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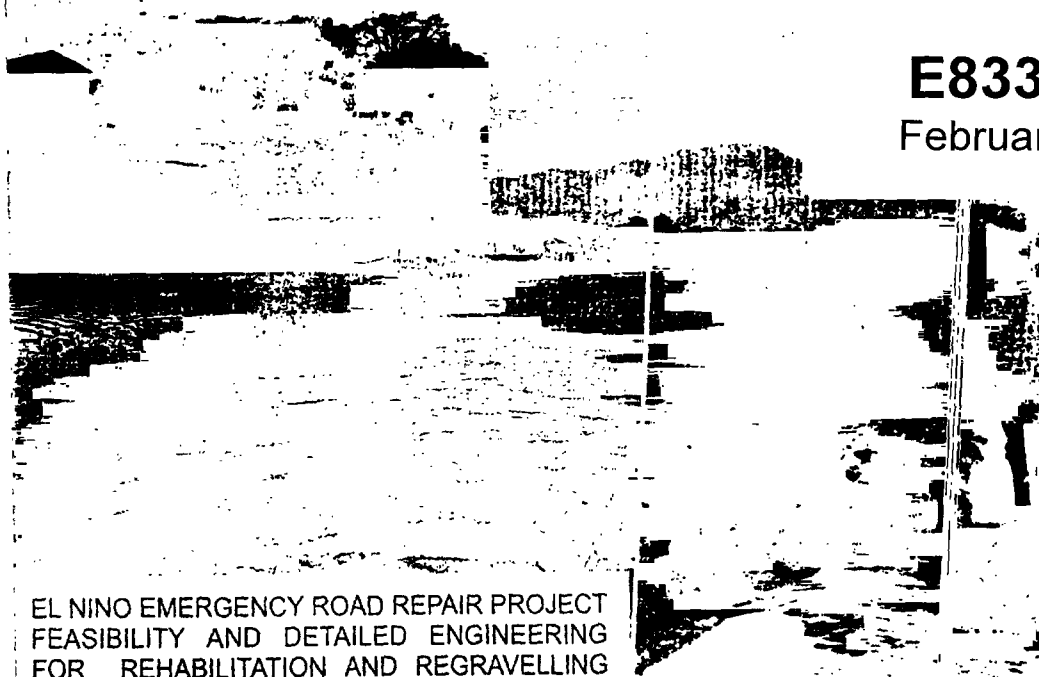


**Ministry of Works, Housing
and Communications**

ATIAK TO MOYO ROAD

E833 V. 1

February 2001



EL NINO EMERGENCY ROAD REPAIR PROJECT
FEASIBILITY AND DETAILED ENGINEERING
FOR REHABILITATION AND REGRAVELLING

FEASIBILITY DESIGN REPORT

VOLUME 2

Section VI - Environmental Impact Assessment Study



Nicholas C'Dwyer
Consulting Engineers
in association with
Sampar Associates

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(Mark 4)



VOLUME 2

SECTION VI

17. ENVIRONMENTAL IMPACT ASSESSMENT STUDY

THIS VOLUME IS THE SECOND VOLUME OF A SET OF THREE VOLUMES.
THE OTHER VOLUMES ARE:

VOLUME 1 - MAIN TEXT

VOLUME 3 - APPENDICES

SECTION VI
ENVIRONMENTAL IMPACT ASSESSMENT STUDY

17. Environmental Impact Assessment Study

17. ENVIRONMENTAL IMPACT ASSESSMENT STUDY

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17 ENVIRONMENTAL IMPACT ASSESSMENT STUDY

17.1 EXECUTIVE SUMMARY

17.1.1 INTRODUCTION

17.1.1.1 Background

The Atiak-Moyo Road was to be periodically maintained in 1991 as part of a network of 400 km of gravel roads to be rehabilitated under the IDA funded Northern Uganda Reconstruction Project. Rehabilitation works on the road began in May 1994, but due to insecurity in the project area, the works were suspended in February 1996. The condition of the road has since deteriorated, and the situation was greatly exacerbated by the El Niño phenomenon.

In October 1998, the MOWHC invited bids for a feasibility study to continue the rehabilitation works on the Atiak-Moyo Road, using funds from the El Niño Emergency Project. In December 1999, Nicholas O'Dwyer Consulting Engineers were awarded the contract for the study and the letter of commencement was issued in February 2000.

The objective of the environmental study is to document the present condition of the environment and assess the positive and negative impacts due to the improvement of the project road.

17.1.1.2 Legal Setting

There are a number of legal instruments that relate to environmental issues associated with the road sector. The most important are the National Environment Statute of 1995, and the Environmental Impact Assessment Regulations of 1998. In addition there are sectoral laws which influence environmental management of the road sector in the country. These include the Constitution of Uganda (1995), the Local Governments Act (1997), the Uganda Wildlife Statute (1996), the Lands Act (1998), the Water Statute (1995), the Roads Act (1964), the Access to Roads Act, the Forest Act, the Mining Act, the Town and Country Planning Act and the Electricity Act.

17.1.2 PROJECT SETTING

The location of the project road is indicated in the Location Map. Hydrologically, the road lies within the Albert Nile Drainage Basin. Average rainfall in the project area is about 1200-1300 mm per year. In broad terms, the soil type from Atiak up to Umi on the River Nile is sandy loam, but beyond the Nile to Moyo it is predominantly sand.

The project road traverses areas of moderate to low population. Subsistence agriculture is the main livelihood of the people living in the area of influence of the project road, while some fishing is also done.

There are several NGOs in the project area that are involved in refugee resettlement programmes.

17.1.3 COMPONENTS OF THE ROAD DESIGN

The project involves the feasibility and preliminary design for upgrading to Class A gravel, approximately 91.7 km of road from Atiak in Gulu District to Moyo in Moyo District.

The project road is an existing road, which had been rehabilitated to various stages of completion before it was abandoned in February 1996 due to security reasons. Consequently, many of the structures, such as culverts, are already in place but need to be completed, while the camber essentially requires reslaping, rather than extension. No realignments are proposed. However all seven bridges will be either substantially rehabilitated or expanded to allow two-way traffic flow.

17.1.4 IMPACTS DUE TO THE EXISTING ROAD

The economic benefits that could be derived from the project road have not been fully realised because of the insecurity along the project road. At present, the project road is in poor condition, and few public service vehicles ply the road - along some sections armed escorts are necessary or vehicles must travel in convoy.

Consequently the existing road has made little difference to the refugee settlement activities that are being carried out by the various NGOs in the area.

A number of open gravel pits and a hardstone quarry were visited along the project road but none had been rehabilitated. The hurried departure by the previous contractor was given as the reason.

Some soil erosion was noticed along the side drains and in mitre drains, and also at the edges of gravel pits.

Dust resulting from the passage of vehicles was very noticeable, particularly in the locality of towns and villages.

No specific attention had been paid to road safety - there is a general lack of warning or directional signs, especially near settlements, towns/villages, hospitals and schools

17.1.5 ANTICIPATED IMPACTS DUE TO THE PROJECT ROAD

Road projects are associated with numerous sociological and socio-economic benefits, resulting from improved access to schools, health facilities and villages (market centres), which contribute to increased productivity and thus an ultimate improvement in standards of living. However, until the security situation in the area improves, little economic or socio-economic benefit will be realised as a direct result of rehabilitating the project road.

Soil erosion will be a major issue during the rehabilitation works, and will result from earthworks, borrowing/quarrying and deviations. Improper drainage of runoff from the road to the lower catchment can also cause erosion. Improvement of the ferry landing will result in protection of the river bank, as well as contribute to the well-being of the ferries themselves.

Air, noise, dust and oil pollution will occur during construction and operation. This could impact on public health. Sediment loads will increase temporarily due to the expansion of the bridges.

Deviations will only be necessary at the seven bridges that will be either substantially rehabilitated or expanded to allow two-way traffic.

Major concerns relating to gravel pits and hardstone quarries include dust and disturbance during excavation (including destruction of structures and graves), and the need to reinstate or landscape the pits/quarries when the contractor has completed excavation.

Loss of land will occur where land must be acquired for the workmen's camp, gravel pits and hardstone quarries, and the crusher plant site. Crops may also be removed at these sites. These impacts will be temporary, provided rehabilitation of the sites is done properly.

There is not expected to be much disturbance to people in the main towns of Atiak, Adjumani and Moyo during construction.

The workforce may put an additional demand, albeit temporarily, on fuelwood and water supplies. Sanitation and solid waste disposal will be a significant negative impact resulting from the workmen's camp. The influx of workmen interacting with the local people may lead to an increase in sexually transmitted diseases.

Faster traffic speeds encouraged by an improved road surface may lead to an increase in the number of road accidents.

17.1.6 MITIGATION

Mitigation in some form is possible for all adverse impacts that may result from the proposed rehabilitation works.

