading of the WAR will provide employment opportunities for up to 500 people for 30-36 months, excluding the Maseru bypass and upgrading of the Maseru railhead. The road thus serves to reinforce the Five Year Plan's objective of job creation.

Approximately 30 villages will directly experience improved access. Improved access is accepted in the Five Year Plan as part of the priority goal of the GOL of facilitating the process of democratisation and peoples participation.

Affected parties : Potential employees on the road construction project and those involved with the Maseru bypass and upgrading of the

Maseru railhead (employment), the GOL (economic growth), and the villagers and travellers (improved access).

Optimisation: LHDA: Establish training programmes to teach local people relevant skills associated with road construction. GOL: Allocate a significant portion of LHWP royalties to regionally coordinated rural development projects to improve economic management, and complete planned infrastructural improvements such as the proposed upgrading of the remainder of the Mountain Road (Patiseng to Thaba Tseka).

Significance: Overall impact is positive and of moderate significance, discounting the GOL optimisation.

(ii) Impact on Lesotho road system

Discussion of impact: The GOL has budgeted M20 million for the upgrading of the Mountain Road between St. Michaels and Thaba Tseka, as this road has been identified as a priority by the Department of Roads within the Lesotho road network plan. Upgrading of the section of the Mountain Road from St. Michaels to Patiseng by the LHDA (funded in terms of the LHWP) will save the GOL an estimated M10 million. As no new road is added to the road network, no additional maintenance will be placed on the GOL, and during the period until the Mohale Dam is completed, maintenance work otherwise required of the GOL will be unnecessary. A saving to the GOL of M2.7 million is estimated. Total estimated saving to the GOL is thus M12.7 million.

Affected parties: The GOL.

Optimisation: GOL: Complete upgrading of the section of Mountain Road from Patiseng to Thaba Tseka, and carry out cost-effective maintenance of

the road following upgrading according to the Department of Road's Pavement Management and Maintenance System (PMMS).

Significance: Overall impact is positive and of high significance, discounting the GOL optimisation.

iii) Alleviation of Maseru traffic congestion

Discussion of impact: It has been assumed that if the WAR is selected as the access to the Mohale Dam, a bypass of the Maseru CBD will be constructed (Chapter 1.4.1). This bypass would alleviate present congestion and provide heavy vehicles an alternate route around the CBD, and thus reinforce Maseru urban planning initiatives.

Affected parties: Maseru inhabitants affected by the current congestion, and travellers having to pass through the CBD.

Optimisation: LHDA: The proposed Maseru bypass should accord with the Maseru urban and regional planning initiatives.

Significance: Overall impact is positive and of high significance.

(b) *The Least Cost Alternative Route (LCAR)*

i) Impact on Lesotho road system

Discussion of impact: Although the LCAR would provide a new linkage between Teyateyaneng and the Mountain Road at Patiseng, this is not considered as a priority in the Five Year Plan, and would, after completion of the Mohale Dam, add an average annual M374 000 for resealing and maintenance of this 55 km section to the GOL budget.

Affected parties: The GOL, travellers to the Mohale Dam, and travellers from Maputsoe to the interior of Lesotho.

Mitigation: GOL: Continued cost-effective implementation of the Department of Road's Pavement Management and Maintenance System (PMMS).

Significance: Negative impact of high significance, with or without mitigation by GOL.

ii) Impact on National Settlement Policy

Discussion of impact: A route through the Jorodane River valley is not envisaged in the National Settlement Policy (NSP), district plans, or decentralisation policies of the GOL, and therefore the LCAR does not reinforce existing plans and policies.

The creation of new settlements along the LCAR would occur at the expense of existing ones, and would contradict the growth of emerging development nodes along the existing Mountain Road.

Much of the mountain region of the LCAR falls within areas lacking an adequate degree of administrative control and effective planning initiatives. The LCAR could reinforce the development of Teyateyaneng as a district centre (Berea district), and to a limited extent could reinforce the development objectives for the Leribe district through prolonging the use of Maputsoe as a border and railhead infrastructure centre.

Affected parties: Residents of the Berea, Leribe and Maseru districts, and the GOL.

Optimisation: GOL: The optimisation of the positive aspects of this impact requires the GOL to coordinate the introduction of the LCAR with the

provisions of the NSP, which is likely to be expensive in terms of financial and institutional resources.

Significance: Negative impact of moderate significance, discounting optimisation by the GOL.

iii) Impact on tourism in the Jorodane River valley

Discussion of impact: The Jorodane River valley is currently the favoured destination for 3 to 5 day pony treks of the Basutho Pony Centre, situated south east of the valley at Molimo Nthuse. Villages in the valley offering overnight facilities gain from cash payments by trekkers. The existence of the LCAR will detract from the current undeveloped rural trekking experience.

The LCAR, in conjunction with the Mohale Dam, could be instrumental in providing access to a wider range of tourist facilities.

