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SUDAN TRANSITIONAL ENVIRONMENT PROGRAM

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT (PEA) OF ROAD REHABILITATION ACTIVITIES IN SOUTHERN SUDAN

FINAL REPORT

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COVER PHOTO

Rehabilitated Roads–Making a Real Difference in Southern Sudan
Photo by: T. Catterson/IRG

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International Resources Group
1211 Connecticut Avenue, NW, Suite 700
Washington, DC 20036
202-289-0100 Fax 202-289-7601
www.irgltd.com

Government of Southern Sudan
Ministry of Transport & Roads

Government of Southern Sudan
Ministry of Environment,
Wildlife Conservation and Tourism

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ACRONYMS

BEP	Best Engineering Practices
BOQ	Bill of Quantities
CAR	Central African Republic
CB	Capacity Building
CCSS	Coordinating Council for the Southern States
CFR	Code of Federal Regulations
CMC	Construction Management Component
CPA	Comprehensive Peace Agreement
DA	Development Assistance
DRC	Democratic Republic of Congo
EIA	Environmental Impact Assessment
FY	Fiscal Year
GOSS	Government of Southern Sudan
GTZ	German Technical Agency for Development Cooperation
IDFA	International Disaster and Famine Assistance
IDPs	Internally Displaced Persons
IEE	Initial Environmental Examination
IR	Intermediate Result
IRG	International Resources Group
JAM	Joint Assessment Mission
Km	Kilometers
MDTF	Multi-Donor Trust Fund
MEWCT	Ministry of Environment, Wildlife Conservation and Tourism
MTR	Ministry of Transport and Roads
MT	Metric tonnes
NCP	National Congress Party
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Products
PA	Protected Area

PASA	Participating Agency Service Agreement
PEA	Programmatic Environmental Assessment
SETIDP	Sudan Emergency Transport Infrastructure Development Program
SFO	Sudan Field Office
SIP	Sudan Infrastructure Program
SO	Strategic Objective
SPLA	Sudan Peoples Liberation Army
SPLM	Sudan Peoples Liberation Movement
SSCCSE	South Sudan Center for Census, Statistics and Evaluation
STEP	Sudan Transitional Environment Program
TES	Threatened and Endangered Species
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WFP	World Food Programme of the United Nations

EXECUTIVE SUMMARY

INTRODUCTION

Road rehabilitation has been an important part of the USAID portfolio in Southern Sudan for some time. Although some of these investments were clearly emergency in nature, others were funded with USAID Development Assistance resources and therefore subject to the Agency's environmental procedures (22CFR216). Under these regulations, road rehabilitation falls into a category of activities always requiring an environmental assessment because of an automatic positive threshold decision. This Programmatic Environment Assessment (PEA) was carried out to meet those requirements.

The PEA mechanism under USAID's environmental procedures is particularly well suited to the road rehabilitation situation in Southern Sudan. It allows those carrying out the PEA to treat the many and essentially similar subprojects of road rehabilitation as a "generic class of actions" (22 CFR 216.6(d)).

DESCRIPTION OF ROAD REHABILITATION ACTIVITIES

From the outset, the thrust of the road rehabilitation has been to make the roads "passable", in order to facilitate the delivery of food aid and relief supplies to war torn areas of the country. USAID's funding has been channeled through the World Food Programme (WFP) under the aegis of their Emergency Road Repair and Mine Clearance project. Started in January 2004, it is now in a second phase that was expected to be completed by the end of calendar year 2005 (now slightly extended to make up for slower than normal implementation as a result of delays in demining and localized insecurity). It should be emphasized as is implied above, that these road rehabilitation activities are a first level of repair aimed at improving road access into Southern Sudan and not the final stage during which more durable repairs are being planned. The specific aims of the road rehabilitation program are:

- Improved road access, reducing the cost of access to food and food production itself;
- Stimulating commercial activity and self-sufficiency;
- Facilitating the movement of Internally Displaced Peoples (IDPs) and other returnees;
- Showing the dividends of Peace; and
- Reducing the transport cost of the massive amounts of humanitarian operations and assistance flowing into the country.

BENEFITS OF ROAD REHABILITATION

There can be little doubt about the benefits of road rehabilitation in Southern Sudan. It is easily the most visible and tangible of the benefits of Comprehensive Peace Agreement to the everyday inhabitants of the Nation. In many places, travel is once again possible; elsewhere travel times have been dramatically reduced. Food aid and development assistance reaches ever more widely and easily throughout the country. Commerce is building up and with it, local economies and employment opportunities.

NEED FOR THE PROGRAMMATIC ENVIRONMENTAL ASSESSMENT

Road rehabilitation and construction will continue to be an important part of the development scenario in Southern Sudan for years, if not decades to come. The current WFP-executed, USAID-funded road rehabilitation activities are winding down and moving to a more direct USAID-executed roads program under the Sudan Infrastructure Program. Similarly, as noted in the Joint Assessment Mission (JAM) reports, there will be continued emphasis on road construction, estimated at as much as US$4 billion equivalent, part

of which is already in the planning stage with the inception of the World Bank-managed Multi-Donor Trust Fund (MDTF).

Indeed, because of the importance attributed to road building by the GOSS and its donor partners, USAID/Sudan has strongly encouraged the PEA Team to reach out to their Bank and donor colleagues with the hope that the PEA might serve their environmental review purposes as well. The expected results of the PEA are as follows:

- Provide the basis for a process and management structure within the GOSS (in the main involving the Ministries of Environment, Wildlife Conservation and Tourism and of Transport and Roads) for environmental screening and review of road rehabilitation activities in Southern Sudan.
- Generate a set of environmental guidelines that can be incorporated into the Special Provisions and Specifications for contracts being awarded by the GOSS and its donor partners (WFP, USAID, the World Bank Multi-Donor Trust Fund, and others) to design consultants and contractors engaged in road rehabilitation in the future in Southern Sudan. Such guidelines will streamline the review process and thereby accelerate the implementation of the large-scale road rehabilitation and re-construction activities that are seen as fundamental to peace and relief and development in the country.
- Serve as the basis for the preparation and eventual promulgation of GOSS sectoral guidelines for the transport and roads sector.
- Provide on-the-job technology transfer/training opportunities for concerned GOSS ministerial staff.
- Meet the requirements of USAID Environmental Regulations (22CFR216) as related to the present program of road rehabilitation.

PEA APPROACH AND METHODOLOGY

The Programmatic Environmental Assessment (PEA) of the Road Rehabilitation activities was carried out over the period late January to March 2006, with an additional period for the review of the draft report. In general, the PEA depended on consultation and collaboration as the primary fact-finding tools, combined with visits to a wide range of road rehabilitation sites in Eastern Equatoria and Bahr el Ghazal. Staff from the GOSS Ministries of Environment, Wildlife Conservation and Tourism and Transport and Roads joined the STEP Team Leader and a Roads EIA Specialist Consultant in performing the assessment. Most importantly, a wide range of beneficiaries and sector stakeholders involved in road rehabilitation including GOSS and WFP staff, road construction contractor staff, the consulting engineers and local authorities and communities along the road segments surveyed were visited and interviewed in the course of this effort.

The analytical base for the PEA methodology included two other classic EA activities: an examination of the alternatives to the present set of activities (concluding that these were indeed the preferred approach to meeting program objectives) and an analysis of the affected environment across a large part of the country where road rehabilitation will or is occurring (to highlight environmental sensitivities that may be affected by road rehabilitation and reconstruction). In the latter case, the description is hampered by the lack of good up-to-date data and information as a result of more than 20 years of civil war.

OUTCOME OF THE PEA

As with any environmental assessment, this PEA has identified a series of adverse environmental impacts and discussess how to avoid and/or mitigate them. This following table provides an overview of the issues, impacts associated with road rehabilitation in Southern Sudan and the environmental management measures to deal with them. A more fulsome analysis of their causes and mitigation and monitoring recommendations, are presented in the penultimate chapter of this report and have also been presented in a summary form as the **Environmental Management Guidelines** in **Appendix D**.

Adverse Environmental Impacts Associated with Road Rehabilitation in Southern Sudan

Issue	Impact	Mitigation Measures	Monitoring Requirements
Planning and Design Phase			
Design and assessment of priority road segments by the road engineering design consultants	At this early stage, environmentally sound design may not be considered along the target road segment; in preparing the design documents and the Bill of Quantities (BOQ), mitigation measures are not identified and budgeted.	• Ensure good collaboration among ministries so that activities can be coordinated—an understanding of the areas of ecological sensitivity • Road rehabilitation Environmental Design Checklist is used by those assessing construction needs for chosen road segments • Costs of environmental management becomes an explicit part of the BOQ • Those in charge of pre-tender site visits identify potential environmental issues for prospective bidders.	• GOSS Ministries of Transport and Roads and Environment review completed checklist and verify that it has been adequately completed • Possible field visit by environmental specialists to road segment in question
Construction Phase			
Soil disturbance from road building and associated excavation.	Soil erosion leading to soil displacement, slope failures, gullying, clogging of drainage ways and sedimentation in watercourses or water bodies.	• Preference for dry season construction • Avoid building roads in very steep terrain (>60% slope) • Spreading and/or compaction of disturbed soils incorporated into BOQ • Install sufficient number of water bars and/or culverts along the roadside ditches to minimize the amount of water that accumulates; more if the area is steep • On steeper slopes, line roadside ditches with riprap or sow grass or other cover crops to anchor the soil • Add splash aprons or energy dissipaters at the outlet of culverts • Add a requirement for the use of silt curtains or mulching for particularly important drainage areas • Ensure adequate maintenance of such drainage ways to prevent blockages and failure.	• Monitor sediment and debris buildup in road ditches or culverts • Measure stream flow, local hydrology and meteorology so as to increase understanding of local conditions and cause & effect

Issue	Impact	Mitigation Measures	Monitoring Requirements
Road construction crossing watercourses or wetlands.	Impeded stream flow or drainage patterns affecting human/livestock access to water or dry season grazing and/or effects on the stability and functions of aquatic ecosystems…	• Preference for dry season construction • Identify suitable crossing points and re-align the road if needed • Establish national riparian zone management policy and apply it • Ensure adequate size (diameter no less than 60 cms) & number of culverts passing watercourses or wetlands • Avoid cut & fill road construction adjacent to torrential or flashy streams that could wash away the toe slope and sink the road platform • Avoid constricting water flow with bridges or drifts • Suitably sized bridges, both volume and spread to accommodate natural flows	• Stream gauging stations at major bridges to measure flood history • Careful routine inspection of bridge, culvert and drift function, ideally during a rainfall event • Verify that road maintenance is being carried out as planned including cleaning culverts
Construction and operation of borrow pits.	Additional habitat for water borne disease vectors; safety issues for people and livestock (drowning in deep/steep pits); and blight on the aesthetic viewscape along road…	• Minimize the number of borrow pits by increasing free haul distance in BOQ • Establish conditions for borrow pit construction • Require contractor to establish and implement a borrow pit management plan • Engage local community authorities to take responsibility for long-term borrow pits in their areas	• Verify that subsequent use of borrow pit, whether for maintenance or by others, meets standards • Verify natural regeneration on restored borrow pit sites and if necessary, replant • Verify conformance with Borrow Pit Management Plan
Establishment, operation and decommissioning of construction crew camps.	Pollution from human wastes, garbage or fuel, oil and lubricants from motorized equipment…and possible competition with local communities for water supply, particularly in arid areas of the country…	• Proper siting with a preference for flat sites and standardized layout with adequate and clearly specified pollution safeguards • Careful attention to water supply issues so as not to disadvantage local communities with whom these are shared during construction • Consider leaving operational borehole for local community use after departure of the road crew • Full cleanup costs incorporated into BOQ	• Verify natural regeneration of restored camp site and if necessary, re-seed or re-plant, ideally using native species
Construction vehicle and traffic use of the road.	High dust conditions affect human health and quality of life, and also create traffic safety issues associated with passing on a dusty road	• Need for sealed roads within urbanized areas • Speed bumps to slow traffic and enforcement of speed limits • Construct wider shoulder widths or improved condition to allow for pedestrian use • Road signage alerting drivers to the dangers of passing on a dusty road plus "no passing zones"	• Traffic laws need to be enforced • Roads liaison officer of MTR maintains continuous log of community inquiries and complaints

Issue	Impact	Mitigation Measures	Monitoring Requirements
Increased traffic and travelers using the improved road system.	The spread of sexually transmitted diseases (STDs) and HIV/AIDS along the road axis…	• HIV/AIDS awareness and prevention campaign working with road crews and adjacent communities • Health clinics along the roads get high priority, with special attention to danger of HIV/AIDS	• Monitor community health statistics at various points along the road network
Operations Phase			
Access to tropical forest and protected areas enhanced because of improved road network	Relatively undegraded natural tropical forests and/or protected areas are degraded through illegal or unsustainable use or increased hunting pressure affects threatened and endangered species	• Collaboration among GOSS ministries targets such areas for early redeployment of protection staff • Boundary re-establishment and demarcation of such areas is given priority • Signage along the roadside makes users aware of special status and regulations near protected areas • For each road segment, a site-specific investigation will be necessary, ideally by comparing the planned road alignment with a map of existing areas of undegraded forest or protected areas. • Initiate community-based natural resources management programs and co-management programs established in buffer zones around the Protected Areas.	• Monitoring routine reports of protection efforts by PA staff charged with managing the areas in question. • Control points along the road network make it possible to monitor the movements of natural products.
Improved access to natural resources leading to their destruction	Unsustainable use of natural resources, degradation of habitat and inappropriate land-use conversion.	• Cross-sectoral planning should link communities where this is a concern with programs for sustainable economic growth activities that will relieve pressure on the natural resource base and that can help devise sustainable use plans. • Intensify the present efforts at urban planning and eventually regulation.	• Both GOSS Ministries of Agriculture and Forestry and of Environment, Wildlife Conservation and Tourism monitor land-use change as part of their routine duties.
IDPs return in large-numbers and destroy the environment to meet their basic needs	Unplanned and unguided development particularly in urbanized areas leads to large-scale environmental degradation.	• Promote a sense of the importance of environmental considerations in IDP assistance programs. • Ensure a balance in development programs that provide social services in both urban and rural areas to take pressures off the growing urbanized areas. • Avoid schemes that displace returning peoples from their ancestral lands forcing them to carry out agricultural on more marginal lands.	• Both GOSS Ministries of Agriculture and Forestry and of Environment, Wildlife Conservation and Tourism monitor land-use change as part of their routine duties.