Hydrological impacts can be minimised by allowing unimpeded flow of water, i.e. through the provision of an adequate number of culverts in the road design.

Impacts due to earthworks and quarry excavation can be reduced by exercising care, and if possible, carrying out these activities during the dry season. Reinstatement/landscaping of gravel pits/quarries, replanting areas cleared for deviations, and vegetating the road embankment in the steep section would help to prevent soil loss and reduce visual intrusion.

The introduction of speed restrictions in towns and villages can reduce dust emissions. Crushing plants should be located downwind of households to lessen disturbance caused by noise and dust pollution. Sensitising motorists and providing special parking areas for trucks at Adjumani and Moyo can control oil and noise pollution.

Deviations should remain within the road reserve as far as is practically possible. Crops and existing structures on land that is temporarily acquired for deviations and lies outside the road reserve should be compensated.

Locating the workmen's camp at either Adjumani or Moyo will minimise some impacts. The workmen's camp should use gas or electric cookers to preclude the need to buy charcoal, and a central canteen for the workforce would reduce energy and water consumption and the amount of solid waste generated. STD awareness campaigns should be conducted in the camp as well as in the towns/villages.

Workmen should be provided with suitable protective working gear. Fully equipped first aid kits should be kept on site and the contractor must have workmen's compensation cover.

Road safety can be enhanced through installing clear and frequent road signs and markings.

Diligence on part of the contractor is essential in mitigating negative impacts, and therefore mitigation measures should be specified in the tender documents and conditions of contract.

17.1.7 MONITORING

Mitigation measures, design features, or actual impacts can be monitored to ensure environmental acceptability of the project during and after construction. In some cases, monitoring can be done as part of routine or periodic maintenance, while other parameters, especially socio-economic or ecological ones, can only be effectively assessed in the longer term. Parameters that can be monitored include:

- efficiency of drainage structures
- interventions for erosion control off road, on the road embankment, and river bank
- gravel pit and quarry rehabilitation
- establishment of trees along the road in the three mi in towns and also larger villages
- sanitation at workmen's camps
- payment of compensation for gravel and hardstone excavation
- impact on public health (due to dust, STDs)
- air, water and noise quality
- impact on road safety
- economic development in study area.

17.1.8 CONCLUSIONS AND RECOMMENDATIONS

17.1.8.1 Conclusions

The primary objective of upgrading the Atiak-Adjumani-Moyo Road is to improve road conditions so that traffic flow is more efficient to and from markets, and substantial savings are made in vehicle operating costs. It is anticipated that in the long term, and provided the security situation along the road improves, there will be considerable economic benefit accruing to the areas of influence of the project road due to stimulated agricultural and fishing activities.

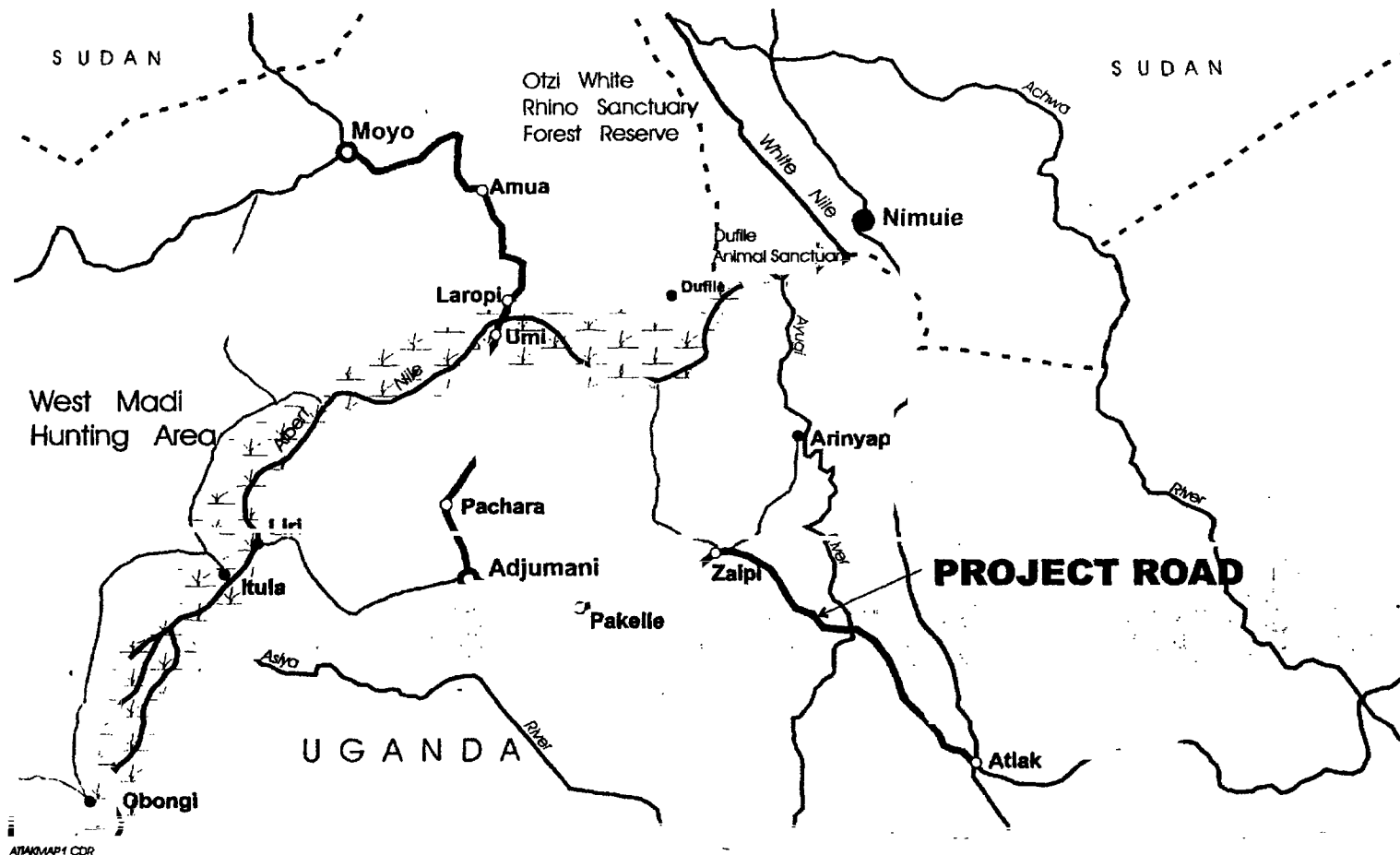
As the project road already exists, the natural environment has already been considerably altered. Therefore any major impacts have already occurred and additional disturbances due to construction will be relatively minor. Neither does the road harm any sites that are historically important.

17.1.8.2 Recommendations

Recommendations made in this report are summarised as follows:

- quarries and gravel pits must be cordoned off or fenced during use, and rehabilitated after use as per the requirements of the landowners;
- gravel pits and quarries that have been abandoned since the previous contract must also be rehabilitated under this contract;
- shrubs and grasses should be planted on the road embankment along the steep chert gorges section from Km 71 to Km 77 to prevent erosion;
- unnecessary clearing of vegetation should be avoided to preclude additional erosion;
- trees should be planted along the roadside at Atiak, Adjumani and Moyo, as well as the major villages along the road (ie. Dzaipi, Pakelle, Umi, Laropi, Amua, Erepi) to improve visual aesthetics and as filters for particulate matter;
- a special parking area should be provided for trucks at Adjumani and Moyo;
- the local people, particularly in the towns, must be informed of the details and progress of the project;
- compensation to landowners who must temporarily relinquish their land for gravel pits, hardstone quarries, deviations (if required), and the workmen's camp must be fair and paid promptly. It should cover crops, all structures (permanent and mud-and-wattle structures, pens, sheds, fences, etc) and material.

Diligence on the part of the contractor and proper supervision by the supervising engineer during construction and the initial operation period is crucial for mitigating impacts. Furthermore all mitigation measures need to be specified in tender and contract documents, and must be included in the Engineering Drawings, Specifications and Bills of Materials.



Map No 1

17.2 INTRODUCTION

17.2.1 BACKGROUND

The Atiak-Moyo Road is located in mid Northern Uganda. The project road begins at Atiak (60 km north of Gulu town), where it branches off from the Great North Road. It ends in Moyo town, just south of the Sudanese border. The road is approximately 91 km in length. (Map 1 shows the location of the project road).

Under the IDA-funded Northern Uganda Reconstruction Project (NURP-Credit No. 2362-UG), the road was to be periodically maintained in 199 , as part of a network of 400 km of gravel roads to be rehabilitated. SIETCO China were awarded the contract to undertake rehabilitation works in May 1994, but due to insecurity in the project area, the works were suspended in February 1996. The contracted works were left at various stages of completion. Continued insecurity in the project area led to the contract being eventually terminated in November 1997. Hence, since February 1996, no maintenance work has been carried out on the road. The condition of the road has deteriorated, and the situation was greatly exacerbated by the El Niño phenomenon.