Affected parties: Local residents, tourists, the tourism industry, and the GOL which operates the Basutho Pony Centre as part of the Basutho Pony Project for improving the national herd.

Optimisation: GOL: Improved marketing of Lesotho's tourist attractions, coupled with improvements to the tourist infrastructure.

Significance: Negative impact of moderate significance, discounting optimisation by the GOL.

4.2.2 IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

(a) *The Western Access Road (WAR)*

i) Improved transport and access to services

Discussion of impact: Upgrading of the WAR would improve access to clinics, shops and schools. Although the Mountain Road has been in existence for more than 40 years, the local communities along the WAR have a perception (EEU, 1993d) that an upgraded road will attract development to the area in the form of new and better services. Higher order services such as banks, post offices, filling stations, lodges and police stations are currently absent east of Molimo Nthuse within the study area to Patiseng, and scarce west of Molimo Nthuse.

Affected parties: Local communities and travellers.

Optimisation: LHDA and GOL: Appropriate siting of sufficient safe stopping and off-loading areas should be provided.

Significance: Positive impact of high significance, with or without optimisation.

ii) Increased employment and business opportunities

Discussion of impact: Specifically related to the short-term period of upgrading of the WAR, economic benefits likely to accrue to local communities along the WAR are from activities such as the selling of food and beer, the washing of clothes, the rental of accommodation, and prostitution. Although the experience from the Katse Road has been that most entrepreneurial introductions have been supplied by people from the

lowlands, the people living along the WAR have been exposed to a more urban market system for over 40 years, and can be expected to seize most of the opportunities themselves.

Affected parties: Local residents offering services and construction workers.

Optimisation: Training programmes for the local communities in marketing and business skills.

Significance: Positive impact of moderate significance, with or without optimisation.

iii) Reduced dust and mud

Discussion of impact: Tarring of the road will alleviate the problem of dust from passing traffic which currently inconveniences residents in houses along the road and pedestrians. Pedestrians will also benefit from tarring as they will not have to walk along a sometimes muddy road.

Affected parties: Nearby residents and pedestrians.

Optimisation: LHDA: Road shoulders should be suitably designed to have a firm, well drained surface, to avoid pedestrians walking on the road itself.

Significance: Positive impact of moderate significance, with or without optimisation.

iv) Improved road safety

Discussion of impact: The upgrading of the WAR entails tarring and widening of the existing road, which will make it safer, especially for

passing vehicles. A broader road shoulder will also assist to separate pedestrians (with or without livestock) from vehicular traffic.

An improved road surface with better lines of sight for vehicle drivers may lead to increased speeds with the probability of more accidents involving livestock, especially at night.

Affected parties: Residents of villages along the road, pedestrians, livestock, and vehicle users.

Optimisation: LHDA: Appropriate speed limits should be imposed along the WAR, especially through villages and narrower sections. Adequate road shoulders should be provided for the safe passage of pedestrians and livestock, including over bridges. Road signage, such as zebra crossings, speed ripples, and speed restriction notices, should be introduced to indicate pedestrian hazards, especially at villages, schools and other crossing points. Access points to and egress points from the WAR should be restricted for safety reasons. Appropriate road safety programmes should be introduced, especially in schools.

Significance: Positive impact of moderate significance, with optimisation.

v) Interference with potable water supplies

Discussion of impact: Potable water is already in scarce supply in many areas along the Mountain Road and 43% of the respondents of the WAR social survey (EEU, 1993d) said that water availability was a problem for their villages. The GOL Village Water Project (VWP), which aims to address this problem, has not yet progressed further east than Nazareth. Most villages rely on unprotected springs, which are especially vulnerable to

direct destruction by the upgrading of the WAR, or indirect interference as a result of altered runoff from the road, pollution, and rockfalls. Seven water collection points along the WAR have been identified. Results of the social survey along the Katse Road (EEU, 1993d) showed that in six of the villages reporting a change in the location of water collection points, more than 80% of respondents said that it took them longer to collect water after the construction of that road.

Affected parties: Local communities, especially women who are responsible for water collection.

Mitigation: LHDA: Replacement water collection points should be provided at points no further from users than the existing ones. Existing sources should be protected during upgrading by appropriate construction methods and strict control over pollution. GOL: The Village Water Project should be extended east of Nazareth should be a priority.

Significance: Negative impact of moderate significance, discounting GOL optimisation.

vi) Inconvenience and risks to people and livestock

Discussion of impact: During the projected 30-36 month upgrading period for the WAR, road users will suffer increased traffic delays and possibly reduced road safety, as a result of the periodic closure of sections of the Mountain Road. During the construction of the Mohale Dam, there will be an increase of 80-100 vehicles daily, 16% of which will be heavy vehicle traffic.

Affected parties: Vehicular road users, pedestrians and livestock.