However, and more to the point, the outcome of this PEA is expected to lead to a process and procedures for ensuring that future road rehabilitation activities can be carried out with the same appreciation of the conditions required for sustainability. This Environmental Management Process is discussed in detail in the last chapter of this report and further illustrated with **Appendices E—Environmental Design Checklist and F—Standard Clauses for Road Rehabilitation Contracts**.

The following table provides an overview of the Environmental Management Process.

The Road Rehabilitation Project Cycle and Environmental Management Procedures

Steps in Road Rehab Process	Applicable EMP Measures	Roles & Responsibilities
1)- Project Identification	Environmental Policy imperatives to be taken into account when choosing road segments for rehabilitation	MTR (or GOSS Road Agency), familiar w/these imperatives because they were consulted in their development.
2)- Project Design & Preparation	MTR Engineers (or their contracted consultant engineers) carrying out road assessment also complete the Environmental Design Checklist, including community consultation over the length of the road segment	MTR engineers must be thoroughly familiar w/GOSS environmental guidelines for road rehabilitation. MTR designates a Community Liaison Officer at this point to interact with County-level authorities and to guide community consultation process. MEWCT personnel are invited &/or choose to verify adequacy of completion of Environmental Design Checklist.
3)- Preparation of Tender or Bidding Documents	Tender documents include environmental management activities in BOQ, standard environmental management clauses that are part of Special Provisions & Specifications of Contract	MTR in-house environmentalist verifies that tender documents include adequate information on environmental management requirements of the road segment in question.
4)- Proposals responding to Tender reviewed and contractor chosen	Contractor applicants include an Environmental Management Plan in their technical proposals and identify the cost of EMP actions in their cost proposals	MTR committee considers adequacy of the EMP proposal w/ possible assistance from MEWCT personnel if needed. MEWCT registers/reviews EMP for this road segment.
5)- Rehabilitation contractor implements mitigation measures specified in the contract EMP	Road rehabilitation activities proceeds as planned and periodic reports by Supervising Engineers include EMP compliance achievements	Selected construction contractor designates an engineer responsible for compliance with environmental management plan. MTR w/ MEWCT makes periodic inspections to ensure compliance.
6)- Community liaison function in place and interacting with authorities/communities as road is rehabilitated	County authorities and concerned local communities have a source of liaison regarding road rehabilitation	GOSS MTR appointed Community Liaison Officer explains benefits and deals with issues such as traffic safety, the implication of the official right-of-way and maintains record of citizen interactions.
7)- Completed road segment is inspected prior to handover to GOSS	Evaluation of adequacy of mitigation measures, all essential decommissioning and EMP compliance	MTR w/ MEWCT carry out final inspection before handover and prepare compliance report.
8)- Regular and routine maintenance program is carried out	Maintenance program regularized according to the road category and systematically implemented. Monitoring is carried out according to the EMP to check against unforeseen adverse impacts and proper attention to environmental safeguards	MTR or another agency budgets for a contractor(s) who executes the maintenance program. Potential for localized maintenance crews operating at state/county level. Periodic monitoring reports prepared w/ copies to MEWCT.

BACKGROUND TO THE PEA

DESCRIPTION OF THE PROPOSED ROAD REHABILITATION ACTIVITIES

Road rehabilitation has been an early and important feature of U.S. Government support, largely with funding channeled through USAID/Sudan Field Office (SFO), for relief and rehabilitation efforts in Southern Sudan. An important thrust of those road rehabilitation activities was to make roads more passable to facilitate food aid and related relief supplies to war-torn areas of the country.

At the outset, many of these road repair program activities, such as those carried out under the UN Habitat Program were funded with disaster relief funds and thus exempt under USAID's environmental procedures—Regulation 216 (22 CFR 216.2(b)(1)(i)). However, since 2004, development assistance resources from USAID have been increasingly used to fund these activities being carried out on behalf of the Agency (and other donors) under the aegis of the U.N. World Food Programme (WFP) Emergency Road Repair and Mine Clearance Project. This was the setting under which an Initial Environmental Examination (IEE) of the Strategic Objectives (SOs) of the USAID/SFO Strategy in 2004 was carried out.

The USAID Sudan **Strategic Objective Eight (SO 8): Foundation Established for Economic Recovery,** seeks to assist Sudan in establishing the foundation for an eventual economic recovery by creating the basic building blocks of a rural economy driven by agriculture, livestock production and marketing. The SO 8 is approved for a period of three-years (FY 2004-2006). The beneficiaries for this program include micro-entrepreneurs (especially women), agricultural training institutions, a microfinance institution, commodity networks of producers and traders, and public sector institutions involved in creating the legal and policy framework for economic recovery.

Among other things, this SO will be achieved under **IR 8.3—Market Support Programs and Services Introduced and Expanded.** This IR will provide increased delivery of market support services such as credit, training, new technologies, and market information. The main focus will be on programs and services offered to entrepreneurs, enterprises and households by the newly established market support institutions. This IR will be achieved through several sub-IRs: (1) Increased access to microfinance; (2) Improved skills, technologies and practices available; (3) **Infrastructure improved**; and, (4) Improved access to HIV/AIDS information. The IEE of the USAID/SFO SO 8—Foundation Established for Economic Recovery (Program/Activity No. 650-008) approved in April 2004 led to a positive threshold determination and the need to carry out the present programmatic environmental assessment of this component of the program, as cited below.

"a. Road repair and rehabilitation planned under IR 8.1 and 8.3. This entails rehabilitation of roads in southern Sudan under the Sudan Infrastructure Program (SIP) and WFP/GTZ programs, and similar work planned, with associated culverts, bridges, etc. A Positive Determination is recommended per 22 CFR 216.3 (a)(2)(iii) and 22 CFR 216.2(d)(viii) for road improvement. Specifically, a **Programmatic (or sectoral) Environmental Assessment (PEA) approach** is recommended, per 22 CFR 216.6(d)."

In April 2006, USAID adopted a new strategy for assistance programs in Sudan. The USAID Sudan Strategy Statement 2006-2008 is focused on responding to the most critical threats to the Comprehensive Peace Agreement. The new strategy authorizes three new strategic objectives; of most relevance to infrastructure investments is Strategic Objective 650-010, "Promote Stability, Recovery and Reform," through which USAID will invest in governance structures, services, and public goods to launch the post-war recovery and reconstruction in Southern Sudan. This will be done through the achievement of four Intermediate Results (IRs):

IR 10.1: Core Institutional Structures for an Effective, Transparent, and Accountable GOSS Developed.
IR 10.2: Selected Urban Areas Strengthened.
IR 10.3: An Electoral System Conducive for Free and Fair Elections Established.
IR 10.4: Persons Affected by Conflict Reintegrated.

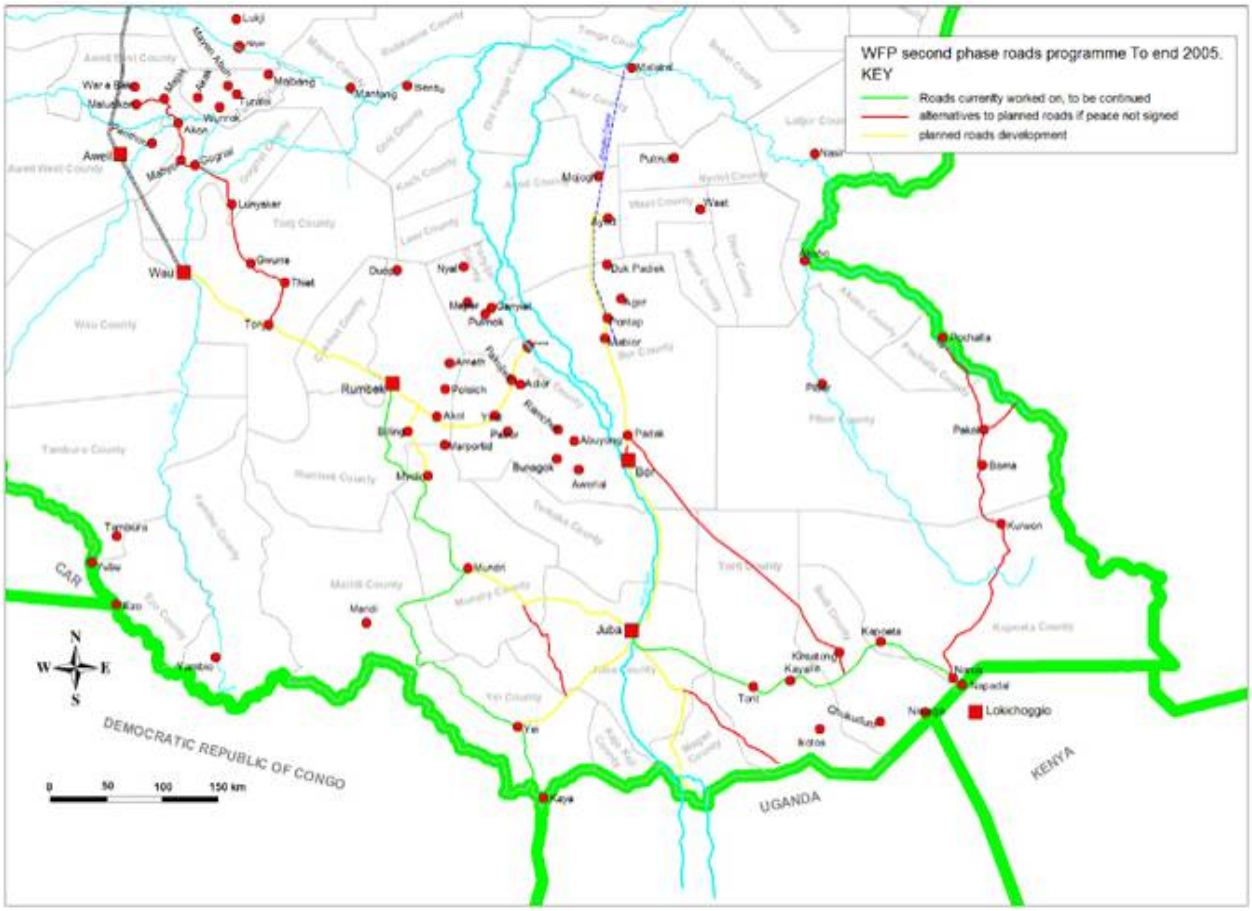
Improving the ability of the public sector to plan, design, finance, and maintain roads will be funded under IR 10.1. Financing for specific road rehabilitation and other infrastructure works will be funded under IR 10.2 and IR 10.3.

The Initial Environmental Examination (IEE) for the new Strategic Objectives (650-009, 650-010, and 650-011) includes a Positive Determination per 22 CFR 216.2(d)(1) for road construction activities. The IEE states that USAID will not finance road construction unless the proposed road segment has undergone an environmental review using the environmental checklist in this Programmatic Environmental Assessment of Road Rehabilitation Activities in Southern Sudan, and construction contracts include the specified mitigation actions in the contract clauses.

ENCOMPASSED ACTIONS

The WFP Emergency Road Repair and Mine Clearance Project (sometimes called the Emergency Road Repair Project or ERRP) started in January 2004 and is now in its second phase. Phase I which ran from January to October 2004 included six elements: 1) road network surveys (for design, cost estimate and mapping purposes); 2) Food-for-Work Roads (improved food security for beneficiaries working on labor intensive feeder road clearing and improved connectivity with the trunk road system); 3) emergency road repairs in the Western Corridor (Kaya to Rumbek); 4) emergency road repairs in the Eastern Corridor (Narus to Juba); 5) Bor Counties Dike Rehabilitation; and 6) Rumbek Airstrip Upgrading (improved safety and allowing for larger aircraft to land).

Figure 1. Present Road Rehabilitation Plans



The second phase of the WFP ERRP was expected to be completed by the end of calendar year 2005.[1] Phase II has now reportedly been extended for some months into 2006 to account for delays associated with the slower than anticipated pace of de-mining and localized insecurity. This phase is directly concerned with a continuation of the road improvement activities in both the Western and Eastern Corridors and with the Bor Dike/Road project (see Figure 1).