In October 1998, the MOWHC invited bids for a feasibility study to continue the rehabilitation works on the Atiak-Moyo Road, using funds from the El Niño Emergency Project. In December 1999, Nicholas O'Dwyer Consulting Engineers were awarded the contract for the study.

The Terms of Reference for the study describe the objective of this feasibility study as being to "investigate the economic, environmental and technical feasibility of improving the Atiak-Moyo Road and to carry out detailed engineering and the preparation of contract documents and cost estimates including facilitation of the bidding process for the works".

17.2.2 OBJECTIVES OF THE ENVIRONMENTAL STUDY

The objective of the environmental study is to document the present condition of the environment and assess the positive and negative impacts due to the improvement of the project road.

The requirements of the environmental study are indicated in the Terms of Reference (see Appendix A).

17.2.3 APPROACH AND METHODOLOGY

Invitations to tender for this project were issued in October 1998. At this stage, the national environmental guidelines had barely been released, and the *Environmental Impact Assessment Regulations* had not yet been enacted. The project was therefore not allocated to a screening category for the purposes of conducting an environmental impact assessment (EIA). Information obtained from the reconnaissance site visit indicated that the project road

would require environmental analysis, but not a full EIA as it was not anticipated that the road would have significant adverse impacts that could not be mitigated. In other words, according to World Bank screening procedures, this project would be classified as a Category B project.

The approach and methodology for conducting this study is based primarily on the National Environment Management Authority's *Guidelines for Environmental Impact Assessment in Uganda* (NEMA, July 1997), the *Environmental Impact Assessment Regulations* (G.O.U., 1998) and the World Bank's *Operational Directive 4.01 Environmental Assessment* (October 1991).

This environmental study is part of the feasibility study for road rehabilitation works, and aims to highlight the environmental issues of concern that need to be considered during the planning, design, construction and operation phases of the project.

Field work for the environmental study was conducted in the third week of March 2000. Discussions were held with various people in the field, as well as in Entebbe and Kampala (a list of persons consulted is presented in Annex 3).

17.2.4 ENVIRONMENTAL POLICY AND LEGAL FRAMEWORK

17.2.4.1 Legal Instruments Applicable to the Road Sector

The National Environmental Action Plan (NEAP) Process began in 1991 and identified the following as being the main problems related to poor environmental management:

- the absence of comprehensive and coordinated environmental policies;
- inadequate environmental legislation;
- lack of cooperation and coordination;
- inadequate information on environment and natural resources; and
- the lack of trained management specialists.

The NEAP process resulted in the formulation of the *National Environment Management Policy* (1994). This document provides the basis for achieving the overall goal of "sustainable socio-economic development which maintains and enhances environmental quality and resource productivity to meet the needs of present and future generations". During the NEAP Process, solutions and options were developed for policy, legislation, institutional reforms and new investments.

Subsequently, the *National Environment Statute* was enacted in May 1995 which provided for a planning framework, standards and strengthened sectoral laws. It also provided for the establishment of the National Environment Management Authority (NEMA) which would be responsible for coordinating all aspects related to environmental management in the country. The *National Environmental Action Plan for Uganda* was published in June 1995. The document puts forward a strategy for integrating environmental concerns into socio-economic planning and development. Finally, the *Environmental Impact Assessment Regulations* of May 1998 made environmental impact assessment mandatory for listed categories of projects (including highways and roads) appearing in the Third Schedule of the *National Environment Statute*.

There are a number of other legal instruments that relate to environmental issues associated with the road sector. The most important are the Constitution of Uganda (1995), the Local Governments Act (1997), the Uganda Wildlife Statute (1996), the Lands Act (1998), the Water Statute (1995), the Roads Act (1964), the Access to Roads Act, the Forest Act, the Mining Act, the Town and Country Planning Act and the Electricity Act. On the whole, these statutes are sector specific; as a result they are not well coordinated and their effectiveness is diminished.

Property rights and compensation issues are catered for under the Constitution of Uganda (1995), the Survey Act, the Land Act (1998), the Roads Act and the Access to Roads Act.

In 1998, an Occupational Safety, Health and Working Environment Bill was drafted by the Department of Occupational Safety and Health in the former Ministry of Labour and Social Services (now the Ministry of Gender, Labour and Social Development). The Bill provides for the health and safety of persons at work in both factories and other working environments, and incorporates international provisions concerning environment and the workplace.

17.2.4.2 Current Situation

In general, environmental considerations are given little importance during improvement and maintenance activities. This perhaps stems from a lack of understanding of the relevance of environmental management by road sector personnel at the MOWHC Headquarters and district level, and also by many consulting engineers and contractors involved in road works. The terms of reference for feasibility studies include environmental impact assessment (EIA) studies usually at the behest of the donors funding the studies. Within the MOWHC there is no system in place for reviewing EIAs that are conducted; and although NEMA is supposed to be involved in the review process they are not continually informed of road projects that are being, or will be, implemented.

A study conducted by Arcadis Euroconsult in 1999 (ref. Annex 2: *FRSP Environmental Policy and Management Study*, Arcadis Euroconsult March 1999) made recommendations for the establishment of environmental units in both the MOWHC and the Road Agency Formation Unit (RAFU). The responsibility for environmental management in the road sector will therefore eventually lie with these units. Currently, these units are in the process of being set up. While the RAFU (or eventually the Road Agency) unit will deal with the implementation of EIAs, the unit in the MOWHC will be concerned mainly with policy and management issues relating to the environment. It is envisaged that the establishment of these units will contribute to mainstreaming environmental issues into road sector activities.

17.2.5 REPORT PRESENTATION

This report presents the findings of the environmental study for the Atiak-Moyo Road Project and recommends preliminary mitigation measures that should be incorporated in order to minimise adverse impacts that may arise from the improvement works.

The Executive Summary is presented as Chapter 1. This chapter (Chapter 2) gives background information relevant to the study, describing the objectives and requirements of the study. Chapter 3 presents the project setting and describes the administrative, physical, natural and social environments of the project areas. Chapter 4 briefly outlines the anticipated project components that are relevant to the environmental study.

Chapter 5 documents impacts and observations from the existing road, while impacts anticipated as a result of the rehabilitation works are described in Chapter 6. Chapter 7 proposes means for mitigation of adverse impacts, and in Chapter 8, monitoring procedures and the environmental management plan are discussed.

Chapter 9 contains conclusions and recommendations.

17.3 PROJECT SETTING

17.3.1 GENERAL

The project road consists of a 91 km section between Atiak and Moyo. The road branches off the Great North Road that connects Cape Town with Cairo. It starts at the Nimule-Adjumani-Atiak junction and runs in a northwesterly direction to just before Dzaipi. Here it turns to run in a westerly direction all the way to Adjumani town.

From Adjumani, it heads generally north to Umi, reaching the ferry crossing across the Nile River (the Albert Nile) shortly afterwards. On the other side of the Nile, the road continues through Laropi and north to Metu, after which it swerves to the west to reach Moyo.

Unless otherwise stated, most of the information presented in the following sections has been sourced from the respective *District Development Plans 1999-2002*, and the *District Environment Profiles* (1998). A list of references is presented in Annex 2.

17.3.2 ADMINISTRATIVE LOCATIONS

The road traverses through three districts, namely Gulu, Adjumani and Moyo, and eight sub-counties. These are tabulated below:

Table 17.3.1: Districts and Sub-Counties Traversed by the Project Road

District	Sub-Counties
Gulu	Atiak
Adjumani	Adropi
	Dzaipi
	Pakelle
Moyo	Moyo Town Council
	Moyo
	Metu
	Dufile

Source: Ministry of Finance, Planning and Economic Development, Entebbe, March 2000.

17.3.3 DEMOGRAPHIC CHARACTERISTICS

It is not possible to determine the exact population within the area of influence of the project road without undertaking a house to house survey. The last population census was held in 1991. Population figures since that time are available only as projections. In the table below, the projected present population of the sub-counties adjacent to or straddling the project road is presented, based on census figures from 1991.

Table 17.3.2: Estimated Population along the Project Road

District	County	Sub-County	Projected Population for 2000	Estimated Average Growth Rate
Gulu	Kilak	Atiak	29,014	3.2%
Adjumani	East Moyo	Adropi	30,730	1.7%
		Dzaipi	22,716	
		Pakelle	19,738	
Moyo	West Moyo	Dufile	14,032	2.8%
		Metu	20,029	
		Moyo	33,132	
		Moyo TC	8,943	
Total			178,334	

Source: Statistical Department, Ministry of Finance, Planning and Economic Development, Entebbe, March 2000.

The growth rates given above for each district are also based on figures obtained from the 1991 census. In the project districts, the influx of refugees has also had an impact on growth rate. Rates shown here have been calculated using the usual formula and projected populations from 1998, and thus can only be considered as indicative.