Mitigation: LHDA: Erect notices and disseminate information to vehicular road users regarding road closure schedules. Retain all current bridges until new ones are in use. Passage of vehicles, pedestrians and livestock should be assisted by trained personnel to ensure one-way traffic and increased safety.

Significance: Negative impact of moderate significance, with mitigation.

vii) Loss of agricultural resources

Discussion of impact: Approximately 4790 m² of cultivated land and 925 m² of vegetable gardens lie within 10 m of the centre line, as do 73 fruit trees and 104 other trees, and four kraals and one stock pen with associated diptank. In addition to the possible permanent loss of these resources, temporary losses may be expected to result from the siting of temporary roads, crusher sites, storage sites, and construction camp sites. The loss of food resources is critical to those affected, whilst the sale of fruit, mainly peaches, to travellers of the Mountain Road, is an important source of cash revenue to the owners.

18 ha of agricultural land will have to be expropriated for the Maseru bypass.

Affected parties: Owners of agricultural resources affected.

Mitigation: LHDA: Widening of the road on the side recommended in the BIR will reduce the resources affected to approximately 3146 m² of cultivated land, 568 m² of vegetable gardens, 36 fruit trees, and 81 other trees. Compensation according to the LHDA Compensation Plan.

Significance: Negative impact of moderate significance, with mitigation.

vii) Increase in cost of living

Discussion of impact: More taxis could ply the WAR, and as reported from the Katse Road, increased fares may result, as opposed to busses. The presence of wage earning construction workers may lead to price hikes, as happened during construction of the Katse Road.

Affected parties: The sectors of the local communities with little cash income, local residents unable to shop elsewhere, and passengers of the Maseru-Thaba Tseka bus route.

Mitigation: GOL: the introduction of economic development plans for the area, and possible government subsidies.

Significance: Negative impact of moderate significance, with or without mitigation.

ix) Loss of houses, businesses and facilities

Discussion of impact: 27 houses, 4 businesses and 9 VIP toilets lie within 10 m of the centre line of the WAR. Although LHDA provides compensation housing, there have been complaints from the Katse Road (BIR) regarding the timing, quality, comfort, and higher maintenance costs.

25 buildings will be lost due to the Maseru bypass.

Affected parties: Residents of houses, and businessmen.

Mitigation: LHDA : If the WAR is widened as recommended in the BIR, the number of structures that will have to be compensated for will be

reduced to 13 houses, 3 businesses and 3 VIP toilets. Rectify the real complaints that have arisen along the Katse Road.

Significance: Negative impact of moderate significance, with mitigation.

x) Social disruption of local communities

Discussion of impact: 36% of the respondents of the WAR social survey (EEU, 1993d) derive income from livestock, and fear an increase in the scale of stock theft which is already a serious problem. 37.6% of the respondents of the Katse Road social survey reported an increase in stock theft since the construction of the Katse Road.

The influx of up to 500 road construction workers between 1994 and 1997, and large numbers of dam construction workers on the Mohale Dam for 5 years thereafter, could disrupt local communities, as has been found to be the case along the Katse Road (BIR), by: exerting pressure on limited resources such as water and toilet facilities; increasing the prevalence of alcoholism, and introducing (/increasing) prostitution and associated sexually transmitted diseases (STD's).

Alteration of village social hierarchies through the provision of modern compensation structures has been found to have caused conflict along the Katse Road (BIR).

Due to crop compensation for a period of 15 years, dependency may occur.

Affected parties: Local communities along the WAR.

Mitigation: LHDA: The establishment of dispute resolution committees comprising members of the local communities and contract labour should be introduced according to the appropriateness to the local communities. The provision of compensation structures should be done in a sensitive and consultative manner. Recreational facilities for construction workers should be provided. Provision of family housing for construction workers would reduce some of the social concerns identified.

Significance: Negative impact of moderate significance, with mitigation.

(b) *The Least Cost Alternative Route (LCAR)*

i) Improved transport and access to services

Discussion of impact: For the first time villages between Pulane (5 km south-east of Ha Mateka) and Ha Mohale (2 km north-east of the Mountain Road) would be served by a vehicular access route. Responses from the questionnaires and informal interviews conducted during the social survey of the LCAR (EEU, 1993d) suggest the following positive effects on the lives of the local residents:

- * Easier and faster access to clinics: currently sick people face a two to three hour walk or ride to the nearest clinic. The majority of respondents indicated that they attend Likalaneng clinic on the Mountain Road, a four to six hour ride from the northern Jorodane River valley villages. Very sick people have to be strapped to a pony or have to rely on someone riding to fetch medicines. Fatalities sometimes occur before medical assistance can be obtained;