ROAD REHABILITATION—EMERGENCY REPAIRS

It should be emphasized, as is widely recognized by both the donors, the Sudan Peoples Liberation Movement (SPLM), and now by the Government of Southern Sudan (GOSS), that these road rehabilitation activities are a first level of repair aimed at improving road access into Southern Sudan and are not the final stage during which much more durable repairs are being planned (see JAM Report, Infrastructure Cluster Report). Their specific aims include:

- Improved road access, reducing the cost of access to food and food production itself;
- Stimulating commercial activity and self-sufficiency;
- Facilitating the movement of Internally Displaced Peoples (IDPs) and other returnees;
- Showing the dividends of Peace; and

[1] USAID/SFO funds are also being used for the rehabilitation of the Bor Dyke and Road in Jonglei State but these activities are the subject of a separate Environmental Impact Assessment being carried out for the Agency under the aegis of the USAID/SFO contract with USDA.

- Reducing the transport cost of the massive amounts of humanitarian operations and assistance flowing into the country.

Much of the work involves earthwork to clear and restore the road bed. Drainage works have been kept to a minimum because of their much greater cost. Then too, these works are largely being carried out on the existing roads and they are not, in the parlance of the engineers, "green field sites" through otherwise untouched territory. Accordingly, re-alignments have been held to a minimum.

The main physical activities include: brush clearing and removal of some trees, to reclaim road width and drains, roadbed preparation to improve the sub-grade, excavation of side and mitre drains (where possible) to improve drainage, filling and compaction to eliminate road surface deformation and the many large potholes (see sample photos).

In general, these repairs raise the road bed slightly above the level of the land and provide for drainage so as to eliminate water on the roads which would quickly lead to their deterioration. A final layer of locally occurring gravels or laterite (known as "murram") is added as a surface or wearing course (see Figure 2. Typical Road Section).

BENEFITS OF PRESENT ROAD REHABILITATION ACTIVITIES

The importance of improved road infrastructure in the context of present day Southern Sudan cannot be overstated. A recent study by the South Sudan Center for Census, Statistics and Evaluation (SSCCSE 2006) stated that:

"The success or failure of all livelihood systems in southern Sudan rests on the ability of people to move and to trade. Mobility allows people to take advantage of seasonal food opportunities in different areas, such as fish and wild foods; it is also crucial for the survival of livestock, which depend on regular migrations between dry and wet season grazing areas. Trade (in labour, cattle, and various local products) increases wealth and capital for better off households, and helps to offset localized production failures in years of bad rain."

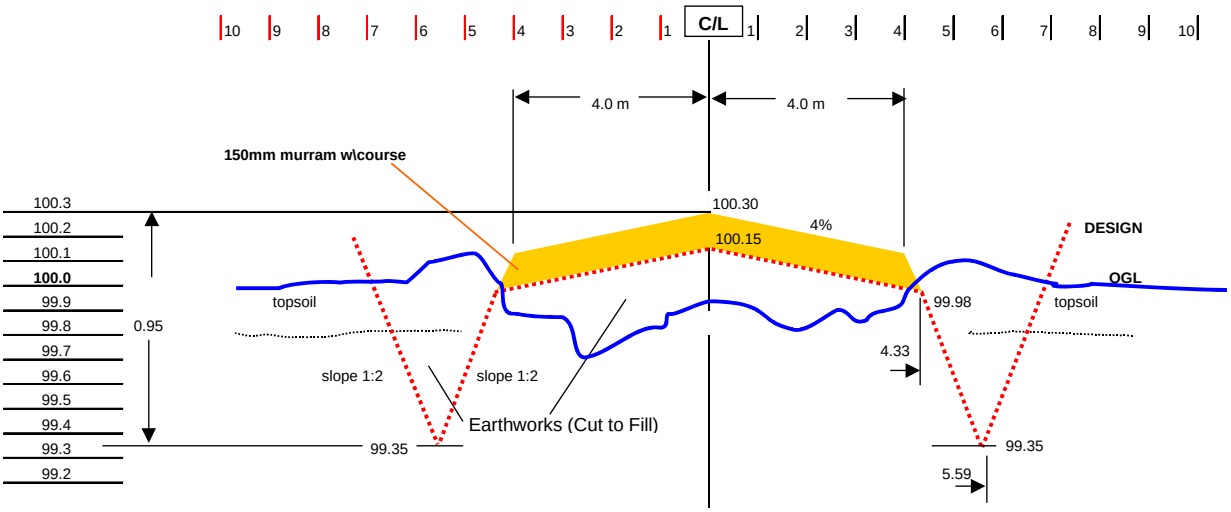
Real achievements are accruing widely across the areas transected by the road rehabilitation activities, clearly the most tangible sign of the benefits of the peace process to the everyday Southern Sudanese. With the improved roads, WFP now moves an average of 2,500 MT of relief food per month by road, compared to 800 MT/month before roads were improved. In 2001, WFP delivered only 15 percent of its food aid by truck and distributed the rest through costly air-drops. Now, the majority of food aid is moved by ground transport due to the lower transport costs, quicker delivery times and increased trucking capacity (Knausenberger, C. 2005).

Travel times have also been significantly reduced. The 80 km trip from the Uganda Border to Yei used to take three to eight hours by road. The road was repaired and the trip reduced to only one hour. Unfortunately, this is one of the stretches of newly repaired road that has not been maintained and the time required to travel it increases every day. The drive between Yei and Rumbek used to take three days, and now can be traveled in one day. Public bus systems have been re-established after a 20-year absence. Daily buses now travel between the Ugandan Border, Yei, Mundri, and Kotobi, and between the Kenyan Border and Kapoeta.

Road rehabilitation is revitalizing the economy by creating more jobs, providing access to markets, decreasing the cost of transport and goods, and increasing availability of goods such as medicines, clothing, tools, spare parts and construction materials. WFP recently reported that prices of some basic commodities, such as sugar, have decreased by 25 percent. In addition, road rehabilitation is creating jobs which are employing local people. Road maintenance will generate additional local employment. Kiosks and businesses are springing up along roadsides, taking advantage of the increased traffic, and providing entrepreneurs with new sources of income.

Figure 2. Typical Road Section

TRUNK ROADS - Section A
OVER UNTOUCHED EXISTING ROADS (Over IMPROVED Existing Roads: SAME PARAMETERS)



Source: Section IV - General Condition of Contract

Levels are approximate and indicative, and may vary according to actual road conditions.

CURRENT ROAD ACTIVITIES WITH USAID FUNDING

The Table 1 provides a synopsis of USAID's involvement in road rehabilitation in Southern Sudan and the subjects (encompassed actions) of this PEA.

Table 1. USAID Involvement

Program	Source of Financing	Status	Relation to USAID Roads PEA
WFP Emergency Roads and Dikes	USAID Development Assistance (DA); USAID International Disaster and Famine Assistance (IDFA); other donors.	On-going: A mix of completed works, on-going works and planned works.	• Subject to IEE's positive determination • Source of sample for completed and on-going works • PEA recommendations to design and construction firms must be implemented by this program.
USDA Mega PASA	USAID Development Assistance (DA); USAID International Disaster and Famine Assistance (IDFA)	On-going: Among many other activities, the Mega PASA funds an Environmental Assessment of the WFP Emergency Roads and Dikes work in the Bor area and funds the WFP engineering staff.	• No civil works so not subject to IEE's positive determination • No need for the USAID Roads PEA to encompass the Bor area work because it is covered by its own specific Environmental Assessment.
Sudan Infrastructure Program: Capacity-Building Component (SIP CB)	USAID Development Assistance (DA)	On-going: Implementing contractor Louis Berger Group mobilized in August 2005.	• No formal link. • PEA recommendations to GOSS can be implemented with assistance from LBG
Sudan Infrastructure Program: Construction-Management Component (SIP CMC)	USAID Development Assistance (DA)	Future: RFP process is still underway.	• Subject to IEE's positive determination • PEA recommendations to design and construction firms must be implemented by this program.
Sudan Emergency Transport Infrastructure Development Program (SETIDP)	Multi-Donor Trust Fund (MDTF) and GOSS	Future: World Bank is managing this project and expects to start civil works in January 2006	• No formal link. • PEA recommendations to design and construction firms may be useful to this program.
Pagak Bridge	USAID International Disaster and Famine Assistance (IDFA)	On-going: Works underway	• Exempt
Small-scale rural road clearance and repair as part of localized relief programs.	USAID International Disaster and Famine Assistance (IDFA)	On-going: Works underway	• Exempt- Often folded into food security or water activities. Implementers might find the PEA useful to their work.

Source: USAID/SFO, 2005.

NEED FOR THE PEA

Road rehabilitation activities funded by USAID typically fall into a category of activities which require an environmental assessment (22 CFR 216.2(d)(viii)) hence the present efforts. In planning for the implementation of this PEA, a decision was taken, with the SPLM and now with the GOSS, to make the PEA as far as possible, a joint exercise with the GOSS counterpart Ministry of Environment, Wildlife Conservation and Tourism, the primary counterpart agency for the USAID-funded Sudan Transitional Environment Program (STEP).[2] In addition, discussions with the Ministry of Transport and Roads suggested that they, too, should share in the execution of the PEA. These decisions were seen as increasing the opportunities for capacity building related to the environment, the main thrust of STEP.

Road rehabilitation and construction will continue to be an important part of the development scenario in Southern Sudan for years, if not decades to come. The current WFP-executed, USAID-funded road rehabilitation activities are winding down and moving to a more direct USAID-executed roads program under the Sudan Infrastructure Program. Similarly, as noted in the Joint Assessment Mission (JAM) reports, there will be continued emphasis on road construction, estimated at as much as US$4 billion equivalent, part of which is already in the planning stage with the inception of the World Bank-managed Multi-Donor Trust Fund (MDTF).

Narus-Juba / road before construction ch 85 km. Photo by: WFP

Narus - Juba road under construction at km 84. A critical road, once all but impassable, now linking Northern Kenya with Southern Sudan. Photo by: WFP

Indeed, because of the importance attributed to road building by the GOSS and its donor partners, USAID/Sudan has strongly encouraged the PEA Team to reach out to their Bank and donor colleagues with the hope that the PEA might serve their environmental review purposes as well. At the request of USAID/SFO, the STEP Team has been assigned the responsibility to carry out the PEA as Performance Measure No. 6 of its contract.

[2] Although USAID's initial planning and discussions about the need for a PEA began as part of the working relationship with the Sudan Peoples Liberation Movement (SPLM), the Government of Southern Sudan (GOSS), its successor, was established only in October 2005. As part of the GOSS, a Ministry of Environment, Wildlife Conservation and Tourism was established and the roles and responsibilities for environmental policy and impact monitoring added to its new mandate.

The expected results of the PEA are as follows:

- Provide the basis for a process and management structure within the GOSS (in the main involving the Ministries of Environment, Wildlife Conservation and Tourism and of Transport and Roads) for environmental screening and review of road rehabilitation activities in Southern Sudan.
- Generate a set of environmental guidelines that can be incorporated into the Special Provisions and Specifications for contracts being awarded by the GOSS and its donor partners (WFP, USAID, the World Bank Multi-Donor Trust Fund, and others) to design consultants and contractors engaged in road rehabilitation in the future in Southern Sudan. Such guidelines will streamline the review process and thereby accelerate the implementation of the large-scale road rehabilitation and re-construction activities that are seen as fundamental to peace and relief and development in the country.
- Serve as the basis for the preparation and eventual promulgation of GOSS sectoral guidelines for the transport and roads sector.
- Provide on-the-job technology transfer/training opportunities for concerned GOSS ministerial staff.
- Meet the requirements of USAID Environmental Regulations (22CFR216) as related to the present program of road rehabilitation.

PEA APPROACH AND METHODOLOGY

The Programmatic Environmental Assessment (PEA) of the Road Rehabilitation activities was carried out much like its Scoping Exercise, that is, with a strong dependency on consultation and collaboration as the primary fact-finding tools. The PEA Team consisted of five persons, a Senior Environmental Policy Advisor cum Team Leader, a Roads EIA Specialist Consultant, a Southern Sudan Ecological Specialist Consultant, a representative of the GOSS Ministry of Transport and Roads, and a representative of the GOSS Ministry of Environment, Wildlife Conservation and Tourism. **Appendix A** presents brief biographical sketches of the PEA Team members. They were joined for part of their work by a representative of the USAID/Sudan Infrastructure Team. The Team was able to consult many of the documents related to road rehabilitation in Southern Sudan assembled during the Scoping Exercise and added a few newer ones in the process (see **Appendix B** for a list of relevant documentation).

The field work for the PEA was carried out during the period late January to mid-February 2006 and involved visits to selected road rehabilitation sites in and around Rumbek, in selected areas of Bahr el Ghazal and in Eastern Equatoria. While carrying out the visits, the PEA Team visited with and consulted many of the main beneficiaries and stakeholders involved in the road rehabilitation program, including GOSS and WFP personnel, staff of the contractors building the roads, the consulting engineers who supervise their work, and the local authorities and communities along the road segments that were visited (see **Appendix C** for a list of persons consulted).