It has also not been possible to calculate the population density along the road because accurate areas for each of the sub-counties were not available.

17.3.4 CLIMATE AND RAINFALL

All three districts are characterised by seasonal variations in rainfall, temperature and winds, influenced greatly by the passage of the Equatorial Trough over Uganda during April/May and October/November. The project area experiences two rainy seasons in April/May and August/October. Consequently, the dry periods occur between November and March, and in June/July. Average rainfall is approximately 1200 to 1300 mm per year. Minimum and maximum average annual temperatures are approximately 21°C and 30°C, respectively.

17.3.5 TOPOGRAPHY

The topography of the project area (and the road alignment) from Atiak can be described as gently undulating hills, descending gently towards the Nile floodplains, then ascending into gently rolling terrain once again. The land then rises steeply as it encounters a small scarp, then descends again across rolling terrain towards Moyo town.

17.3.6 HYDROLOGY

The project area lies in the Albert Nile hydrological basin, and this river is the major feature of the project area. There are several rivers in the project area, most of which are seasonal, while some are perennial. The major rivers within the project area that

drain into the Nile include the Erudzi, Ayug, Esia, Itirikwa, Irei, Chala, Surumu and Amua Rivers.

17.3.7 GEOLOGY AND SOILS

The project area lies mainly on the West Nile Plateau. Geologically, the main rock formations are of the Pre-Cambrian era comprising quartzites, phyllites and undifferentiated acid gneiss, with some intermediate gneisses.

The main soil types within the project area are vertisols, lithosols, alluvials, ferruginous and ferralitic.

17.3.8 VEGETATION AND FORESTS

The main vegetation types in the project area are woodland, Combretum savanna, Butyrospermum savanna, grassland savanna and swamps.

Gazetted forest reserves (FR) near the project road are the Era and Otzi (East) Forest Reserves. Both are woodland forests rather than tropical high forests. The western boundary of the Otzi (East) FR runs parallel to the Laropi-Erepi stretch of the road, and is about 5 km away from the road. Era FR is situated about 10 km directly south of Moyo town, and 10 km to the west of the Laropi-Erepi stretch of the road. However, access to these forest reserves from the project road is difficult.

Other forest reserves in the three project districts, such as the Zoka, Kilak, Wicari, Achwa and West Madi Forest Reserves are too far from the road, and are not accessed by this road.

17.3.9 WILDLIFE

There are two wildlife reserves in the vicinity of the project area: Dufie Animal Sanctuary and Otzi Game Reserve. Wildlife found in these protected areas include Uganda Kob, Sitatunga, Warthog, Hippopotamus, Vervet Monkey, Baboon, Crocodile, and hundreds of species of birds and butterflies. Chimpanzees have also been seen in Otzi Game Reserve, but they are nomadic and frequently move into southern Sudan.

17.3.10 WETLANDS

The banks of the Albert Nile are covered with permanent wetlands, the main vegetation species being papyrus and reeds.

There are a number of seasonal wetlands in the project districts. However, the project road crosses only two, at Km65+000 and Km 66+000 approximately.

17.3.11 AGRICULTURE

The main type of economic activity along the project road is subsistence agriculture. The farming system is categorised as the "northern system" which is based on cotton rather than tobacco. The main food crops grown are cassava, sorghum and millet. Groundnuts, sesame, beans, maize, sunflower, cow and pigeon peas, and potatoes are also grown. There is potential for growing cotton as a cash crop, but poor infrastructure, inadequate extension services, poor pest and disease management, and lack of access to markets have led farmers to concentrate on food crops.

Livestock production is a minor activity. The main breed of cattle kept is the indigenous zebu breed, and these are usually kept under the traditional communal grazing system. Goats, sheep, pigs and chickens are also kept.

17.3.12 FISHERIES

Fishing is a part-time activity undertaken by men to supplement the household food needs and for sale locally. Fishing takes place in the River Nile and in the seasonal and permanent rivers. However, in recent years fish production has declined, apparently as a result of the establishment of water hyacinth in the Nile (*Moyo District Environment Profile*, 1997). There is some fish-farming too. But lack of access to fish landing sites and markets makes fishing commercially non-viable at present.

17.3.13 TOURISM

Tourism in the project area has not been exploited yet. The lack of infrastructure and facilities (in terms of lodges/camps, water supplies, and access) hinders the development of tourism. In addition, the forest reserves and wildlife reserves (Otzi, Era, and Dufile) are generally outside the tourist circuit that does not go beyond Marchison Falls National Park. Consequently, Ugarda Wildlife Authority (UWA) has not prioritised these reserves for development in the near future (*pers comm* Lilly Ajarova, UWA, March 2000).

Just north of Adjumani lies the Arra Fishing Lodge, which opened in May 1999. On average the camp receives 10-15 guests per month who come in from Europe to fish for Nile Perch (*pers comm* Horst Pirker, Arra Fishing Lodge, March 2000). However, at the time of the site visit, the camp was closed due to generator problems.

17.3.14 REFUGEE CAMPS AND ASSOCIATED ACTIVITIES

The insurgency in southern Sudan has led to an influx of refugees into Moyo and Adjumani Districts. The main refugee camps are located in Itula in Moyo District, and Adropi, Ciforo, Dzaipi, Ofua and Pakelle in Adjumani District. As a result there are numerous non-government organisations (NGOs) operating in the project area, including Aktion Afrika Hilfe (AAH), International Aid Sweden (IAS), Agency for Cooperation in Research and Development (ACORD), Action Contre le Faim (ACF), Lutheran World Federation (LWF) and Danish Assistance to the Self-reliance

Strategy (DASS), among others. Activities undertaken by these organisations include camp management, micro finance, agricultural support, water resource development, infrastructure development, health programmes, community services, education, and vocational training. The activities carried out by these NGOs are all coordinated by the United Nations High Commission for Refugees (UNHCR).

17.4 COMPONENTS OF THE ROAD DESIGN

17.4.1 GENERAL

The road design is described in more detail in other sections of the Feasibility Report. However, it must be noted that at this stage the design is by no means final, and the preliminary design only makes recommendations for incorporation into the final design. For the purposes of this environmental assessment, it is necessary to understand certain features of the road design in order to identify significant impacts that may arise as a result of the project.

The project road is an existing road, on which construction had begun but was abandoned in February 1996 due to security reasons. Consequently, many of the structures, such as culverts are already in place but need to be completed, while the camber essentially requires reshaping, rather than extension.

17.4.2 DESIGN FEATURES

Features of relevance to the environmental assessment are as follows:

- the project road is an existing road, where rehabilitation works are in various stages of completion
- consultancy is to design of approximately 91.2 km of gravel road to Class A standard
- no realignments are proposed
- width of carriageway = 6.0 m
- width of each shoulder = 1.0 m
- total width of road = 8.0 m
- existing culverts of armco type to be repaired and headwalls completed (number to be confirmed)
- trapezoidal side drains will be constructed through villages/towns and where there is little space for excavation along the side of the road. Elsewhere, side drains will have the standard cross section, as illustrated in the Inception Report
- seven (7) existing bridges to be either rehabilitated or widened for 2 way traffic located at the following chainages: Km 14+400, Km 17+600, Km 21+200, Km 43+000, Km 70+100, Km 76+100, Km 87+300
- The road crosses two swamp areas at Km 65+000 and Km 66+000 (just before and after the River Nile)
- maximum gradient of fill slopes = 4.0%
- no new rock cuts
- the design will include ferry landings on the Nile River
- road reserve for A Class gravel road = 30 m (15 m each side of centreline)
- deviations will not be necessary during construction, except at bridges
- gravel pits have been identified and sampled, but final selection is to be made
- hardstone sources have been identified and sampled, but final selection is to be made
- a workmen's camp (including the contractor's camp) will have to be established along the project road.

17.5.2.2 Impact on the Refugee Settlement Activities

As such the road has not contributed to enhancing the refugee settlement activities that are being carried out by the various NGOs in the area. The prime reason for this is insecurity along the road, rather than any impacts resulting from previous construction activities.

17.5.2.3 Gravel Pits and Hardstone Quarries

A number of open gravel pits were visited along the project road, but none have been rehabilitated. When gravel pits are left open after use, the entire quarry area is rendered useless for cultivation. At Erepi, one family had about 0.5 acres of the farm excavated. That area is now totally barren, although the stockpiles of topsoil are still there.

The field trip was undertaken during the dry season. Consequently, no water was seen to have accumulated in the pits that were inspected. However, in the rainy season water does pond in these abandoned pits, posing a potential health risk as they provide breeding habitats for mosquitoes. A further risk is put to children who may play in the water. Erosion was also noticed at the edges of some pits.

Evidently the contractor (SIETCO) had no time to rehabilitate or "make good" the pit sites because he had to leave so abruptly. However, from experience elsewhere in the country, it is doubtful that he would have rehabilitated the pits even if he had stayed on. Reasons frequently quoted for leaving pits open are that rehabilitation of pits was not included in the contract documents; the contractor was not instructed to do so by the supervising engineer; the pits are often required till the end of the project, so there is no point in rehabilitating them; the local people prefer that the pit is left open (although the local people are often not consulted on the matter), etc.