- * Transport for large items such as furniture, building materials, and bulk supplies: People of the Jorodane River valley are involved in the cash economy, and some purchases of large factory made furniture are made, such furniture having to be carried or packed in from Thaba Putsoa on the Mountain Road. Bulk supplies to village shopkeepers, and modern building materials, follow the same route;
- * Transport to and from mortuaries: To allow time for family to assemble for customary burials, bodies have to be carried or packed out to the Mountain Road en route to the nearest mortuary at Maseru, and then retransported back to the village for burial, a costly and time consuming process;
- * Transport for migrant workers: Approximately 80 people (10% of adults) in the Jorodane River valley are employed in the RSA, returning on average for one weekend a month. Having to travel via Maseru, by bus to Thaba Putsoa, and then on foot to their village, they only arrive home at midnight on Friday and have to depart on Sunday morning;
- * Improved social contacts: Several respondents of the LCAR social survey expressed a need to be able to visit and be visited by relatives outside of the valley. The Katse Road social survey shows that that road had positively benefitted respondents;
- * Improved access to agricultural requirements and livestock facilities: Fertilizers and seed are difficult to transport into the Jorodane River valley, whilst excess crops are marketed through middlemen who pay lower prices than the co-

operative on the Mountain Road. Access to shearing sheds and diptanks may also be improved by the presence of a road;

- * Improved access to the regional market: Possible economic benefits may accrue if wool, mohair and crops, plus individual's skills, are able to reach the regional market;
- * Improved access for emergency services: Residents of the Jorodane River valley expressed a wish for easier access for the police to combat stock theft, and for ambulance access, and
- * Improved access to schools: The proposed alignment of the LCAR crosses several tributaries of the Jorodane River, which, during the rainy season, prevent schoolchildren from crossing. Travelling time for high school children (there are no high schools in the valley) will also be shortened.

Affected parties: Local residents, migrant workers, police.

Optimisation: LHDA: Bus stops should be provided along the length of the road, to serve all villages or village clusters. A sufficiently wide road shoulder, including over bridges, should be provided to facilitate safe passage of pedestrians and livestock. GOL / private sector: An efficient and affordable public transport system should be developed along the LCAR.

Significance: Positive impact of high significance, with or without optimisation.

ii) Disruption of local economy

Discussion of impact: The local economy of the Jorodane River valley is very strongly rooted in the informal economic sector. Potential loss of income from the major cash crop as a result of a road being constructed is estimated at between M200 000 and M500 000 per annum. This will be a long term impact on a community with little other access to the mainstream cash economy. A cash income is essential for this community to school their children, as well as to buy food, clothes and seed. No other crop that can grow in this area will be able to match the level of income generated currently.

Affected parties: Local residents, regional traders.

Mitigation: GOL: Development of other sources of income for local residents, including skills training, and development of regional or national markets for other commodities produced within the valley.

Significance: Negative impact of high significance, discounting mitigation by the GOL.

iii) Social disruption of local communities

Discussion of impact: Discussion of impact: The major crime in the Jorodane River valley is stock theft (reported by 92% of the LCAR social survey respondents) and fear an increase. 37.6% of the respondents of the Katse Road social survey reported an increase in stock theft since the construction of the Katse Road.

The influx of up to 500 road construction workers between 1994 and 1997, and large numbers of dam construction workers on the Mohale Dam for 5 years thereafter, could disrupt local communities, as has been found to be

the case along the Katse Road (BIR), by: exerting pressure on limited resources such as water and toilet facilities; increasing the prevalence of alcoholism, and introducing (/increasing) prostitution and associated sexually transmitted diseases (STD's).

Alteration of village social hierarchies through the provision of modern compensation structures has been found to have caused conflict along the Katse Road (BIR).

Due to crop compensation for a period of 15 years, dependency may occur.

Affected parties: Local communities along the LCAR.

Mitigation: LHDA: The establishment of dispute resolution committees comprising members of the local communities and contract labour should be introduced according to the appropriateness to the local communities. The provision of compensation structures should be done in a sensitive and consultative manner. Recreational facilities for construction workers should be provided. Provision of family housing for construction workers would reduce some of the social concerns identified.

Significance: Negative impact of moderate significance, with mitigation.

iv) Loss of agricultural resources

Discussion of impact: Approximately 148 600 m² (14.86 ha.) of cultivated land and 3 320 m² of vegetable gardens lie within the 20 m proposed road reserve of the LCAR, as do 87 fruit trees and 20 other trees, and 9 kraals and 4 stables. In addition to the possible permanent loss of these resources, temporary losses may be expected to result from the siting

of temporary roads, crusher sites, storage sites, and construction camp sites. The loss of food resources is critical to those affected, whilst the sale of fruit, mainly peaches, to travellers of the LCAR, as on the WAR, could provide cash revenue to the owners.

Affected parties: Owners of agricultural resources affected.

Mitigation: LHDA: Where possible, compensation for lost land should be in the form of alternative fields. Avoid siting of road construction infrastructure on arable land. Rehabilitate construction infrastructure areas after completion of the road according to the recommendations in the BIR. Compensation according to the LHDA Compensation Plan.