PROPOSED ACTION AND ALTERNATIVES

PROPOSED/ONGOING ACTION AND ALTERNATIVES:

Sound environmental assessment always looks at the premise that there may be alternatives for achieving program objectives than the chosen set of activities. This is to avoid a situation wherein a series of mitigation measures or small changes are taken up when a more radical course of action, changing the basic solution, would be a wiser choice of action. The following section examines the alternatives, albeit few in number, for meeting program objectives.

For the alternatives analysis, the PEA Team explored alternatives to the proposed action at the programmatic level. Alternatives to be evaluated in a PEA must meet the program's objectives, in this case, the objective of IR 8.3, "market support programs and services introduced and expanded" and Sub-IR 3, "infrastructure improved." The IR, which is increasing delivery of market support services such as credit, training, new technologies, and market information, hinges on a rehabilitated and functioning road infrastructure.

No alternatives that the team explored would provide the broad base of road infrastructure improvements that the current road rehabilitation does. Infrastructure improvement that reaches throughout Southern Sudan is the basis for linking the Southern Sudanese people and economy to local, national, regional, and international networks, and bringing improved service delivery to previously marginalized areas and areas formerly under conflict. While the *no action* alternative fails to meet the program objectives, it is included in the analysis as a means of sharpening the discussion and highlighting the overall consequences and benefits of the proposed action.

The PEA Team considered the proposed action, no action, and also eliminated from further study two additional alternatives, discussed below.

NO ACTION SCENARIO

Southern Sudan has an extensive system of gravel roads, but during the war years, the network was not maintained and in fact many parts of it, including crucial bridges and causeways through wetland areas were willfully destroyed as a result of hostile action. After these years of civil war, Southern Sudan's foundation for development has been greatly weakened and its institutions, technical capacity, and infrastructure have been depleted. The country faces significant short to medium-term challenges—putting an end to conflict and its causes and ensuring short-term food security in the near-term while also grasping the new opportunities for development and the reversal of high levels of poverty and vulnerability among its peoples.

USAID's contributions to the infrastructure program are improving the lives of the Southern Sudanese and strengthening the GOSS's ability to ensure the peace by delivering services to its citizens. Without USAID funding (currently amounting to approximately US$ 72.2 million or 70 % of the total resources currently available from the donor community for this purpose), road rehabilitation activities could not proceed at the present pace, resulting in a slower process of bringing Southern Sudan's people and economy into the mainstream.

Without USAID funding, or GOSS or Multi-Donor Trust Fund resources to substitute for it, not only would the pace of road rehabilitation slow but there is also a very real possibility that critical infrastructure already rehabilitated will be left to degenerate owing to the lack of resources for a planned road maintenance program to take over newly rehabilitated road segments. In the *No Action* scenario, funding would not be available for

road rehabilitation activities, roads will continue to degrade, the economy will take longer to feel the effects of the peace, and the GOSS will find it more difficult to demonstrate its competence as a government.

The lack of basic infrastructure has contributed to the overwhelming poverty that still prevails. The current infrastructure situation leads to limited access to markets and services (including health and education services); and leaves people with limited ability to participate in democratic processes and for government to play a role in peoples' lives. Without roads to viable markets, there is less likelihood that agricultural and livestock husbandry practices can be intensified thus avoiding gradual land degradation from extensive and low productivity farming systems. Growing commercial linkages with both Uganda and Kenya for supply and trade could also be curtailed thrusting Southern Sudan back into the isolation it has suffered over the war years.

Under the *No Action* alternative, food distribution would continue, but food aid would mainly be distributed by air, a more expensive method for bringing food to food insecure communities and vulnerable populations groups among them. It will be much more difficult to ensure that food air reaches communities as a distance from the existing air strips. Southern Sudan would remain in an under-developed state, and continue to require food aid, and logistics of food aid delivery would remain extremely difficult. Within this scenario, there is also a real probability that conflict would return threatening the lives and livelihoods of millions of people and affecting regional and world peace.

No Action: Summary of Environmental Effects: Over the four decades of civil war, Southern Sudan's toll in human suffering, lack of development progress, damage to vital infrastructure and accompanying pervasive threats to the stability of the natural resources base, is staggering. The Southern Sudanese are largely left to be subsistence farmers, livestock keepers, to collect wild food, and to hunt for significantly depleted game. This situation is particularly alarming and unsustainable in this region of erratic rainfall, where much of the land is unsuitable for mixed agricultural systems, and where it is difficult to produce enough food to feed the population.

The *No Action* alternative would have significant negative effects on the socio-economic, cultural, education, and health status, and general well-being of the population of Southern Sudan. However from a strictly environmental perspective, and, as shown in the table below, the *No Action* alternative will have other adverse impacts as well. These effects will mainly be a result of unrelenting poverty and the need to resort to unsustainable practices to provide for basic needs.

Huge potholes on the Rumbek to Yei Road along the Western corridor...before rehabilitation. These potholes prompt truckers to try and go around them, often without success, simply widening the damage. Photo: WFP

Travel time on this rehabilitated road from Rumbek to Yei, a matter of approximately 500 kms, has been cut from 2 to 3 days to 8 hours. Photo: WFP

Under the *No Action* scenario, there will continue to be limited ability of government to regulate access to resources, and to encourage communities to participate in and support natural resources conservation, and when necessary, to enforce regulations. Natural resources will continue to be mined unsustainably—harvesting timber, hunting wild game, unsustainable agricultural practices. *No Action* translates to continued degradation of ecosystems, agricultural and natural. These communities will continue to be isolated, and not receive the basic inputs to improve agricultural productivity and the technical assistance to improve timber harvesting and agricultural practices.

The road network will continue to degrade, resulting in increased soil erosion, especially on slopes, and also at specific locations (culverts) on flatter topography, where scouring is a problem. Hydrology will be altered by erosion and resulting siltation into nearby water courses and wetlands from roads that are degraded. The proliferation of potholes along the road system, particularly in black cotton soils or wetland areas will prompt drivers to seek to widen the road right of way, further exacerbating the impact on the environment.

The table below summarizes these *No Action* impacts in comparative form with the *Proposed Action* impacts.

A COMPARISON OF THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH DIFFERENT ALTERNATIVES

The Scoping Statement identified potential environmental impacts of the proposed action; and these were further elaborated during the PEA exercise. To help provide a clear basis for choice between the *Proposed Action* and *No Action*, the environmental impacts are presented in comparative form, with brief explanations, in the table below. The environmental consequences of the *Proposed Action* are analyzed in detail in Part D.

Table 2. A Comparison of the No Action versus Proposed Action Scenarios

Issue	Proposed Action: Construction Phase (short-term effects)	Proposed Action: Operation Phase	No Action:
1) Access to protected areas, TES, and undegraded tropical forest/ forest conversion	[-] Construction crews may gain access to protected areas and undegraded forests and use resources for shelter and food; disturbance to habitat of TES could reduce biodiversity.	[-] Improved access to protected areas and undegraded forest may result in unsustainable use and conversion of forest to other land uses; and TES habitat may be disturbed. Regulatory authorities may not yet be in place to manage protected areas, TES, and forests, but once regulatory bodies are strengthened, improved access will improve their forest/biodiversity conservation capability. *This is a potentially significant issue that would need to be evaluated and mitigated on a site-specific basis.*	[-]Currently, forest resources (not necessarily from undegraded forest) may be "mined" spurred on by poverty, lack of choices, and limited governance (although communities exert their own controls). PAs and TES may be at risk due to limited management/control.
2) Access to natural resources, loss of habitat, and land use conversion	[-/0] Construction crews will gain access to areas for hunting and fishing.	[-/+]Roads rehabilitated along original route, will not result in loss of habitat, but villages and ancillary services may expand, resulting in some loss of habitat (indirect); species abundance may decrease from increased hunting pressure; regulatory authorities will have improved access for control/ management.	[-]The current situation, where natural resources are "mined" to provide basic requirements of food and shelter will continue unsustainably. Species abundance will continue to decrease, and ecosystems will continue to become fragmented, decreasing the quality of available habitat.

Issue	Proposed Action: Construction Phase (short-term effects)	Proposed Action: Operation Phase	No Action:
3) Soil erosion	[-] On slopes or where water/wetland crossings are constructed, soil erosion may occur. This would only be a potential short-term impact if BEPs were used.	[-] Roads will be stabilized and soil erosion may be minimized, but the material to put in place BEPs to control erosion during operation phase may not be available, necessitating a higher degree of attention to routine maintenance.	[-] The current situation, where roads are not maintained and are in poor condition results in erosion and siltation of waters and wetlands.
4) Hydrological alterations	[-] During construction, water courses and wetlands will be temporarily disrupted. This is a short-term and minor issue if BEPs are used.	[-] With properly sized, placed, and maintained culverts, bridges and drifts, hydrology of water courses and wetlands will not be disturbed in the long-term and may be improved from the current situation; however, the typical situation in Southern Sudan has been poorly placed, sized, and maintained culverts.	[-] The poor condition of some bridges and culverts has resulted in altering hydrology, especially where vehicles have used alternative routes, driving through wetlands and dry riverbeds; and where herders move livestock through these areas.
5) Wetland filling or conversion	[-] Where rehabilitation involves widening (this would be for safety reasons only) wetlands may be filled during construction.	[-] If widening involves wetland filling, portions of the wetlands will be lost, leading to a reduction in water filtering, flood attenuation, and ecosystem functions and values.	[-]Wetlands are being silted in as described above, losing the hydrological, soil, vegetation characteristics and the functions of a natural wetland.
6) Borrow pits (siting through closure)	[-/+]Borrow pits may disturb natural vegetation and habitat and wildlife use of the area; they provide a source of drinking water for livestock.	[-/0/+]Borrow pits left open may be a health and safety concern but would provide watering holes for livestock; and borrow pits properly closed would have no environmental effects.	n/a
7) Construction camps (siting through closure)	[-/0]Clearing and constructing the camp could affect wildlife habitat, wildlife, and other natural resources; pollution from fuel, oil, lubricants, human waste, and garbage could impact the environment.	[-/0]A construction camp properly closed will have no long-term effects (into operation phase); an improperly closed construction camp could have negative effects if waste is left behind to pollute the environment.	n/a
8) Dust	[-]The creation of dust is a significant issue during construction, especially during the dry season. Construction vehicles churn up dust along the road.	[-]Use of laterite as the finished surface leads to extreme dust conditions. Increased traffic along the rehabilitated roads increases the negative effects of dust from both a health and traffic safety standpoint.	[0]The current road surface and minimal traffic on the roads does not create a dust problem.
9) Traffic safety	[-]Construction vehicles can cause accidents since during construction there are many more vehicles on the road than what people are accustomed to, and they make frequent stops and turns.	[-]With improved road conditions the potential for accidents involving people, domestic animals and non-motorized transport is high.	[0/-]Minimal traffic and the poor state of the roads, where traffic has to move slowly, results in a relatively safe driving experience. This would remain the case until the road system was in an even greater state of disrepair, where it created a hazard to drivers.
10) Spread of contagious diseases	[-]Construction crews may spread contagious diseases to local populations.	[-/+]Increased traffic will bring contagious disease into areas, HIV/AIDS being a particular concern. Health care would be expected to improve as access improves.	[0/-]There would be less mixing of people from outside the area, and less chance of bringing in contagious disease, but health care would continue to degrade.

Issue	Proposed Action: Construction Phase (short-term effects)	Proposed Action: Operation Phase	No Action:
11) Limited routine maintenance	n/a	[-]Roads will degrade, resulting in erosion, siltation, pooling of water, and eventually they will be in the state of disrepair they are now in.	n/a
12) Return of IDPs	[0]IDPs are returning regardless of road re-construction.	[0/+]During operation phase, IDPs will continue to return and create settlements, regardless of the state of the roads, however, with the improved roads in place, it will be easier to reach them with services and the environment will be more secure for their passage.	[-]IDPs will return regardless of the state of the road, but with continued deterioration of roads, settlements will be scattered throughout the areas, governance and service provision will be more difficult.

Key: +=positive effect; -=negative effect; 0=neutral/no effect

IDENTIFICATION OF AGENCY'S PREFERRED ALTERNATIVE

The agency's preferred alternative is to rehabilitate the roads, as proposed, with the measures presented below to mitigate the impacts described in the Table above and further elaborated under Section D.3 on "Environmental Consequences."

ALTERNATIVES ELIMINATED FROM CONSIDERATION

The PEA Team considered and eliminated from detailed study the following alternatives:

Alternative 1: Rehabilitate a combination of select roads and river ports to provide a network of transportation routes throughout Southern Sudan. This alternative would construct/rehabilitate ports along the Nile River and link them to select roads which would be rehabilitated. Due to the expense, fewer roads would be rehabilitated under this alternative, as compared to the *Proposed Action* While transport routes along the rivers, and linking rivers to a road network would have certain benefits, focusing on road improvements will be a much quicker way of reaching a greater number of people and providing broader access for bicycles, motorcycles, and other vehicles, as well as for people on foot, and to facilitate movement of livestock keepers and their animals.

It is also clear that the nature of the lands lying adjacent to the river system suggest that this alternative would force the construction of many roads through low-lying wetland areas with greater construction and maintenance costs and doubtless more significant potential for adverse environmental impacts. Much of such a road system would need to be constructed on raised causeways with environmental issues akin to those being experienced on the eastern side of the river on the Bor Dike/Road Construction segment (for which a separate environmental assessment has been commissioned).