At one gravel pit site which is used by the District Council, some structures (huts, pit latrines) were left perching on little islands in the middle of the pit. Villagers also complained that the contractor (not SIETCO) even dug up some graves. In this case it appears that the contractor had little regard for the villagers living adjacent to the borrow areas. This underlines the need to supervise contractors during negotiations with landowners and during actual excavation of pits and quarries.

Another sensitive issue relating to gravel pits and hardstone quarries is that of compensation. Although most landowners were paid for borrow material taken, only a few people have been compensated for demolished structures and loss of crops. (This was mainly in Adjumani District, where the villagers organised themselves to approach the MOWHC for compensation). Livestock killed during blasting operations were not compensated for. Consequently there is a certain amount of acrimony amongst the local people.

17.5.2.4 Soil Erosion

Some soil erosion was noticed along the side drains (particularly in the steeper sections) and in mitre drains. However, overall there was no serious damage due to erosion, and the new project will include remediation measures for this.

17.5.2.5 Dust Emissions

Most vehicles, but heavy goods vehicles in particular, throw up a lot of dust in their wake as they move along the road. Although respiratory track infections as well as eye infections are among the ten most common illnesses in the project area, these cannot be attributed only to dust emissions from the road. However, it is likely that dust is a contributing factor.

17.5.2.6 Road Safety

There is a general lack of warning or directional signs, especially near settlements, towns/villages, hospitals and schools.

17.6 ANTICIPATED IMPACTS DUE TO REHABILITATION WORKS

17.6.1 INTRODUCTION

This chapter deals with the impacts anticipated as a result of the proposed rehabilitation/ improvement works on the project road. Issues considered as being significant for the purposes of the overall assessment are described in more detail in Section 6.2, while mitigation measures for adverse impacts are addressed in Chapter 7.

The impacts due to or affecting certain elements during construction and operation are presented below in tabular form for ease of reference. Impacts can be positive or negative, direct or indirect. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localised) or widespread, reversible or irreversible.

These qualities are indicated in the assessment table as follows:

Key	Type of Impact	Key	Type of Impact
++	major positive impact	+	Minor positive impact
--	major negative impact	-	Minor negative impact
0	negligible/ zero impact	NC	no change
Sp	specific/localised	w	Widespread
R	reversible	ir	Irreversible
Sh	short term	L	Long term
T	temporary	p	Permanent
Y	mitigation of negative impacts/ enhancement of positive ones IS possible	N	Mitigation of negative impacts/ enhancement of positive ones is NOT possible

Generally, temporary impacts having no obvious long term consequences are regarded as being minor. But those with long term repercussions are classified as significant.

17.6.2 ASSESSMENT OF IMPACTS

The project road is an existing and functioning road, and therefore the most serious impacts would have occurred when the original alignment was constructed. Impacts due to the existing road have been discussed in Chapter 5.

Rehabilitation works will be confined to upgrading the existing alignment to Class A gravel road. The existing carriageway will not be widened, although reshaping of the camber and some clearing of vegetation will be necessary. No realignments are proposed, and deviations will only be required at the bridges.

The table below describes impacts which are expected to result from the rehabilitation works.

Impacts on or due to	Construction	Mit	Operation	Mit	Remarks
Agricultural activities	NC		++ p w		During construction, little or no change is expected with regard to agricultural activities. However after construction, the improved road should encourage agricultural activity along the project road and in its area of influence by providing better access to markets, provided that security in the area also improves.
Fisheries	NC		++ p w		As with agriculture, fishing activities will not be affected during construction. However, the improved road will facilitate transport to the markets and would thus encourage this industry.
Workmen's camp	- t sp	Y	0		The camp is likely to impact on water, fuel and food resources. Location of the camp is essential in order to mitigate impacts.
Public health	- t ir w	Y	- p w ir	Y	During construction and operation, increased dust, noise and air pollution levels could impact on public health.
	- p ir sp	Y	- p ir sp	Y	Immigrant workers on road projects, and truck drivers are associated with the spread of socially contracted diseases. Awareness campaigns would help to mitigate this problem.
			++		Better access to health facilities can be regarded as a major positive impact, but this again depends on the security situation along the road.
Cultural, historical or traditional sites, or sites of personal importance	0	Y	0		There are no sites of cultural, historic or traditional value that would be affected by the road improvement works. However care must be taken during excavation of gravel pits to avoid graves.
Road safety	- t sp	Y	-	++	During construction there will be some danger to road users, but this can be mitigated with awareness campaigns and road signs, and by providing shoulders that can be used by non-motorised traffic.
			-	Y	The rehabilitation works will be designed to improve road safety during operation. Road safety can be enhanced by erecting warning and directional signs, particularly near schools, hospitals and villages.
Visual intrusion	- t/p	Y	-	Y	The improved road will encourage speeding which could be a hazard.
			-	Y	During construction visual intrusion will be due to earthworks (including gravel pits quarries) and construction traffic.
			-	Y	These conditions will create a greater impact during operation and will include nocturnal glare. Mitigation will be achieved through controlling traffic, sensitising motorists, clearing construction debris and rehabilitating/landscaping quarries.

17.6.3 SUMMARY OF MAIN ISSUES

17.6.3.1 Economic and Socio-Economic Benefits

Road projects are associated with numerous sociological and socio-economic benefits, resulting from improved access to schools, health facilities and villages (market centres), which contributes to increased productivity and thus an ultimate improvement in standards of living.

Numerous schools and health centres are located along the project road. Improved access to health centres and schools implies that these facilities would be better staffed and equipped.

However, until the security situation in the area improves, little economic or socio-economic benefit will be realised as a direct result of rehabilitating the project road.

17.6.3.2 Erosion

Soil erosion will be a major issue during the rehabilitation works, and will result from earthworks, borrowing/quarrying and deviations. Improper drainage of runoff from the road to the lower catchment can also cause erosion. Incorporating soil conservation measures during construction would help to mitigate damage caused by erosion.

Clearing of vegetation from road reserves, and excavating murrum from gravel pits having slopes exceeding 4% could result in an increase in runoff along the slopes and thus encourage erosion. Hardstone quarries tend to have soils with more stable structures, so erosion may not be an issue here.

At present the ferries crossing the River Nile near Laropi bang into the river bank when landing. This is causing considerable erosion of the bank, and in addition the ferries are being damaged by the impact of the landing. Improvement of the ferry landing will result in protection of the river bank, as well as contribute to the well-being of the ferries themselves.

17.6.3.3 Pollution

Exhaust and engine emissions from vehicles cause air pollution, which can have an impact on public health, as well as soils, crops and water supplies. Oil wastes are a problem at the main centres, especially Adjumani and Moyo where the heavy commercial vehicles stop to rest. During construction, there will be some waste from construction equipment. Air, noise and dust pollution and disposal of oil wastes is already occurring to a certain extent (whether significant or not) along the project road. The situation will be exacerbated temporarily during construction, but will also occur during operation as a result of anticipated increased traffic along the road.

Where bridges are to be either rehabilitation expanded, sediment loads in the rivers will increase as a result of construction debris and excavation works along the banks.

But the impact of increased sediment loads due to construction activities is not expected to be significant in relation to the turbidity levels in the rivers and in view of the temporary nature of the impact.

17.6.3.4 Deviations

During rehabilitation works, it will only be necessary to have deviations while work is going on at the seven bridges. In most cases, the deviations will remain within the road reserve; but in some cases this may not always be practical or possible, so traffic may have to be diverted temporarily across private land. In such cases, landowners will have to be compensated for loss of crops/ grazing land, nuisance, fencing, etc.

17.6.3.5 Gravel Pits and Hardstone Quarries

A number of gravel pits and hardstone quarry sites were identified during the materials investigation conducted in March 2000. These are listed in other sections of the Feasibility Design Report.

Major concerns relating to gravel pits and hardstone quarries include dust and disturbance during excavation (including destruction of structures and graves), and the need to reinstate or landscape the pits/quarries when the contractor has completed excavation.

Most of the gravel sites are privately owned farms with homesteads on them or located fairly close by. Most of these homesteads will therefore be affected by dust and noise during excavation and quarrying.

Traffic to the gravel sites and quarries will also pose a nuisance to people living around them.

Erodibility depends largely on soil type and to some extent on the gradient of the site (slope). Gravel pits are more susceptible to erosion than hardstone quarries. In general the soil types along the project road and gravel pit locations are fairly stable, and erosion was mainly noticed at the steep section between Km 71 and Km 72.

17.6.3.6 Loss of Land, Crops, etc

Loss of land will occur where land must be acquired for the workmen's camp, gravel pits and hardstone quarries, and the crusher plant site. Crops may also be removed at these sites. These impacts will be temporary, provided rehabilitation of the sites is done properly.