Significance: Negative impact of moderate significance, with mitigation.

v) Loss of houses, businesses and facilities

Discussion of impact: 19 houses, 2 businesses and 3 VIP toilets lie within the 20 m road reserve of the proposed LCAR. Although LHDA provides compensation housing, there have been complaints from the Katse Road (BIR) regarding the timing, quality, comfort, and higher maintenance costs.

Affected parties: Residents of houses, and businessmen.

Mitigation: LHDA : Apply compensation but rectify the reasons for the real complaints that have arisen along the Katse Road.

Significance: Negative impact of moderate significance, with mitigation.

4.2.3 IMPACTS ON THE BIOPHYSICAL ENVIRONMENT

(a) *The Western Access Road (WAR)*

i) Destruction and local extinction of the Spiral Aloe

Discussion of impact: The Spiral Aloe plant, *Aloe polyphylla*, is listed as a Red Data species by the IUCN, and is endemic to the mountain region of Lesotho. It is under threat due to illegal collection for sale and medicinal purposes, and the known distribution of the plant is believed to have shrunk by a third due to this collection. Several locations of this plant lie near to the WAR, one (at km 47.6) fairly close. Personal observations showed that this plant is commonly offered for sale along the Mountain Road.

Affected parties: Basutho reliant on a sustainable yield for medicinal purposes, botanists wishing to study aloes, tourists wishing to see naturally growing aloes, and the international conservation community.

Mitigation: GOL: Proclamation of strictly conserved and managed aloe reserves along the WAR, with benefits accruing to local communities. Training of current pickers to cultivate aloes from seed. Effective policing.

Significance: Negative impact of moderate significance, discounting GOL mitigation.

(b) *The Least Cost Alternative Route (LCAR)*

i) Increased sediment loading of rivers and streams

Discussion of impact: Lesotho soils are particularly susceptible to erosion, exacerbated by intense summer rain events. Any soil disturbed and exposed by heavy machinery, is rapidly washed downslope into watercourses. As discussed in the BIR, it has been shown that much greater than normal levels of suspended solids occur in watercourses during the construction of roads and bridges, the sources of these solids coming from: erosion from cleared surfaces, unstable cutfaces, side spoil and disturbed river banks; sheet runoff and runoff channeled through culverts into existing drainage courses which erode due to increased water volume and velocity; dumping of rubble and clay into watercourses to facilitate dry bed construction, and movement of heavy machinery in the watercourse during bridge construction.

Negative effects of increased sediment loading include: reduction in the number and diversity of fish and invertebrate populations; reduction in primary productivity by decreased light penetration; sediment abrasion of organisms; smothering of respiratory surfaces, especially in larvae and anurans; sorbing or binding of essential nutrients by the sediment, and alteration of stream bed characteristics by deposited sediments, with associated changes in stream benthic fauna and flora.

As the Jorodane River is a major contributor to the Mohale Dam, increased sediment loading has potentially severe implications for the life span of the dam.

Affected parties: People dependant on, and researchers interested in, the natural ecological functioning of the system. People dependant on water provision from the Mohale Dam.

Mitigation: LHDA: Strict enforcement of erosion control measures as recommended in the BIR. An Environmental Management Plan (EMP) should be drawn up and agreed to by the resident engineer, contractors, and the

recommended Environmental Control Officer (ECO) who should be on site on a permanent basis during the construction period and be empowered to enforce the provisions of the EMP. all runoff from the road should be channeled into side drains or settling ponds to allow for settling out of most of the suspended sediment prior to release into watercourses.

Significance: Negative impact of moderate significance, with mitigation.

ii) Impacts on wetlands and bogs

Discussion of impact: Only about 5% of Lesotho is comprised of bogs (Meakins and Duckett, 1993) Several marshes are crossed by or are adjacent to the proposed alignment of the LCAR. These are important in the ecological functioning of riverine systems, acting as water storage and filters of sediments and excess nutrients. Disturbance or destruction of these wetlands may lead to a change in flow regime of rivers, river bank erosion, and reduction in water quality due to siltation. Most of the wetlands along the LCAR are dominated by broom grass (*Merxmuellera macowanii*), which is the main source of thatching and broom-making material in the Jorodane River valley.

Affected parties: Local communities, and conservationists.

Mitigation: Rehabilitation of high altitude wetlands has been shown by experience with the Bokong wetland on the Katse Road to be difficult. Construction activities in wetlands should be avoided, but if required, a minimum of infilling should take place. The natural water flow of the wetland should be simulated by having many medium diameter rather than fewer large diameter culverts, to reduce water velocity. Gabions or weirs upstream of culverts should be constructed to maintain water levels.