This alternative fails to meet the objective of the project and the GOSS because it would not provide the extensive network that is necessary to bring goods and services to Southern Sudan.

Alternative 2: Rehabilitate roads to the standards of a paved or sealed road. This alternative was proposed to minimize the problems of dust and the maintenance needs. However, this alternative was eliminated since available funds would not allow for the rehabilitation of a road network whereby a large enough proportion of the population would receive the benefits. For example, a tarmac road might cost anywhere from US$350,000 to $525,000 per kilometer to build under Southern Sudanese conditions, as compared to the current gravel road or laterite covered roads which are costing anywhere from US$ 40,000 to $60,000 per kilometer to reconstruct.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

The on-going road rehabilitation and reconstruction program foresees building an extensive network of roads west to east across the southernmost parts of Southern Sudan linking the country to the neighboring states of Uganda and Kenya, and a trunk road system that extends northwards on both the western and eastern sides of the Nile, to eventually link the South with the North. As such, this planned road network will cover almost the entire area of Southern Sudan and all of the agro-ecological zones of the South could be affected.

This section sets out to provide sufficient background on the different agro-ecological zones as well as some of the particular environmental features of the country in order to highlight the environmental sensibilities as they may be affected by the road rehabilitation and reconstruction activities. This description is hampered by the lack of good and up-to-date data and information as a result of more than 20 years of civil war.

PHYSICAL AND BIOLOGICAL CHARACTERISTICS

GENERAL CHARACTERISTICS:

The Sudan, with a total area of 2.5 million km2, is the largest country in Sub-Saharan Africa; Southern Sudan occupies approximately 640,000 km2 or slightly more than 25% of it (Biong Deng, 2004).[3] Administratively, the autonomous regional Government of Southern Sudan has divided the country into ten states, governed by state governments, in what was formerly called "Upper Nile" (Upper Nile, Unity and Jonglei States), formerly called "Bahr el Ghazal" (Northern Bahr el Ghazal, Western Bahr el Ghazal, Lakes and Warrab States) and formerly called "Equatoria" (Western Equatoria, Bahr el Jebel, Eastern Equatoria).

The population within what is considered Southern Sudan has been estimated at 7.5 million in 2003 but is expected to expand with the return of up to 4.5 million IDPs and refugees (ibid). Even at the higher figure, average population density is quite low, at less than 20 persons/km2. It is a land of wide-open spaces and long distances between populated areas. Estimates of the total number of kilometers of rehabilitated or improved road required (albeit admittedly an upper limit) to provide linkages across the breadth of Southern Sudan range to 4200 kms of paved roads and 9300 kms of gravel roads (JAM Cluster 6 Report, 2005).

Southern Sudan is much better watered and more fertile than the arid north but it is still a land where the imperatives of fragile soils, erratic rainfall regimes and under-developed land-use technologies mean that local people are persistently vulnerable to food insecurity. The 20 plus years of civil war have added even greater challenges and uncertainties to the survival and coping mechanisms of the local population.

The late GOSS President John Garang wrote, in the preface to the publication, "Towards a Baseline" (Biong Deng 2003) that:

"Children are always ill, with malaria and diarrhea as their biggest killers. One out of every four newborns will die before reaching age five. Alarmingly one out of every five children suffers from moderate or severe wasting. More than one million kids, particularly girls, are out of school and only one out of every 50 children attending school finishes primary education, and this is even worse among girls. The chance of a woman dying in pregnancy or childbirth is one in nine" (in Biong Deng, 2003).

[3] The data and information offered in this section is not intended to cover the "three areas" of Abyei, Nuba Mountains and Southern Blue Nile where information of this type is even more difficult to derive.

The following is a synopsis of the key socio-economic indicators in Southern Sudan which gives a sense of the setting under which the road rehabilitation and reconstruction activities are taking place.

Table 3. Key Socio-Economic Indicators for Southern Sudan

• Total Population- 7.5 million (estimated 2003)…expected to increase by 4.5 million with return of refugees & high growth rate.	• Prevalence of general malnutrition in children under five- 48%, and severe malnutrition- 21.5%
• Population Growth Rate (annual)- 2.85 %	• Infant Mortality Rate (per 1,000 live births)- 150
• Portion of population under 5 yrs.- 21%	• Illiteracy Rate, adult males (% of males 15+)- 76.0%, adult women- 88.0%
• Rural Population (% of total)- 98 %	• Net enrollment in primary school- 20% (worst in the world)
• Total Surface Area (hectares)- 64,000,000.	• Gross National Income- US $90/capita
• Poverty Rate (% of total population)- 90%	• Improved Water Source (% of pop. with access)- 27 %
• Life Expectancy (years)- 42 years	• Improved Sanitation Facilities, (% of population with access)- 16%

Source: NSCSE 2004: Towards a Baseline: Best Estimates of Social Indicators for Southern Sudan.

Climate and Rainfall: Total precipitation and periodicity are key components of the agro-ecological equation and nowhere in Southern Sudan can crop productivity be taken for granted. Rainfall is seasonal across most of the south, with a pronounced dry season lasting from January to April, coinciding with the hot season. This causes large scale migration of many of the pastoral people to wetlands along the river and elsewhere in pursuit of water and fodder for their herds. When the rains return (reportedly later in recent years), up until June, people return to the upland agricultural areas to graze their animals and raise some basic food crops. This seasonality is much less pronounced in the extreme south and in the hilly areas of Equatoria where better rainfall and good soils promote a more sedentary crop-based lifestyle and where the higher humidity is conducive to tsetse that limits livestock husbandry.

Rainfall in the southwestern extremes and highland areas of Equatoria ranges from 1200 to 2200 mm. As one moves north along the Nile, the lowland areas of Eastern Equatoria, Jonglei, Upper Nile, Bahr el Ghazal receive anywhere from 700 to 1300 mm of rainfall per year. The most arid portions of Southern Sudan occur in the extreme southeast along the border with Kenya where rainfall may not exceed 200 mm.

Topography and Soils: Southern Sudan is bisected roughly by the Nile River which is surrounded by a gently sloping to flat basin into which the highlands of the surrounding countries drain. This gentle drainage pattern typical across much of the country, with exceptions for hills and mountains in the extreme south and more broken topography in the southwest (Western Equatoria and Bahr el Jebel), is of course directly related to the soil types.

Seen from the agro-ecological perspective, much of Southern Sudan has "substantial areas of relatively high soil suitability ratings for rainfed agriculture" (relatively flat topography, productive albeit occasionally heavy soils, and low intensity of cropland use) (USGS Greater Horn of Africa Home Page…http://edcintl.cr.usgs.gov/gha/natural.html). This potential improves generally on a gradient from north to south. The combination of the natural resources normally offer a wide range of crop producing opportunities with a growing season ranging from 150 days in the northern plains to 240 days in the Green Belt in the southern zone where double cropping is routinely practiced. One might characterize Southern Sudan as an agricultural frontier which has yet to benefit from more modern agricultural technologies and inputs because of the disruptions of the past decades of Civil War. Despite past tendencies toward food insecurity as a result of a certain measure of drought prone conditions, knowledgeable persons agree that the growing conditions hold great potential.

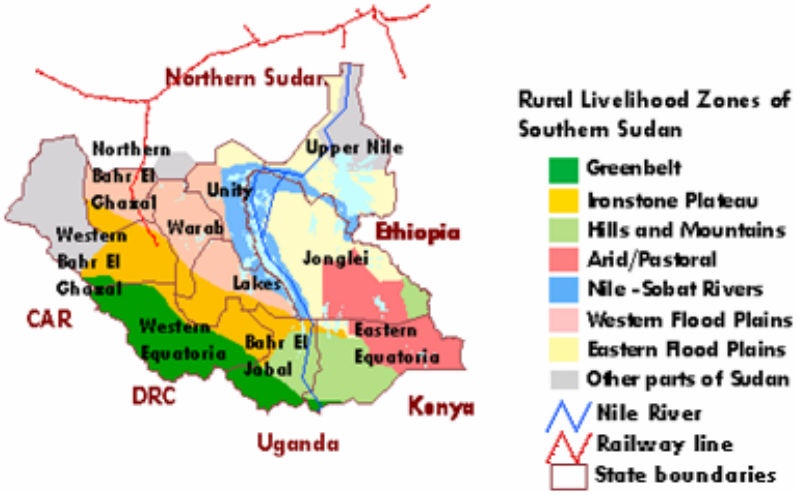
AGRO-ECOLOGICAL (LIVELIHOOD) ZONATION WITHIN SOUTHERN SUDAN:

Up until quite recently, descriptions of the ecology and environment of Southern Sudan had to be cobbled together from older documentation, much of it citing earlier works which might no longer be entirely valid or which contained unverified data and information. This section has been based on the recent publication of the South Sudan Centre for Census, Statistics and Evaluation (SSCCSE) titled "Southern Sudan Livelihood Profiles" and a thorough summary of it is beyond the scope of the PEA.[4] It is, however, heartily recommended as obligatory reading for anyone interested in a good understanding of the agro-ecological under-pinning of the rural economy of Southern Sudan.

The "livelihood" paradigm is also well suited to this type of environmental analysis. It is predicated on the notion that planning and development interventions need to take account of both the physical environment and how people use it to derive their livelihoods. It thus mirrors the environmental assessment technique of considering both direct impacts on the physical environment as well as the indirect socio-environmental impacts of a given activity. The livelihoods paradigm is also useful in that an understanding of it can serve to highlight how adverse impacts from the activities being assessed can affect how people cope with hardships inherent to where they live or how they survive from year to year. Conversely, it is the livelihoods approach that also aids in an understanding of how the intervention being considered—in this case road rehabilitation—actually benefits local people.

According to this report, Southern Sudan may be divided up into seven broad "Livelihood Zones" (see Figure 3 below), as depicted in the following figure:

Figure 3. Rural Livelihood Zones of Southern Sudan



Source: SSCCSE 2006

[4] This report was published in January 2006 at the South Sudan Center for Census, Statistics and Evaluation (SSCCSE) with the joint support of Save the Children UK and the USAID-funded Famine Early Warning Systems Network (FEWS NET) under the Livelihoods Analysis Forum. It has been intentionally adopted here as an important source of information for this PEA in keeping with the resolution to consistently reinforce the idea of the SSCCSE as the custodians of vital data and information records for Southern Sudan.

In summary, these "Livelihood Zones" are described as follows:

Greenbelt Zone	Households in the wetter south-western areas of the Greenbelt Zone rely almost exclusively on agriculture to meet their food needs. Here, surplus production is common and households cope with dry years by increasing their dependence on root crops and exchange.
Arid Zone	In the Arid Zone, which occupies the south-eastern tip of the country, households practice a nearly pure form of pastoralism and there is almost exclusive reliance on livestock and livestock trade for food. Seasonal migrations in search of both water and pasture provide opportunities for substantial trade and exchange with neighbouring communities.
Hills and Mountains Zone	The Hills and Mountains Zone falls somewhere between these two extremes (agriculture and pastoralism) with reliance on cattle, trade and root crops increased in difficult years.
Western and Eastern Flood Plain Zones	In the Western Flood Plain Zone, livestock and agriculture, supplemented by fish and wild foods, are the main food sources. Similar food sources are available in the Eastern Flood Plains Zone, but with an additional option of game hunting.
Ironstone Plateau	Households in the Ironstone Plateau Zone are heavily dependent on crop production and are well placed to access surpluses in the neighbouring Greenbelt.
Nile and Sobat Rivers Zone	Apart from crops and livestock, wild foods and fish contribute significantly in the Nile and Sobat Rivers Zone. Fish and wild foods are collected in varying quantities depending on the season and the location.

Source: drawn verbatim from SSCCSE 2006.

OTHER IMPORTANT AND SENSITIVE FEATURES OF THE AFFECTED ENVIRONMENT

Wetlands: No discussion of the "affected environment" of Southern Sudan can fail to highlight the importance of the numerous wetland ecosystems. Estimates suggest that fully ten percent of the total area of the country is permanent or semi-permanent wetlands, one of the highest percentages in the world (personal communication, Ipoto 2006).

Primary among these wetlands is the Sudd, the great inland delta swamps of the White Nile. This vast area extends from Bor north to its widest point between Bentiu and Malakal where the Bahr el Ghazal River drains it back into the main course of the Nile. Between these two points, bridge crossings of the Nile will be almost impossible and approach roads from the periphery through the permanent swamp lands prohibitively expensive and of great potential harm to the environment.

It is probably not the Sudd, however, where the greatest environmental sensitivities lie as concerns wetlands. Wetlands are a common feature of the flat plain areas west and east of the Nile and the existing road system traverses them on countless occasions, often over causeways or raised roadbeds that were also expensive to build and which have disrupted the wetland ecosystem.[5] The predominance of wetlands is vitally important as part of the land-use strategy among the agro-pastoralist society which retreats to them (the "toic") during the long dry season to sustain their cattle with fresh fodder and water.

[5] USAID/Sudan and the World Food Programme (WFP) have sponsored an environmental assessment to examine the potential adverse impacts of the road and dike construction activities near Bor in Jonglei where there is great concern that the road on the dike could radically alter flood and drainage patterns and affect the livelihoods of many local people.