17.6.3.7 Protected Areas and Forest Reserves

In Moyo District there are two gazetted protected areas, namely Dufile Animal Sanctuary and Otzi Game Reserve, and two forest reserves, viz: Otzi and Epi. The project road does not directly lead to any of these protected areas or forest reserves. It is therefore unlikely that the rehabilitation of the road will have any further impact on these environmentally sensitive areas, since the road is already existing and passable.

However, if the security situation improves, there may be an increase in the felling of trees for fuel.

17.6.3.8 Tourism

The insecurity in the project area, together with the lack of infrastructure (apart from roads), makes it difficult to promote tourism in this area. Furthermore, these areas do not lie along or near the usual tourist circuits. Discussions with UWA revealed that this was not a high priority for the development of tourism.

17.6.3.9 Towns and Villages

It is not expected that there will be much disturbance in the main towns of Atiak, Adjumani and Moyo during construction. At Atiak the carriageway is very wide, while at Adjumani the road bypasses the centre of the town. In Moyo, there are alternative routes that can be used for access while rehabilitation work is in progress.

17.6.3.10 Workmen's Camp

It will be necessary to set up a workmen's camp during the rehabilitation works. In general a camp would require approximately 2 to 5 acres of land. In setting up a workmen's camp, consideration must be given to water availability and fuel supplies. It is likely that the workforce will put an additional demand, albeit temporarily, on fuelwood for cooking. This demand may affect local fuelwood supplies and may also compromise its availability to the local people.

Water supplies are not extensive along the project road. Water in the camp is important in terms of maintaining hygiene and sanitary conditions. The demand for water may put temporary pressure on local supplies.

The villages/towns along the project road are not served by sewage systems or waste collection services. Sanitation and solid waste disposal will be a significant negative impact resulting from the workmen's camp.

In addition, an area will have to be allocated to plant and equipment, and for crushing hardstone, for the concrete section from Km 71 to Km 77.

The actual location of the camp will determine the extent of the impacts due to the camp. This is dealt with in Chapter 7.

17.6.3.11 Public Health

Improvement works and traffic during operation will create dust, air and noise pollution which can have an impact on public health. Oil wastes from vehicles can also impact on public health if they find their way into water sources.

Sanitation and hygiene in the workmen's camp are also issues of concern, and if not properly addressed may lead to outbreaks of illnesses such as hepatitis, typhoid, intestinal worms, etc.

Road projects are associated with an increase in sexually transmitted diseases due to the influx of workmen interacting with the local people, as well as the greater number of drivers who are expected to pass through the villages, towns and settlements along the road as a result of the improved road conditions.

17.6.3.12 Road Safety

The project road is to be designed for a speed of 80 km/h. Although the residents along the project road may be used to traffic, they may not be used to fast traffic, and there may therefore be an increase in the number of accidents (for both motorised and non-motorised traffic), at least in the initial months of operation.

17.6.4 ANALYSIS OF ALTERNATIVES

It must be documented here that for this project the analysis of alternatives is not necessary as no alternative alignments have been proposed. Similarly, the mitigation measures recommended are standard and straightforward, and hence again there is no need for discussion of alternative mitigation measures.

17.7 MITIGATION

This chapter focuses on measures that can be incorporated into the design, and during the rehabilitation works and operation stages of the project in order to mitigate the negative environmental impacts and enhance the positive ones described in the preceding chapter.

17.7.1 HYDROLOGY/DRAINAGE

The road design must ensure that flow of water is not impeded from upper to lower catchment by rehabilitating culverts, and by installing side drains and mitre drains to direct road runoff away from the road.

It is important that these features are well designed, properly constructed and regularly maintained so that runoff does not accumulate by the side of the road, water that is drained off the road does not create gullies, and siltation of the structures does not occur. Drainage structures must therefore ensure safe final disposal of water and must also be self-cleaning. It may be necessary to construct artificial waterways to facilitate the safe discharge of runoff to a final recipient body. Again care must be taken during design and construction so that the waterway itself does not lead to erosion and gullyng.

17.7.2 EROSION CONTROL

The speed of road runoff is one of the major contributing factors to erosion and scouring in the side drains along steep sections of a road. In order to reduce the impact of runoff, check dams or scour checks should be introduced in the side drains at specified intervals, depending on the gradient of the slope.

Earthworks should be controlled during the construction phase, so that land that is not required for deviations, gravel pits or quarries is not disturbed. Quarries/gravel sites that were used for the previous contract and new sites to be opened for this contract must be landscaped and revegetated after use in order to prevent erosion. (This is discussed further in Section 7.6). Contract documents should stipulate that, wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain.

The road embankment along the steep section between Km 71 and Km 77 should be planted with shrubs and grasses to stabilise it as well as to reduce the chances of erosion.

In order to ensure that environmental protection is taken into account during construction, these issues must be specified in the contract documents.

17.7.3 POLLUTION CONTROL

Dust can be prevented if the road is well maintained, and by creating awareness among drivers. Noise abatement, particularly in the towns, can be done through sensitizing motorists/truck drivers, by using signboards and conducting awareness campaigns. Regulations should be introduced that prohibit movement of heavy vehicles and hooting after dark.

Dust emissions during earthworks (along the road and in gravel pits) can be reduced by sprinkling the surface with water. However, this is sometimes not practical as it is not always easy to obtain enough water for this purpose. Dust, air and noise pollution emanating from the crushing plant (required for the short concrete section between Km 71 and Km 77) can be reduced by ensuring that the plant is located downwind of villages or homesteads. Plant should not be operated during the night. Maintenance of equipment and plant will also contribute towards mitigating pollution.

Oil is often drained from trucks and lorries by the side of the road, usually in the main towns of Adjumani and Moyo. Such maintenance activities should be carried out in specially designated trucking stops or at petrol stations. This can only be assured through legal means. Contamination of soil and/or water sources resulting from oil in stormwater drains can be controlled through installing oil sumps at truck parking bays.

Sediment loads in the rivers and streams can be reduced by rehabilitating the culverts during the dry season, wherever possible. In addition, the contractor must ensure that construction debris is disposed of in a sensible manner and not thrown into the rivers.

17.7.4 DEVIATIONS

As mentioned earlier, deviations are only necessary at the bridges which are to be either rehabilitated or expanded to allow two way traffic. Deviations should, wherever practical, adhere to the road reserve. However, this may not always be possible, and in some cases traffic may have to be diverted temporarily across private land. In such cases, landowners will have to be compensated for loss of crops/grazing land, nuisance, fencing, etc. All deviations must be planned and their routes specified in the contract documents.

As a condition of contract, any trees removed for the purposes of a deviation must be replanted when the road works are complete and the deviation ceases to be of use.

17.7.5 COMPENSATION

The project road has scattered inhabitation and cultivation along its length. Most of the road reserve was cleared during the previous contract. Since then there are only small pockets of cultivation within the road reserve that will have to be cleared during construction to improve sight distance. As the road reserve is considered to be government land, no one is entitled to build or cultivate within it, and therefore no

compensation need be paid for the removal of crops/structures lying within the road reserve.

Some land may have to be acquired for deviations that cannot be contained within the road reserve. In such cases, compensation must be paid for crops lost as well as any permanent structures that need to be removed, provided they lie outside the road reserve.

Land will have to be acquired temporarily for workmen's camp, quarries and gravel pits. In setting up the workmen's camp, the contractor will have to negotiate lease of the land from the individuals or from the councils involved. This is included in the BOQ as part of the mobilisation costs.

Material sites will be acquired by the contractor who will negotiate rates for material excavated directly with the landowners. Some of the sites are existing ones that will have to be extended onto private land. New gravel sites will also have to be opened up. The landowners will have to be paid compensation for crops lost, and for material excavated.

17.7.6 GRAVEL PITS AND HARDSTONE QUARRIES

At this stage of the study, although gravel pits and quarries have been identified, their selection has not been finalised. In this section, therefore, general means of mitigation are discussed.

17.7.6.1 Excavation

Mitigation measures for soil erosion and dust emissions from gravel pits and hardstone quarries have been discussed under Sections 7.2 and 7.3.

Normally landowners sign contracts with the contractor before excavation begins which include terms and conditions for payment, the amount of land to be excavated and rehabilitation measures to be carried out.

The area to be excavated should be cordoned off, particularly for hardstone quarries which tend to be very deep and pose a danger to livestock and children. The contract documents should instruct the contractor to maintain fences and "make good" afterwards.

All access routes to gravel pits/quarries should be planned ahead of construction and described in the contract documents. This will stop several routes being created to one gravel/quarry site which would have severe implications on environmental degradation around the excavated area.

Blasting for hardstone should be done only during the day, and residents in the vicinity of the quarry should be suitably warned of blasting activities. This must be specified in the conditions of contract.