Significance: Negative impact of moderate significance, with mitigation.

iii) Impacts on 2 rare and endangered species of aquatic fauna

Discussion of impact: Two South African Red Data Book species of aquatic fauna, namely the Maluti minnow fish (*Pseudobarbus quathlambae*) which is listed as endangered, and the Aquatic River frog (*Rana vertebralis*) which is listed as restricted, occur in the Jorodane River.

A full descriptive account of the two species is given in the BIR. Both species populations occurring in the Jorodane-Senqunyane River system may represent genetic variations of their species, emphasizing their conservation status. Both species have been shown to be sensitive to silt loading of their river environment as the minnow ova and frog eggs and larvae are highly susceptible to being smothered by silt.

It is unlikely that road construction and later silt and pollution loading of the Jorodane River can be effectively mitigated against, and this in the 14% remaining habitat of these populations after full flooding of the Mohale Dam, a reduction of habitat of this magnitude already possibly enough to force the populations to extinction.

Affected parties: Future generations of Basutho, conservationists, and researchers.

Mitigation: LHDA: construction activities to occur only during the winter months to avoid the period of emergence of larvae or egg spawning. The time schedule for completion of an access to the Mohale Dam site makes this unlikely. Strict application of mitigatory measures as discussed in section 4.2.3 (b)i) above. Full support of the current research being

undertaken by Rall et al, to focus on practical and efficient conservation measures.

Significance: Negative impact of high significance, with or without mitigation.

iv) Destruction and local extinction of the Spiral Aloe

Discussion of impact: The Spiral Aloe plant, *Aloe polyphylla*, is listed as a Red Data species by the IUCN, and is endemic to the mountain region of Lesotho. It is under threat due to illegal collection for sale and medicinal purposes, and the known distribution of the plant is believed to have shrunk by a third due to this collection. Several locations of this plant lie near to the LCAR, one large one near the village of Soosa (10 km from LCAR alignment). Personal observations showed that this plant is commonly offered for sale along the Mountain Road, and it can be expected that similar sales will be made to passing motorists on the LCAR.

Affected parties: Basutho reliant on a sustainable yield for medicinal purposes, botanists wishing to study aloes, tourists wishing to see naturally growing aloes, and the international conservation community.

Mitigation: GOL: Proclamation of strictly conserved and managed aloe reserves along the LCAR, with benefits accruing to local communities. Training of current pickers to cultivate aloes from seed. Effective policing.

Significance: Negative impact of high significance, discounting GOL mitigation.

4.2.4 IMPACTS ON ARCHAEOLOGICAL REMAINS

(a) *The Least Cost Alternative Route (LCAR)*

i) Impacts on Bushman cave paintings

Discussion of impact: The LCAR will traverse the Pulane valley nine the lowlands north of the Maluti mountains. This valley is known to be extremely rich in archaeological sites. The archaeological specialist report in the BIR has identified that construction of the LCAR may threaten rock painting sites (and some stone tool scatterings), presumably due to improved access.

Affected parties: Archaeologists, Basutho national heritage.

Mitigation: The route should be walked by a trained archaeologist and mitigatory measures recommended and implemented.

Significance: Negative impact of moderate significance, without mitigation.

4.3 COMPARISON OF THE WAR AND THE LCAR

Tables 4.1 and 4.2 in the previous section show the major selected positive and negative impacts respectively for the WAR and the LCAR. Table 4.3 presents the predicted major impacts according to four user groups, namely: National and regional planning and development authorities; Local

TABLE 4.3 : FRAMEWORK TABLE of MAJOR IMPACTS ON USER GROUPS

USER GROUP	WAR		LCAR	
	SIGNIFICANCE	COMMENT	SIGNIFICANCE	COMMENT
NATIONAL/REG. PLANNING AUTHORITIES	+ Moderate + High + High	Reinforces national planning objectives Accords with national road plans Maseru bypass will alleviate congestion	- High - Moderate - Moderate	Contradicts national road plans Contradicts national settlement plan Detracts from existing tourist facility
LOCAL COMMUNITIES	+ High + Moderate + Moderate + Moderate - Moderate - Moderate - Moderate - Moderate - Moderate - High	Improved transport, access to services Increased employment/business chances Reduced dust and mud Improved road safety Interference with potable water supply Inconvenience/risks to people/livestock Loss of agricultural resources Cost of living increase Loss of houses, businesses and facilities Social disruption	+ High - High - High - Moderate - Moderate	Improved transport, access to services Disruption of local economy Social disruption Loss of agricultural resources Loss of houses, businesses and facilities
CONSERVATIONISTS	- Moderate	Destruction of Spiral Aloe populations	- Moderate - Moderate - High - High - Moderate	Increased sediment loading of watercourse Impacts on wetlands and bogs Impacts on rare & endangered aquafauna Destruction of Spiral Aloe populations Impacts on Bushman cave paintings
THE PROPONENT	- Moderate	Compensation cost M 811,014 more than for LCAR	+ Moderate	Compensation cost M 811,014 less than for WAR

4.3.1 FRAMEWORK DISCUSSION ACCORDING TO USER GROUPS

(a) *Authorities concerned with national and regional planning and development*

Discounting optimisation or mitigation measures of agencies other than LHDA, it is clear from Table 4.3 that the WAR offers positive impacts, whereas the LCAR offers only negative impacts to national and regional planning and development authorities. For a relatively poor and developing nation, any strengthening of the national infrastructure should be welcomed, whilst projects detracting from or contradicting such infrastructure should be avoided.