Wetlands—rivers waiting to happen—are a common feature of the landscape in the central plains of Southern Sudan. Building roads across them is challenging from both the engineering and environmental perspectives and costly. Realignment to find narrower stretches of wetlands should be considered. Photo by: T. Catterson/IRG

Crossing wetlands requires the construction of a fairly massive and expensive causeway. Lots of culverts of sufficient diameter and carefully maintained are needed if the causeway is not to become an obstruction to the water flow, leading to damage of the road and significant adverse impacts on the wetlands. Photo by: T. Catterson/IRG

Wetlands also serve an important ecological function as well, absorbing the run-off from occasionally torrential rain storms, storing it and releasing it slowly later in the season regulating the flow of many streams and watercourses. In effect, wetlands act as natural sponges and serve as an edaphic buffer mitigating the erratic rainfall patterns typical of much of Southern Sudan. The wetlands, of course, also serve as habitat and refuge for many wildlife species in Southern Sudan including all of the main "threatened and endangered species" except the chimpanzee.

Inherently environmentally sensitive as ecosystems, the difficulty of building or reconstructing roads through the wetlands is exacerbated by the lack of good data on their hydrological characteristics. In many cases, wetlands are rivers waiting to happen wherein upstream run-off in some years will come together to form a previously unknown stream or river.

Protected Areas: On paper, Southern Sudan has an extensive system of protected areas (PAs), including national parks, game sanctuaries and forest reserves (see Figure 4 - Conservation Areas of Southern Sudan). As might be expected after 20 years of civil war, there is great uncertainty about the status of these PAs and the wildlife that formerly inhabited them.[6]

Reliable data and information on the present status of wildlife resources in Southern Sudan is unavailable. Some reconnaissance work done in selected national parks in recent years with support from USAID gives a rather somber picture of the level of the depletion of the resource. The present easy availability of firearms and an acknowledged widespread subsistence consumption of game meat suggest that illegal hunting is rampant and that wildlife populations are under threat. There is also commercial marketing of game meat, particularly in the southwest along the border with the Democratic Republic of Congo (DRC) and the Central African Republic (CAR). Finally, there is reportedly still active poaching of threatened and endangered species (TES) such as elephant and rhino by well armed bands of poachers, supposedly operating along the western side of the Southern National Park.

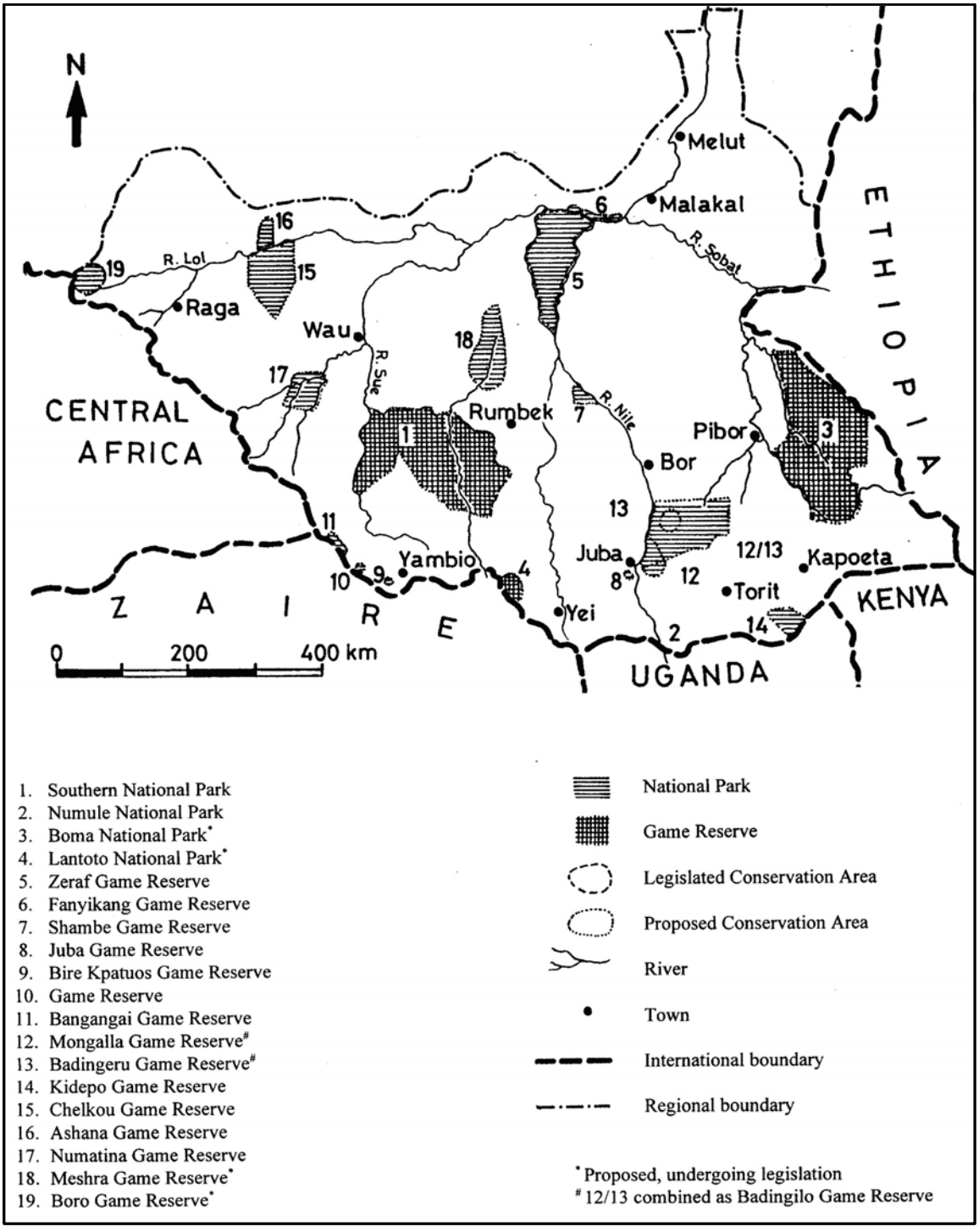
The Wildlife Conservation Directorate believes that all hunting should be temporarily banned and is hopeful that the gradual disarmament accompanying the peace process will reduce the pressure on wildlife populations. It is planning to redeploy its forces and take charge of the protected areas again to bring them under protection and management. At present, there is no indication that any of the planned road improvement projects will pass directly through wildlife related protected areas or indeed provide access to such areas formerly inaccessible, although such is possible in the future.

There is also an extensive system of Gazetted Forest Reserves in Southern Sudan, some natural forest and others replanted with fast-growing hardwood species such as teak. According to a 1989 report, there were 68 such forest reserves in the three regions of the South with a total area of approximately 625,000 hectares. The actual status of these forest reserves is not known, although there have been some studies on those planted with teak (*Tectona grandis*) which have been heavily high-graded to meet local timber needs and for generating foreign currency earnings, under both governmentally sanctioned arrangements and by illegal operators.

In addition to the reserves, forest resources, both timber and non-timber forest products are vital elements of everyday life in Southern Sudan whether for building or as subsistence foods. Charcoal production and sales to emerging urban areas and for informal export (truckers returning south) offers an income earning opportunity for many rural people. A few of the Non-Timber Forest Products (NTFPs) are potentially attractive sources of income for rural people such as the Lulu (*Vitellaria paradoxa*) which produces the internationally marketed Shea-Nut Butter Oil.

[6] For a more expansive discussion of the biodiversity and tropical forest conservation situation in Southern Sudan, the reader should see: Catterson et al., 2003—Environmental Threats and Opportunities Assessment, produced for USAID/Sudan.

Figure 4. Conservation Areas of Southern Sudan



Source: Copy furnished by members of the New Sudan Wildlife Society

INSTITUTIONAL FRAMEWORK

When considering the institutional framework for environmental regulation in this country, it is important to bear in mind that the Government of Southern Sudan is a very recent creation. It was only in late October 2005, as part of the power sharing protocol under the Comprehensive Peace Agreement (CPA) that First Vice President and President of Southern Sudan, H.E. Mr. Salva Kiir Mayardit issued Presidential Decree No. 14 announcing the establishment of the ministries to be included in the Government of Southern Sudan (GOSS). This analysis is concerned primarily with two of those ministries, the Ministry of Environment, Wildlife Conservation and Tourism and the Ministry of Transport and Roads.

Ministry of Environment, Wildlife Conservation and Tourism: This GOSS Ministry was formed as an amalgamation of the SPLM Secretariat of Wildlife and Tourism and the CCSS (Coordinating Council for the Southern States) Ministry of Tourism and Environment. The Minister is H.E. Lt. Gen (rtd) Mr. James Loro Sericho, a member of the NCP. At present the MEWCT is organized into four major directorates: the Directorate of the Environment; the Directorate of Wildlife Conservation; the Directorate of Tourism; and an Administration and Finance Directorate.

The Directorate of the Environment has recently been further subdivided, as follows: an Environmental Conservation Unit; a Natural Heritage and Museums Department ; and an Ecological Zones and Wetlands Department, headed by Directors. Regrettably, it is still quite unclear where the authority and capacity for policy and impact monitoring will lie within this Directorate or even the Ministry.

Most of the ministerial staff, and with it most of the budget because budget is presently calculated on the basis of staff assignments, will rest with the Wildlife Conservation Directorate, a legacy of the SPLM days during which there was greater attention to wildlife conservation out of a base in Yei. With this exception, the ministry is woefully under-staffed in particular with technical and professional specialists capable of ensuring the sustainable management of the environment. The new budget allocations are expected to allow for the recruitment of significant numbers of sorely needed additional staff, up to 37 staff (of all kinds) for the Directorate of the Environment. There is also an expectation that the Ministry will absorb large numbers of former SPLA soldiers and combatants from other armed groups as part of the Demobilization, Disarmament and Reintegration Program, also part of the CPA.

One of the specific mandates (Performance Measures) foreseen for the USAID-funded STEP which is also carrying out this PEA, is to assist the GOSS in the establishment of enhanced capacity for environmental policy and impact monitoring.

Ministry of Transport and Roads: The Ministry of Transport and Roads (MTR) was established at the same time as the MEWCT with the same Presidential Decree. The Minister is H. E. Madame Rebecca de Mabior (the widow of the late and honored President John Garang). The MTR has five directorates, to wit: Railways; Roads and Bridges; Mechanical Transport Department; Civil Aviation; and River Transport. There is also an Administrative and Finance Department.

Under the MTR, the unit most concerned with environmental matters associated with road rehabilitation and reconstruction is the Directorate of Roads and Bridges. This Directorate is further subdivided as follows (with Deputy Directors in charge): Design, Planning, Maintenance, Construction, and Projects.

The MTR is being assisted by a USAID-funded contract with Louis Berger Group (LBG) aimed at strengthening institutional capacities for infrastructure development. Under the aegis of that contract, a study has been undertaken regarding the feasibility of creating a semi-autonomous Southern Sudan Roads Agency.

Policy-Legal Framework: The MEWCT will develop an Environmental Policy for Southern Sudan, which will include a national mandate for environmental impact monitoring, and from the policy, procedures will be developed. They will coordinate with donors to determine methods for harmonizing EIA requirements. STEP is helping to create the environmental policies that will underpin these procedures.

Currently, there is no Environmental Policy and no environmental regulations. There are several Acts (Forestry Act, Fisheries Regulations, Town Council orders, i.e., for town planning) but these are largely out-of-date translations of earlier regulations. There are presently no procedures for when an EIA is needed, how to conduct an EIA, or the review and approval process.

The expectation is that the Environmental Policy would be introduced and approved in the Council of Ministers, and then enacted in Parliament, where it will become the law. The aim is to have the Environmental Policy introduced into Parliament in mid-2006. Once the Environmental Policy is enacted, implementing regulations will be developed. The Environmental Policy will be developed with assistance from the primary counterpart projects currently assisting the MEWCT, STEP and the Post-Conflict Environmental Assessment Project of the United Nations Environment Programme (UNEP). Additional support for specific sectoral regulations is also anticipated from the World Bank as part of its efforts to put in place a Bank-mandated Safeguards Procedure for the Multi-Donor Trust Fund that it will administer.

While the exact nature of the policy and implementing regulations has yet to be discerned, the MEWCT envisions that the ministry will serve as a regulatory body, working together with line ministries and collaborating with donors and the NGO community to coordinate an approach to the EIA process, from activity/project screening, scoping and EIA, when necessary, review of environmental documentation, and monitoring.

The MEWCT will help line ministries to create their own sector guidelines and STEP or another route will be used to train staff in line ministries to implement the guidelines. Decentralization of environmental responsibilities will be to line ministries and to the States.

Support by Donors for EIA Capacity in Southern Sudan: The USAID-funded STEP program has funded EIA training for two people in the Environment Directorate and the intention is to send more people for this EIA training in the future. MEWCT will also send staff members for the Study Tours supported by STEP which are designed to introduce Southern Sudanese environmental specialists from both the GOSS and from among the alumni of these training courses, to the evolution of and systems for environmental policy and impact monitoring in neighboring African countries.

There is an expectation that the MEWCT will be better equipped as a result of collaboration between the United Nations Environment Programme (UNEP) and USAID, including creating an Environmental Information Center to be housed in the Ministry's building in Juba. The Center could also serve as a training wing for the department, a conference center, and a library, where EIA documentation will be available for public review, and where this documentation will be kept and tracked in a database. The MEWCT is also planning on creating an environmental awareness campaign through radio programs and introducing environmental education into schools.