17.7.6.2 Rehabilitation

When gravel pits are being excavated, that land cannot be used by the landowner for cultivation. After excavation the landowner may still not be able to cultivate his/her land because the topsoil has been removed. A substantial portion of the cropping or grazing land therefore becomes unproductive. Furthermore, excavation sometimes leaves an uneven land surface, which makes it difficult to cultivate later.

Gravel pits must be landscaped, then reinstated or backfilled with overburden/topsoil. If excavation is properly planned, organised and executed, it would be possible to rehabilitate most of the gravel pits. It is therefore important to have separate stockpiles for overburden, gravel, etc.

Hardstone quarries are more difficult to rehabilitate especially if they are very deep. Where the hardstone site is a kopje, then there is generally no great hole in the ground to fill in. Nevertheless, all hardstone quarries must be fenced and access to them restricted for safety.

Terracing and replacement of fencing is part of the rehabilitation process. Contract documents should instruct the contractor to plant trees to replace those that have been removed during excavation.

Sometimes landowners wish to leave the gravel pits as they are so that they can be used as temporary water sources (pans) for livestock. Apart from encouraging the breeding of mosquitoes (the vectors for malaria), the pans will encourage localised erosion caused by trampling.

Landowners must be informed of the environmental implications of excavation at the time of selection of the gravel pits. They should be told at the earliest whether testing has revealed that material from their plot was acceptable or not for use on the project road. They must also be told of the options available to them after excavation, i.e. rehabilitation/landscaping, construction of water pans, or leaving the quarries be for further exploitation. It is very important that they understand the conditions on the contract form before they sign it, and must ensure that these conditions include their requirements such as backfilling, fencing, terracing, etc.

As part of the new contract, the old gravel pits and hardstone quarries that were opened under the previous contract and are now abandoned should also be rehabilitated.

17.7.7 WETLANDS/SWAMPS

There are two sections where the road crosses swampy areas, viz. Km 65+000 and Km 66+000 approximately. Although these swamp areas are not regarded as having any conservation significance, special attention must be given to the design of the culverts at these sections, so that flow of water from one side of the road to the other is not hindered in any way. There will be also be some sediments going into the swamps as a result of road improvement activities.

The contractor must therefore be instructed to carry out his activities with particular diligence here, especially with regard to disposal of construction debris and earthworks.

As far as possible, swamp vegetation should not be cleared.

17.7.8 TOWN AND VILLAGES

In order to minimise the nuisance caused to the public by road works, signs should be erected indicating when road works are likely to begin and end, and what alternatives are available for access.

In the towns and villages, trees (such as *Nerium* or *Casuarina* spp) should be planted along the edge of the road reserve after completion of the rehabilitation works. The contractor should be instructed to do this by the supervising engineer, but the trees should be cared for by the town councils or the District Forestry Officer. They would contribute to improved aesthetics, and also towards preventing erosion of soil by the roadside. The air filtering qualities of trees (especially dust and particulate matters) would lessen the impacts on public health due to air pollution.

17.7.9 WORKMEN'S CAMP

17.7.9.1 Local Resources

The major issues of concern as regards the workmen's camp are water supplies and fuelwood.

The location of the camp will determine the impact on water sources. Water may be available from local sources or it may be necessary to drill a borehole. However, the project area is fairly arid, and water supply is unreliable. Care should be taken not to stress the supply or aquifer, as the case may be, at the expense of the local population.

The workforce should be discouraged from buying charcoal. A central canteen to serve the entire workforce should be set up within the camp. Use of gas or electric cookers should be made mandatory in the camp. It would therefore be advantageous to set up camp where electricity is available, but this is not a necessity as camps often have their own generators.

17.7.9.2 Location of the Camp

To minimise the impact of the workmen's camp, it would be better to locate the camp at either Moyo or Adjumani. In these two towns, the natural environment is already substantially altered. In addition, facilities for water supply and electricity are available, and food supplies are also readily obtainable.

The camp should not be located at an isolated point along the road where it will attract periphery businesses, and provide a nucleus for the growth of unplanned settlements.

17.7.10 PUBLIC HEALTH AND OCCUPATIONAL SAFETY

A central canteen for the workforce at the camp would contribute towards the general health in the camp as kitchen wastes can be disposed of in an organised manner, while hygiene can be monitored.

The location of pit latrines in the camp should preferably be downhill of potable water sources, or 200 m to 500 m from any water body. Communal bathrooms/lavatories with soakaway pits are a less polluting option, but would be a slightly more expensive.

STD awareness campaigns should be conducted in the camp as well as in the towns and villages.

Workmen should be provided with suitable protective gear (such as nose masks, ear muffs, helmets, overalls, industrial boots, etc), particularly during quarrying, blasting, drilling, and while working on the crushing plant. There must be a fully equipped first aid kit on site and a Safety Officer who has first aid training and knowledge of safety regulations. In addition, the contractor must have workmen's compensation cover.

These issues are included in the Standard Specification.

17.7.11 ROAD SAFETY

The danger posed to pedestrians and cyclists (particularly at towns and villages along the road) due to increased traffic volumes and higher speeds can be mitigated by installing clear and frequent road signs and markings (both directional and warning). Signs are also necessary near health centres and schools.

The provision of shoulders will also contribute to making the road safer, in that they can be used as foot and cycle paths.

17.7.12 VISUAL INTRUSION

Once road works are complete, the contractor must ensure that the landscape is restored as much as possible to its original form. Landscaping/reinstating quarries and deviations and replanting them would reduce visual intrusion caused by excavation and clearing. Planting trees along the project road, particularly in Moyo, Adjumani and Atiak, and also in the larger villages along the road (eg. Dzaipi, Pakelle, Laropi, Amua, Erepi), would also greatly improve aesthetics.

17.7.13 MOWHC ENVIRONMENTAL REQUIREMENTS

A number of MOWHC documents give guidelines on environmental protection and mitigation. These include the MOWTC's Road Design Manual and Maintenance Manual, and tender documents such as the General Specifications for Road and

Bridge Works. These documents address environmental requirements covering construction activities, drainage, protection of water sources, workmen's camps, safety and public health, soil erosion, quarries and borrow pits, deviations, haulage routes, asphalt plants and machinery units, spillage of oil/fuel, etc.

It is essential that all remedial measures are stipulated in detail in the contract documents. This would then obviate reliance on the contractor's and the supervising engineer's willingness and ability to incorporate the recommended mitigation measures. In addition, the contractor must cost all remedial measures in his tender documents as unit costs.

17.8 MONITORING

17.8.1 GENERAL

Monitoring is a long-term process, which should begin at the start of construction and should continue throughout the life of the road project. Its purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. Monitoring involves the continuous or periodic review of construction and maintenance activities to determine the effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established, and previously unforeseen impacts can be identified or pre-empted.

Environmental audits are carried out some years after completion of the project. These audits assess the relevance, efficiency and impact of any mitigation measures that have been employed.

17.8.2 ENVIRONMENTAL MANAGEMENT PLAN

Table 11.8.1 below summarises the environmental management plan. It describes parameters that can be monitored, and suggests how monitoring should be done, how frequently, and who should be responsible for monitoring and action.

The types of parameters that can be monitored may include mitigation measures or design features, or actual impacts. In some cases, such as drainage structures and soil conservation interventions, monitoring is fairly straightforward and can be done as part of routine or periodic maintenance. However, other parameters, particularly those related to socio-economic and ecological issues can only be effectively assessed over a period of 3 to 5 years.

Table 17.8.1: Monitoring of Impacts and Mitigation Measures

Environmental/ Social parameter	Responsibility for intervention and monitoring during construction and defects liability period	Responsibility for monitoring and/or maintenance after defects liability period	Monitoring means	Frequency of monitoring
Unimpeded drainage/efficiency of drainage structures	Supervising Engineer & contractor	District Engineer i/c Works/MOWHC Maintenance Section	during routine maintenance	3-4 times a year throughout project life
Off road erosion; erosion of road embankment; road side erosion; river bank erosion	Supervising Engineer & contractor	District Engineer i/c Works/MOWHC Maintenance Section	during routine maintenance	3-4 times a year throughout project life
Quarry/gravel pit rehabilitation	Supervising Engineer & contractor	District Engineer i/c Works/MOWHC Maintenance Section (supported by Environmental Unit)	periodic assessment	Twice a year to account for seasonal variations over a period of 2-3 years, until vegetation has reestablished
Planting of trees along road in 3 towns and main villages	Supervising Engineer & contractor	Local councils and District Forest Dept (supported by Environmental Unit)	periodic assessment	Twice a year to account for seasonal variations over 3 to 5 years, until trees are established
Payment of compensation for gravel and hardstone material	Supervising Engineer & contractor	District Engineer i/c Works/MOWHC Maintenance Section	independent study	Once in the first year after completion of project, thereafter once a year
Sanitation at workmen's camp Impact on public health (dust, STDs) *	Supervising Engineer & contractor Supervising Engineer & contractor	- Environmental Unit	periodic assessment Env Unit monitoring activity / independent study	Once a month Twice a year during construction, and first year after completion of project, thereafter once a year
Air/water/noise quality *	Supervising Engineer & contractor	Environmental Unit	Env Unit monitoring activity / independent study	Once during construction, and first year after completion of project, then every 2-3 years
Impact on road safety (number of accidents) *	-	Environmental Unit or National Road Safety Council	Env Unit monitoring activity / independent study	Once a year after completion of project
Impact on economic development in project area *	-	Environmental Unit and MOWHC Planning Section	Env Unit monitoring activity / independent study	Just after completion and then after 5 years

Note: * after construction, these issues may be incorporated into the routine monitoring activities of the Environmental Unit in the MOWHC, where information can be obtained directly from the districts, and that data subsequently analysed. Alternatively, these parameters can be monitored through conducting independent studies, but this will depend on the capacity and resources within the MOWHC to do so.