(b) *Local Communities*

Bearing in mind that there are two discrete sets of impacted local communities, it would appear from the table that the WAR has more to offer its local communities than does the LCAR for its local communities. Due to their already better access, the negative impacts on the WAR local communities are more likely to be further mitigated sooner than those of the LCAR.

(c) *Conservationists*

The term 'Conservationists' is taken to include all parties having an interest or stake in the conservation of Lesotho's natural resources, whether for intrinsic, scientific, or economic reasons.

It is clear from the table that construction of the LCAR could lead to severe negative impacts on several natural resources, whilst upgrading of the WAR will have little effect.

(d) *The proponent*

Table 4.4 shows the monetary value, which the proponent will have to pay in compensation, of elements which will be destroyed by the WAR or the LCAR, according to the LHDA Compensation Plan. It has been assumed that Maseru alternative no.6 has been chosen by the proponent, as the total compensation figure for that alternative was provided by GBJV during May 1993, as one component of the comparative total costs of the two accesses. A table showing these total costs is attached as Appendix B to this report.

It is estimated that the compensation cost to the proponent of upgrading the WAR will be M811 014 higher than for the construction of the LCAR. However, besides the fact that the proponent, the JPTC, also has to consider the other environmental impacts, the compensation element should also be seen in the context of the entire project costs. In this regard, the compensation costs for the WAR are only 1.0085 % of total WAR costs and the compensation costs for the LCAR are only 0.4321 % of total LCAR costs.

(Appendix B shows that the total estimated cost of upgrading the WAR will be M53 912 535 less than for the construction of the LCAR).

TABLE 4.4 : COMPENSATION REQUIREMENTS OF THE WAR AND THE LCAR
(MALOTIS)

RESOURCE	WAR		LCAR	
	QUANTITY	COMPENSATION	QUANTITY	COMPENSATION
	1. St. Michaels - Patleng			
BUSINESSES	3	115,200	2	80,000
HOUSES	13	499,200	19	760,000
TOILETS	3	2,250	3	2,100
ARABLE LAND (sq.m)	3,148	2,045	148,800	98,590
VEGETABLE GARDENS	588	3,858	3,320	21,381
FRUIT TREES	36	5,580	87	11,310
OTHER TREES	81	8,482	20	1,300
LIVESTOCK STRUCTURES	4	20,360	13	1,080
SPRINGS	7		4	
SUB - TOTAL		854,775		973,781
	2. Maseru Bypass			
BUILDINGS	25	880,000		
LAND (Ha.)	18	450,000		
SUB - TOTAL		1,130,000		
TOTAL		1,784,775		973,781

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5. CONCLUSIONS AND RECOMMENDATIONS

With the exception of the Maseru bypass element, the WAR does not introduce any new infrastructure to Lesotho, but improves the existing infrastructure. The LCAR on the other hand, introduces infrastructure which happens to contradict national planning and development policies and plans.

It is evident from the social surveys conducted during LHDA 1000 that both sets of local communities likely to be affected by either the WAR or the LCAR would welcome the relevant access to the Mohale Dam, even though each will have, or are perceived to have, major negative impacts on these communities.

If information regarding the resettlement and development plans for the major component of LHWP Phase 1B, namely the Mohale Dam construction and flooding, had been known, the significance ratings accorded to the LCAR may well have been different. It is recommended that an integrated development plan be compiled as a matter of urgency. (The same criticism applies to the components of Mohale Dam advanced infrastructure assessed by the LHDA 1000 study team but not included for the purpose of this report (EEU, 1993e).

The negative impacts of the LCAR on the biophysical environment have been shown to be great. If the LCAR is chosen above the WAR as the access to Mohale Dam, it is recommended that the new environmental assessment considers alternative routes and construction methods to reduce the impacts presented in this report.

Whilst for the purposes of this report optimisation and mitigation measures to be applied by agencies other than LHDA have been discounted,

they should not be ignored. it is recommended that the Government of Lesotho, particularly, should implement such measures.