Additionally, the World Bank is working with the GOSS to set up a Safeguards Committee to provide oversight for the management of projects and disbursements under the Multi-Donor Trust Fund (MDTF). The Bank anticipates that representatives of both the Ministry of Environment and the Ministry of Transport and Roads would serve on that committee in light of the importance of road infrastructure development activities anticipated under the MDTF. The Safeguards Committee will be responsible for ensuring compliance with the World Bank Safeguards, among which are those related to environmental impact assessment and mitigation.

ENVIRONMENTAL CONSEQUENCES OF ROAD REHABILITATION—GUIDELINES

The Scoping Statement identified potential environmental impacts of proposed road rehabilitation activities and during its field work, the PEA Team was able to confirm that some of these issues were indeed of significant concern and must thus be addressed with further elaboration, including suggestions for their avoidance, mitigation and monitoring.

This section of the report identifies each of the potential impacts, both direct and indirect, notes the stages in which they occur in the road reconstruction process, and discusses them in more depth. This is followed by a section of the report which recommends mitigation measures for each potentially significant impact. In effect, this part of the PEA Report which discusses the potential adverse impacts typical of road rehabilitation and how to mitigate them, constitutes **a set of Environmental Guidelines** for those involved in road rehabilitation in Southern Sudan. An extract of these guidelines in summary form is also presented in **Appendix D** in a format that will allow them to be carried to the field for easy reference during the design and implementation of road rehabilitation activities.

THE NATURE OF ROAD REHABILITATION ACTIVITIES

Before moving into the analysis of potential adverse environmental impacts, it is useful to recall in more detail the nature of the road rehabilitation and reconstruction activities as currently being carried out in Southern Sudan. Road rehabilitation or reconstruction typically involves (all phases, design to project completion) the following types of activities:

- the assessment process which includes identifying the nature and extent of the road rehabilitation work involved, including drainage structures, the need for re-alignment if any and surveying the current road configuration, and any recommended road engineering design changes, identification and sources of road building materials (alignment soils, base/sub-base materials and quarry materials, as necessary), all culminating in the Bill of Quantities for the road segment being assessed;
- clearing land and building construction camps to house staff and store equipment and supplies;
- clearing brush and removing some trees to reclaim road width and drains;
- excavating borrow pits, and where appropriate, re-grading and "closing" them;
- roadbed preparation to improve the sub-grade;
- excavating potholes and occasionally areas of black cotton soils or other unsuitable substrate and replacement with suitable sub-base:
- excavating side and mitre drains, and placing culverts to retain/improve drainage;
- reconstructing bridges or constructing drifts;
- filling and compacting to eliminate road surface deformation and the many large potholes;

- providing required signage to ensure traffic safety and directional indications, and constructing speed bumps, where appropriate; and
- closing the construction camp when the road segment is completed.

In general, these repairs, in places, may raise the road bed slightly above the level of the land and crown it to provide for drainage to eliminate the water on the roads which otherwise can quickly lead to deterioration. A final layer of crushed and compacted gravel is added to create a wearing course. As gravel is not available in most areas of Southern Sudan, a final layer of crushed and graded laterite-based ("murram") wearing course is added.

Laying down the wearing course–laterite-based murram on the Rumbek to Tonj road, near the Catholic Cathedral, a good site for a sealed road surface to avoid dust in this relatively congested area of Rumbek Town. Speed bumps have now also been used extensively on the main roads of Rumbek to slow traffic thus reducing the dust and improving traffic safety. Photo by: Tom Caterson/IRG

Building a "drift" or ford on the Narus-Kapoeta Road. These low water crossings make great sense in this semi-arid area of Southern Sudan but need to be carefully constructed, well marked and well maintained to avoid having them become damaged during high water, washing out the downstream edge creating dangerous crossing conditions. Photo by T. Catterson/IRG

Road rehabilitation, as currently being carried out, is taking place mainly along the original alignment; however, where the road is unsafe, impassable, or rehabilitation is not feasible from an engineering standpoint, the alignment will vary slightly from the original. Because these are "emergency" roads, there has been no attempt to decommission or otherwise restore areas of abandoned road alignments, although this is something that could certainly be considered in the future. Finally, this PEA has also considered the potential adverse impacts resulting from the *operation* of rehabilitated and reconstructed roads.

GUIDELINES TO THE POTENTIAL ENVIRONMENTAL IMPACTS OF ROAD REHABILITATION IN SOUTHERN SUDAN

The Sudan is a huge country, the largest in Africa, and Southern Sudan as a substantial part of it, no less so. From Nimule, on the border with Uganda, to Malual Kon in northern Bahr El Ghazal, the distance is 1260 kms up the western corridor; on the eastern side from Loki in Northern Kenya to Malakal on the Nile north of the Sudd, it is a distance of approximately 900 kms. Across the middle latitudes of the country, say from Tambura to Boma, the distance is about 600 kms (UNJLC Map). To say the least, its people and places are spread far and wide.

Rehabilitated and reconstructed roads will be the key to the future of Southern Sudan. The Joint Assessment Mission estimated that approximately 9300 kms of gravel roads would have to be rehabilitated over the course of the next ten years to meet the development needs and opportunities of the country (JAM Sudan

2005). They will link towns and peoples together, with the marketplace, to the national economy and to the neighboring states.

Roads spreading in all directions will reach a common destination, bringing local people the benefits of the Comprehensive Peace Agreement, along with more robust socio-economic development achievements and widespread improvement in the quality of life. As the road rehabilitation programmatic environmental assessment (PEA) has demonstrated, there are no viable alternatives to a continuing program of road rehabilitation/road reconstruction in Southern Sudan.

If care is not taken, road construction, rehabilitation, and operation can have multiple and significant adverse environmental impacts. These impacts can be direct and indirect and over the length of the roads involved here in Southern Sudan lead to unacceptable cumulative impacts on both the bio-physical environment and on the human environment. These must be avoided or mitigated if the roads program is to be fully effective and efficient. The impacts discussed below are the explicit findings of the PEA Team after assessing the experience with road rehabilitation in Southern Sudan and are deemed likely to reappear along other road segments if these guidelines are not heeded.

PURPOSE OF THESE GUIDELINES

The purpose of these guidelines is to anchor the procedures for the environmental assessment and management of road rehabilitation and reconstruction projects in a thorough understanding of how they may adversely affect the environment. These guidelines have been developed as a direct output of the programmatic environmental assessment (PEA) of on-going road rehabilitation activities carried out in Southern Sudan in late 2005/early 2006. Eventually, they will become or evolve into sector specific guidelines for road rehabilitation as part of an overall national policy, regulatory framework and procedure for environmental impact assessment, mitigation and monitoring. The policy and legislative framework for such a procedure has as yet to be developed in the country, but it will be one of the priority objectives of the Ministry of Environment, Wildlife Conservation and Tourism and its donor partners under whose aegis this PEA was carried out.

More specifically, **the purposes of these guidelines** are multiple, including:

- to enable those concerned with road rehabilitation and operation to base their design and construction efforts on the application of environmentally sound design and management planning;
- to stimulate the creation of a more systematic approach to environmental management and mitigation as part of a normalized environmental assessment (EA) procedure within the framework of the working relations between the Ministry of Environment, Wildlife Conservation and Tourism, and its sister GOSS ministries, in this case, the Ministry of Transport and Roads; and
- to provide for a benchmark in the understanding of the importance of environmental considerations to the sustainability of road rehabilitation investments in Southern Sudan that can be used as a teaching tool and also be further developed as experience with road construction accrues across the country.

ENVIRONMENTAL CONSEQUENCES: SIGNIFICANT, DIRECT IMPACTS

The following sections examine each of the adverse impacts identified in the Scoping Statement and subsequently confirmed as critical issues to be addressed in assessing the environmental dimensions of road rehabilitation. Each issue statement is followed by a brief discussion of its causality.

Issue—Soil Erosion Problems from Road Building: In some areas, soil erosion and gullying may occur, particularly those with more rugged, sloping topography, resulting in loss of topsoil, diminished soil fertility, and ultimately, siltation of waterways and wetlands. (construction phase, [-]; operation phase [-])

Discussion: Although the general plan is to carry out road construction activities in the dry season, this is not always possible and feasible. During construction, with the earth movement and disturbed soil that occurs

to rehabilitate roads, there may be potential for increased soil erosion. This will especially be a problem on steeper slopes and when constructing/rehabilitating along water courses. Similarly, in draining the cambered surface of the road, water channeled off into and along the roadside ditches can gain force and cause erosion in-situ or lead to adverse off-site consequences on neighboring lands. These consequences could be significant if homes are adjacent to the road or if the land is used to grow crops. Discharging culverts or cross drains on to fill-based slopes without protection will quickly erode the side hill. Even in the flatter areas, loose or disturbed soil can be washed into the road ditches or drainage ways, adding to the need for maintenance of these structures.

In general, with the use of Best Engineering Practices (BEPs) which serve to control the velocity, flow and amount of water run-off, soil erosion could be kept to a minimum. However, some of the types of BEPs (hay bales, silt curtains, and in some cases, even rock with which to build protective structures or facings) to control soil erosion will not be feasible in Southern Sudan and therefore soil erosion during construction remains an issue. Material excavated and stockpiled temporarily during placement of culverts, bridges, and drifts could erode and result in siltation of wetlands and/or water courses.

On the flat plains of Southern Sudan, draining the road can be almost impossible because of the lack of any topographical relief. An alternative, often chosen, is a "mitre drain with sump." These structures are literally trenches leading away from the road ditch and ending in a deep hole where run-off is collected. Although often the only alternative, mitre drains can have adverse environmental impacts, including safety issues for people and livestock, breeding areas for water borne vectors and conflict with landowners along the road right-of-way. Photo by T. Catterson/IRG

Issue—Road Construction Impacts on Local Hydrology: During construction, temporary, direct impacts to stream flow and drainage may occur. In some cases, wetlands may have to be filled to build causeways across them for the road thus requiring culverts to allow water to pass through them in an unobstructed manner. (construction phase, [-]; operation phase [-])

Discussion: Directly and closely related to the previous issue, road construction crossing watercourses and wetlands can alter the stream flow and drainage patterns with both ecological and socio-environmental effects in Southern Sudan. Although construction is supposed to take place in the dry season, when it occurs in the wet season or when wetlands or watercourses are still holding water, hydrological conditions could be disrupted, affecting flow downstream and wetland functions. Heavy machinery operations at crossing points will leave soil and substrate prone to washing by renewed stream flow leading to sediment transport and alterations of stream hydrology.

During operation phase, the design and construction of culverts, drifts, and bridges may come into play. Although the expectation (when using BEPs) is that they have been designed and constructed in ways that retain the original hydrological characteristics, in Southern Sudan, there is frequently no accurate data on stream hydrology on which to base design considerations. Similarly, the cost of construction of such structures is directly related to their size and number and thus the "emergency" nature of the road rehabilitation may have under-specified the scale and number of these drainage structures to the point where they may not accommodate seasonal flooding. Furthermore, it may be difficult to find rock or other robust materials to be used to prevent scouring of culvert margins, the downstream edge of drifts (fords) or stream banks adjacent to bridges. As the soil becomes worn at the edges, it can narrow the roadway or worse, result in the collapse of the structure, and eventually of the road.

Unimpeded drainage through a road causeway or under a similar road structure in a wetland is critical to both the durability of the road and to mitigating impacts of construction. Inadequate culvert size (or clogged culverts because of the lack of maintenance) can lead to a build up of surface water on the upstream side which penetrates and softens the road base. The traditionally heavily overloaded trucks which ply the roads of Southern Sudan, including those carrying food aid for WFP, sink into these soft spots causing yet another pothole.

Drainage may also need to be spread rather than concentrated to maintain the former hydrological characteristics of a wetland. Although an individual wetland site sacrificed for the purposes of transportation infrastructure may seem insignificant, the cumulative impacts of many such sites, given the frequency of wetlands and swamps in Southern Sudan could lead to significant and unacceptable adverse socio-environmental impacts. In many parts of the country, the loss of wetlands would mean the loss of dry season grazing areas (the "toic") and thus additional conflict among pastoralists dependent on these areas. Southern Sudan's wetlands are also part of a regional system that supports the rich biodiversity of aquatic ecosystems in which hydrological disruptions at one point may have unpredictable and unintended consequences downstream.

Issue—Borrow Pits and Drainage Features: Environmental Health, Safety and Aesthetics: The construction of borrow pits and drainage features (e.g., sumps at the end of mitre drains) may create habitat for water borne disease vectors; and pose a safety issue for people and livestock. Also, there are matters of aesthetic or visual impact, loss of natural habitat, run-off and erosion, loss of productive lands, including grazing lands along the road corridors as a result of over-zealous borrow pit construction. (construction phase, -/+; operation phase, -/0/+).

Discussion: Road construction crews create borrow pits along the roadway to mine road construction material. In some locations, borrow pits seem to be spaced close to each other. This may be done to reduce material haulage costs.