17.8.3 INSTITUTIONAL RESPONSIBILITIES

Institutional responsibilities for each of the monitoring activities have been indicated in Table 17.8.1.

During the defects liability period the contractor must make sure that the road is completely serviceable, which entails ensuring optimal performance of all structures.

After the defects liability period, responsibility for the maintenance of the project road will lie with the Maintenance Section in the MOV/HC. Therefore certain parameters, such as efficiency of drainage structures and quarry rehabilitation can be monitored by the District Engineer in charge of Works during routine or periodic maintenance, or when annual maintenance needs assessments are being carried out.

The MOWHC is currently in the process of setting up an Environmental Unit. The Unit will be responsible for ensuring that such monitoring does take place. As indicated in the footnote to Table 8.1, monitoring of certain parameters should become part of the Unit's routine monitoring activities. The Unit will also be responsible for analysis of data collected during monitoring, so that overall performance in terms of environmental degradation or improvement can be assessed. The Unit can then instruct the relevant District Engineer i/c Works, as to what (further) measures should be implemented, or whether changes or modifications are necessary to interventions or monitoring methodologies.

17.9 CONCLUSIONS AND RECOMMENDATIONS

17.9.1 CONCLUSIONS

The primary objective of upgrading the Atiak-Adjumani-Moyo Road is to improve road conditions so that traffic flow is more efficient to and from markets, and substantial savings are made in vehicle operating costs. It is anticipated that in the long term, and provided the security situation along the road improves, there will be considerable economic benefit accruing to the areas of influence of the project road due to stimulated agricultural and fishing activities.

The project road is an existing one, and much of the initial works (such as clearing of vegetation, extending the carriageway, etc) have been carried out under the previous contract. The road traverses an area of scattered habitation and cultivation. Thus the natural environment along the road has been altered already and any major impacts will have occurred when the original alignment was carved out. Additional disturbances due to construction will therefore be relatively minor.

At this stage, no adverse environmental impacts of significant magnitude are foreseen that would hinder the proposed upgrading of the project road. The rehabilitation works will not harm any sites that are historically or environmentally sensitive.

There will be temporary loss of land for gravel pits, hardstone quarries, the workmen's camp, and perhaps deviations. Landowners must be compensated for material taken, crops lost, and buildings/structures removed for these purposes.

Pollution due to air, dust, noise, and sediments will occur during construction and continue during operation. Pollution of swamp areas is not a major concern. Soil erosion is also likely to occur, particularly as a result of earthworks and excavation of gravel pits; but this can be mitigated. The ferry landings on the Nile River at Maropi will in fact prevent erosion of the river bank. Impacts on natural vegetation and wildlife are considered to be negligible.

The workmen's camp should preferably be located at Moyo or Adjumani. In addition, the camp must not stress local fuelwood and water supplies at the expense of the local population. The contractor must maintain camp hygiene.

There is a possibility that an improved road will encourage higher traffic speeds which would pose a danger to non-motorised traffic. The provision of shoulders and installation of road signs will help to mitigate this impact.

17.9.2 RECOMMENDATIONS

Recommendations for the prevention and mitigation of adverse impacts are as follows:

- quarries and gravel pits must be cordoned off or fenced during use, and rehabilitated after use as per the requirements of the landowners;
- gravel pits and quarries that have been abandoned since the previous contract must also be rehabilitated under this contract;
- shrubs and grasses should be planted along road embankment along the steep section from Km 71 to Km 77 to prevent erosion;
- unnecessary clearing of vegetation should be avoided to preclude additional erosion;
- trees should be planted along the roadside at Atiak, Adjumani and Moyo, as well as the major villages along the road (ie. Draipi, Pakelle, Umi, Laropi, Arua, Erepi) to improve visual aesthetics and as filters for particulate matter;
- a special parking area should be provided for trucks at Adjumani and Moyo;
- the local people, particularly in the towns, must be informed of the details and progress of the project;
- compensation to landowners who must temporarily relinquish their land for gravel pits, hardstone quarries, deviations (if required), and the workmen's camp must be fair and paid promptly. It should cover crops, all structures (permanent and mud-and-wattle structures, pens, sheds, fences, etc) and material.

Many of the environmental concerns due to this project are included in the MOWTC's Road Design Manual, Maintenance Manual, and the General Specifications for Road and Bridge Works. These documents contain general rules for "making good", for example for rehabilitating areas where gravel excavation has taken place. Diligence on the part of the contractor and proper supervision by the supervising engineer during construction and the initial operation period is crucial for mitigating impacts. However all mitigation measures need to be specified in tender and contract documents, and must be included in the Engineering Drawings, Specifications and Bills of Quantities.

During operation, maintenance of the road is a key factor in protecting the environment. For example, if the project road is always in motorable condition, vehicles would not have to drive off-road, thereby destroying vegetation, road structures, and posing a danger to pedestrians and cyclists.

Environmental monitoring allows measures to be implemented in order to prevent or avert negative impacts. The Environmental Unit in the MOWHC will need to set up a monitoring system whereby the respective District Engineers i/c Works can feed the necessary environmental data to the Unit for analysis, evaluation and future action.

ANNEX 1 - ACRONYMS AND ABBREVIATIONS

AAH	Aktion Afrika Hilfe
ACF	Action Contre le Faim
ACORD	Agency for Cooperation in Research and Development
ADT	average daily traffic
BOQ	Bills of Quantities
DASS	Danish Assistance to the Self-reliance Strategy
EIA	environmental impact assessment
EIRR	economic internal rates of return
EMP	environmental management plan
GOU	Government of Uganda
IAS	International Aid Sweden
IDA	International Development Agency
Km	kilometre
LWF	Lutheran World Federation
MOWHC	Ministry of Works, Housing, and Communications (formerly the Ministry of Works, Transport and Communications - MOWTC)
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
NGO	non-government organisation
NURP	Northern Uganda Reconstruction Project
RA	Road Agency
RAFU	Road Agency Formation Unit
STD	Sexually Transmitted Diseases
TOR	Terms of Reference
UNHCR	United Nations High Commission for Refugees
USD	United States Dollar
UShs	Uganda shillings
VOC	vehicle operating costs

ANNEX 2 - REFERENCES

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ANNEX 3 – LIST OF PERSONS CONTACTED

Eng D Bisutti	Commissioner of Works (Maintenance), MOWHC, Entebbe
Eng M M Odongo	Project Coordinator MOWHC, Entebbe
Mr B Sperring	Director, RAFU, Kampala
Mr Moses Wafula	Planning & EIA Coordinator, Uganda Wildlife Authority, Kampala
Ms Lilly Ajarova	Tourism Marketing Services Manager, Uganda Wildlife Authority, Kampala
Mr Justin Ecaat	National Environment Management Authority, Kampala
Mr Andrew Mukulu	Statistics Dept, Ministry of Finance and Planning, Entebbe
Mr Charles Andriku	Cartography, Statistics Dept, Ministry of Finance and Planning, Entebbe
Mr John Dissi	National Biomass Study Project
Mr John Begumana	National Biomass Study Project
Mr Lomunyu Gregory	Deputy CAO, Moyo District
Eng D Beyagala	District Engineer, Moyo
Mr Vudiga Tobias	Warden – Law Enforcement, Game Department, Moyo
Mr Logwe Alfred	Head Ranger, Game Department, Moyo
Mr Steven Wani	Programme Coordinator, ACORD, Moyo
Mr Lawrence Akuti	Veterinary Officer, Adjumani
Mr Horst Pirker	Proprietor, Arra Fishing Lodge, Adjumani
Mr F Iwa	Field Coordinator, Lutheran World Federation, Pakelle
Ms Margarita Vargas	Field Officer, UNHCR, Adjumani/Pakelle
Mr Mondia Owens Philip	Vice Chairman, Adjumani District Local Government
Ms Sophie Laenkholm	Programme Manager, DASS, Pakelle

In addition, discussions were held with persons residing beside borrow pits and along the project road.