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APPENDICES

**APPENDIX A: IDENTIFIED IMPACTS OF LHDA 1000 NOT SELECTED
IN THE REPORT**

**APPENDIX B: TABLE B.1: COST COMPARISON OF THE WAR AND
THE LCAR**

APPENDIX C: LHDA 1000 STUDY TEAM

APPENDIX A

IDENTIFIED IMPACTS OF LHDA 1000 NOT SELECTED IN THE REPORT

1 THE WAR

1.1 POSITIVE IMPACTS

1.1.1 OPTIMISATION/MITIGATION BY AGENCY OTHER THAN LHDA REQUIRED

Promotes the objectives of the National Settlement Policy (NSP)
Promotes tourism

1.1.2 LOW SIGNIFICANCE WITH LHDA OPTIMISATION/MITIGATION OR LOW ANYWAY

none

1.2 NEGATIVE IMPACTS

1.1.1 OPTIMISATION/MITIGATION BY AGENCY OTHER THAN LHDA REQUIRED

none

1.1.2 LOW SIGNIFICANCE WITH LHDA OPTIMISATION/MITIGATION OR LOW ANYWAY

Aesthetic impacts
Increased siltation of watercourses
Clogging of watercourses with rocks
Loss of marsh areas
Loss of faunal elements
Loss of *Leucosidea* shrubland
Loss of other vegetation
Impact on archaeological materials

2 THE LCAR

2.1 POSITIVE IMPACTS

1.1.1 OPTIMISATION/MITIGATION BY AGENCY OTHER THAN LHDA REQUIRED

Promotion of national planning objectives

Creation of new transport linkages

Promotion of tourism

Promotion of decentralisation

Increased employment opportunities

1.1.2 LOW SIGNIFICANCE WITH LHDA OPTIMISATION/MITIGATION OR LOW ANYWAY

Increased marketing opportunities

2.2 NEGATIVE IMPACTS

1.1.1 OPTIMISATION/MITIGATION BY AGENCY OTHER THAN LHDA REQUIRED

Loss of future options for conservation

1.1.2 LOW SIGNIFICANCE WITH LHDA OPTIMISATION/MITIGATION OR LOW ANYWAY

Interference with/ destruction of potable water supplies

Traffic congestion and increased accidents

Increased crime

Increased risk to livestock

Disturbance of burial sites

Noise disturbance due to blasting

Rockfall on fields

Scarring of landscape and loss of rural character

Loss of *Leucosidea* shrubland

Clogging of river courses with rockfalls

Altered drainage through culverts and bridges

APPENDIX B

TABLE B.1: COST COMPARISON OF THE WAR AND THE LCAR

(MALOTIS)

Source: GBJV

		WAR										
WAR ELEMENT	DISTANCE kms	CAPITAL COSTS	REHABILITATION COSTS	COMPENSATION COSTS	TRANSPORTATION COSTS	MAINTENANCE COSTS	TOTAL COSTS	LCAR				TOTAL COSTS
LCAR ELEMENT	DISTANCE kms	CAPITAL COSTS	REHABILITATION COSTS	COMPENSATION COSTS	TRANSPORTATION COSTS	MAINTENANCE COSTS	TOTAL COSTS					TOTAL COSTS
Maseru Station	0.0	5,818,000	0	0	17,990,000	0	23,808,000					
Maseru Bypass	21.0	16,403,142	0	1,130,000	9,964,957	86,940	27,585,039					
Mazenod - St.Michaels	13.5	0	599,174	0	8,406,043	55,890	7,081,107					
St.Michaels - Paltseeng	60.0	69,813,966	0	654,774	42,284,000	248,400	113,001,140					
TOTAL	94.5	92,035,108	599,174	1,729,174	78,645,000	391,230	171,455,286					
Ficksburg Station	0.0	0	0	0	15,055,000	0	15,055,000					
Ficksburg - Teyateyaneng	45.0	0	2,261,650	0	27,818,504	186,300	30,266,454					
Teyateyaneng - Ha Mateka	18.5	0	2,743,120	0	11,436,496	76,590	14,256,206					
Teyateyaneng Bypass	0.0	8,808,000	0	0	0	0	8,808,000					
Ha Mateka - Paltseeng	60.0	113,553,000	0	973,761	44,207,000	248,400	158,982,161					
TOTAL	123.5	120,361,000	5,004,770	973,761	98,517,000	511,290	225,367,821					

The costs presented in Table B.1 were provided in May 1993 by GBJV.

It will be noted that the Compensation Cost for the Maseru Bypass in the WAR accords with Alternative No. 6 in the Initial Assessment of the Maseru Bypass (EEU, 1993a).

Capital costs relate to new structures,

Rehabilitation costs relate to upgrading of existing structures,

Compensation costs relate to those elements to be compensated for by LHDA.

Transportation costs relate to the operating costs of vehicles transporting material and equipment to the Mohale Dam.

Maintenance costs relate to costs of maintaining accesses up until completion of the Mohale Dam.

Note. This table has been amended as the compensation figures for the WAR and the LCAR were transposed, the compensation cost for the Maseru Bypass was listed under Rehabilitation costs, and the WAR compensation cost was duplicated as Rehabilitation cost to the WAR.

APPENDIX C

LHDA 1000 STUDY TEAM

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