During construction of a specific road segment, the borrow pit will remain open and operational, and during rainy seasons, it will collect water. The borrow pit may then become a breeding ground for mosquitoes and

other water-borne disease vectors. Also, if water is collected in the borrow pit, people and livestock may drown—there have been cases, cited to the PEA Team during community meetings, of livestock getting mired in mud, unable to climb up the side of the borrow pit due to the steep slope, and drowning.

A flooded borrow pit with an algae bloom. These pits can be environmental health hazards as breeding grounds for water-borne disease vectors or physical hazards to people and livestock who risk drowning. This one installed right along the road is also an eyesore. Photo by T. Catterson/IRG

Of similar concern are the drainage features in flatter areas, such as mitre drains and sumps, used to remove water from around the road ditches. If they are too deep, and sides too steep, people and livestock could be injured falling into the or even drown, or if they hold water for lengthy periods, they can become breeding grounds for vectors.

Close to towns borrow pits may create additional concern since a greater number of people may have access to them and because disease vectors are more of an issue.

As the PEA Team was told in many community meetings, herder communities favor keeping borrow pits open, even once construction is complete, as a source of dry season drinking water for their livestock.

Issue—Construction Camp Impacts: Creation of construction camps may result in environmental pollution from waste material, including human waste and garbage, and from fuel, oil, and lubricants from associated machinery. (construction phase, [-/0]; operation phase, [-/0])

Discussion: Road camps are constructed along an individual road segment to house the road crew and the equipment and supplies to rehabilitate the road. The construction camp becomes a small village—housing many people, usually in temporary accommodation, with latrines, and food preparation areas and common eating areas. Often, motorized equipment is kept, fueled and serviced at the camp.

When clearing land for a construction camp, there will be direct impacts on the environment at the camp site. In most cases, a camp can be easily sited to minimize direct effects of camp construction and operation. In arid areas of Southern Sudan, road construction demand for water for camp use and for wet compacting of road layers or for concrete work can compete with local human needs causing hardships and/or conflict.

During operation of the road camp, measures are needed to minimize the potential for pollution from human waste, solid waste and from fuel, oil, and lubricant spills to ensure adverse effects do not occur. This is particularly important in Southern Sudan because typically local people turn to the camp and its borehole for potable water supplies. Every effort must be made to avoid activities which could contaminate the water supply, especially if , as is recommended, these boreholes are left in an operational status to avail more water supplies needed by local communities.

With proper management during operation and with proper closure and decommissioning of the construction camp site, there will be no long-term environmental effects. However, during the PEA Team's site visits, the Team visited a construction camp that had been closed, but the workers had left behind a lot of litter and some of the structures were still standing, although in a state of disrepair. The PEA Team's site visits indicated that improved closure practices are needed.

Issue—Environmental Health and Safety Hazards of High Dust Conditions: Dust is generated by vehicles driving on the road, resulting in human health concerns, affecting livelihoods, and affecting vegetation (crops and natural vegetation) adjacent to the roadway. (construction phase, [-]; operation phase, [-])

Discussion: During road rehabilitation, construction equipment is plying the road, churning up an enormous amount of dust. Vehicles using the road while it is still under construction are doing likewise. During operation, the increased traffic on the road combined with the likelihood of increased average speeds will likewise, increase the amount of dust. This is particularly true on the laterite road surfaces which are more easily subject to pulverization of the wearing course than the stone-based gravel wearing courses.

During the long dry season, traffic generates heavy clouds of dust along the laterite surfaced roads. In urbanized areas of Southern Sudan, the dust is creating an environmental health hazard and affecting the quality of life. On the roads, passing a slower vehicle through its dust cloud can be extremely dangerous, causing collisions with oncoming vehicles or accidents with unseen pedestrians. Photo by T. Catterson/IRG

During the field investigation for the PEA, communities, particularly in the more urbanized areas, complained about the dust and mentioned health concerns. Respiratory diseases are already common in Southern Sudan and continuous exposure to fine dust from the road surfaces will exacerbate the environmental health hazards for local people. There will also be occasions where the dust will affect their crop yield on agricultural fields adjacent to roads. It was reported that some bars and restaurants along the road had to close down because of the dust. High amounts of dust also create a major traffic safety issue, blind passing through dust clouds. Faster vehicles attempting to pass a slower moving truck raising a lot of dust will not be able to see on-coming traffic nor pedestrians or Non-Motorized Traffic (NMT) in the road ahead.

ENVIRONMENTAL CONSEQUENCES: SIGNIFICANT, INDIRECT IMPACTS

Issue—Traffic Safety on Improved Roads: With improved roadway conditions encouraging more vehicular traffic and higher average speeds, there is increased possibility for accidents between vehicles, and with non-motorized transport (such as bicyclists), pedestrians and animals. (construction phase, [-]; operation phase, [-])

Discussion: Improved road surfaces will allow vehicles to travel at faster speeds. Although the rehabilitated road will be wider in certain areas, straighten dangerous curves, thus making it safer to travel at higher speeds, there are still likely to be more collisions between vehicles and with vehicles and bicycles, pedestrians, and livestock (and wildlife).

Local people in Southern Sudan have lived so long without good roads that there is a lack of awareness of the dangers of the roadways and fast moving vehicles. People, animals, NMTs, and particularly children are unaware of the danger of a fast approaching vehicle and may cross the road in front of it. Livestock wandering semi-attended by herd boys is a very common feature of much of the country and these animals too often wind up in the road. Stopping a vehicle on these gravel faced roads takes time and space, as there is a possibility of skidding.

Especially during daytime hours when traffic is heavier and when drivers are able to move faster, wildlife is scarce in most of the areas where roads will be rehabilitated. Because of insecurity and the road conditions, there is currently little traffic from sunset to sunrise, the most active time for most wildlife. However, as security and road conditions improve, there will be increased chances for vehicle-wildlife collisions.

Issue—The Spread of Disease along Roads: Increased traffic on the roads, and construction crews who work on the roads could introduce diseases, especially HIV/AIDS into the area. (construction phase, [-]; operation phase, [-/+])

Discussion: During the PEA Team's field work, community members often mentioned that already, with the improved roads, there is an increase in the traffic coming in from outside the area. This situation is expected to continue. Interior areas of Southern Sudan now have very low infection rates (0.04%) for HIV/AIDS as compared to neighboring countries or even the fringe areas (4.0%) along the border. Given the proximity and close ties to Uganda there will be a renewal of the flow of commerce and trade carried by truck deep into Southern Sudan on these rehabilitated roads. It is well-known that truck drivers have played a significant role in the spread of HIV/AIDS in East Africa and thus the improved roads could pose a significant threat to health in the region. Similarly, during the construction phase, road crews, often strangers to the area in which they are working, may bring contagious diseases to local populations, perhaps not previously affected by some of the diseases.

The improved roads will also serve to improve health services to these outlying areas, previously underserved by health clinics and health workers. However, the significance of contagious disease spread and the prevalence of HIV/AIDS in the region overwhelm any additional health care that may be provided to these areas.

ARC International, an NGO funded by ERRP, is implementing an HIV/AIDS Awareness and Prevention Program targeting the current road construction projects, and is working with construction companies and their road crews to educate them about AIDS prevention. HIV/AIDS awareness and prevention programs also work in local communities along the road network. These programs can serve as models for awareness raising programs that should be part of any road rehabilitation activity.

POTENTIALLY SIGNIFICANT INDIRECT IMPACTS

Issue—Impacts on Tropical Forests and Protected Areas: Road rehabilitation activities may improve access to relatively undegraded tropical forest and/or protected areas. This could result in unsustainable/uncontrolled resource extraction, land use/forest conversion, and a decrease in biodiversity richness. As a result too, threatened or endangered species (TES) which previously were difficult to access could be put at risk. (construction phase, [-]; operation phase, [-])

Discussion: Proposed road rehabilitation will take place along existing roads, with minor modifications in some areas where safety or engineering concerns warrant limited road realignments. As can be seen by comparing the map of present road projects at the beginning of this report (Figure 1) with the map of known conservation areas (Figure 4), there are certain segments where the road will pass adjacent or close to protected areas, including national parks, forest reserves, and game reserves.

There is presently limited information available on the existence, habitat, and extent of TES in Southern Sudan. Areas along the roads the PEA Team visited are unlikely to contain habitat for TES, especially since these roads are existing, and traffic has filtered down these routes for decades. In the past, decisions on which roads to rehabilitate have not taken into account the existence of or impact on sensitive habitats, undegraded tropical forest, PAs, and TESs. The ideal process would be that at the planning stage—which takes place at the GOSS and MTR level—when roads to be rehabilitated are identified, the location and potential impacts to these ecological landscapes and systems should be considered. However, it is unlikely that the presence of critical ecological features and potential impacts will influence the road planning process at the Ministry level, and therefore, significant impacts could result if roads are rehabilitated near these areas.

Once the roads to be rehabilitated are identified, the MTR looks for a funding mechanism. It is incumbent upon the financer (USAID) of the road rehabilitation work to ensure that the roads funded do not result in significant impacts to sensitive habitats, TESs, PAs, and undegraded tropical forest.

Issue—Increased Access to Natural Resources and the Potential for Land-Use Changes and the Rate of Habitat Loss: By definition and intent, rehabilitated roads will improve physical access to natural resources across the landscape in Southern Sudan. Concerns have been expressed that this will lead to large-scale degradation of the natural environment as people exploit these resources without controls.

Discussion: As is clear from the description of the affected environment in Part C above, road rehabilitation in Southern Sudan will occur across a range of ecosystem types, and through urban, peri-urban, towns and villages, and small settlements, and into areas with sparse populations; through landscapes most suited for livestock grazing or agriculture; and through dry, tropical forest, wetlands, and degraded landscapes, burned for agriculture or previously settled but abandoned.

During the construction phase, improved access to natural resources is a potential significant issue because road crews would gain access to these resources, with no regulatory authority to oversee sustainable use. During the operations phase, it is also a potentially significant issue since traffic will increase on these roads, improving access to resources by a growing number of people. Uncontrolled hunting, fishing, and mining of other natural resources, including wood for charcoal, for use in construction, and for brick making, and harvesting of non-timber forest products are among the concerns.

Habitat loss as a direct result of road rehabilitation is unlikely as these are existing roads; however, indirectly, from increased traffic, settlements, and new enterprises, habitat may be lost. Land-use conversion (from agricultural land to settlements, from grazing land to agricultural land, etc.) may occur. Roads may serve as

firebreaks, controlling the fires that are set to burn agricultural fields and thus indirectly benefit the natural environment.

Villages would be expected to grow, and enterprises and other ancillary services will increase to provide for the growing wealth and numbers of people. Therefore, indirectly, road rehabilitation may result in habitat loss and land use conversion. However, improved roads will also help to guide development and town/village planning so that growth may occur in a more organized fashion, and thereby may decrease the impact on natural habitat.

Regulatory authorities would gain improved access to the resources they are charged with managing, and be able to access local communities, to work with local people and promote sustainable use, while discouraging resource mining; and to enforce regulations. This regulatory authority though, is currently lacking. There is limited capacity at Ministry levels and less at local levels to regulate the use and management of resources.

Markets for goods will follow the improved roads—increased traffic will bring consumers, and income generated from the employment opportunities (from road works and from new enterprises) will create a demand for forest and other natural resources products, such as timber, charcoal, lulu, and bush meat. This trade in natural resources products will need to be regulated, and improved infrastructure will pave the way for regulating it. However, capacity needs to be built in the natural resources professions to implement sustainable management schemes; and communities need to be encouraged to put in place conditions to ensure sustainability. Without these pieces in place, natural resources could be mined, with no forethought of future benefit.

Issue—Lack of Routine Maintenance of Gravel Roads: A gravel road without routine maintenance will quickly degrade. Unfortunately, such maintenance is often overlooked/not budgeted, resulting in hardships for local people who rely on the roads for goods and services. This lack of maintenance, failure to clean ditches and culverts can cause increased erosion and consequent siltation of waters and wetlands and will lead to further damage to the road. (construction phase, n/a; operation phase [-])

Discussion: During the PEA Team's field work, communities mentioned the lack of routine maintenance as a primary concern of the road rehabilitation work. As mentioned in the Scoping Statement, longer and more durable repair work (permanent roads) would require less maintenance, but for the emergency road repair, laterite will continue to be the surface material used, and routine maintenance will be needed. Typically, road construction contracts include a minimum "defects liability period," in some countries of up to 24 months in each such contract to ensure that the road is maintained until a replacement maintenance contract can be put in place or governmental authorities can take full responsibility for the road segment in question.

Less than two years after rehabilitation, this road in semi-arid Eastern Equatoria shows the results of a lack of maintenance. Vehicles can lo longer ride in the extremely rough main wearing course (where vehicle is located) and all have resorted to riding along in the road ditches on each side of the road. During rains, these ditches fill with water and become impassable. Photo by T. Catterson/IRG.

There are several examples already in Southern Sudan among the road sites rehabilitated where the lack of maintenance has allowed them to deteriorate significantly. Examples include two projects initiated and promoted with USAID resources: the Loki to Narus road segments rehabilitated in 2003 and the Rumbek Airstrip where deterioration at both ends of the main runway has reputedly prompted one of the commercial carriers to cancel flights. Despite the best of intentions, a planned road maintenance contractor is not in place, funding shortfalls appear likely to continue to delay this contract and the rainy season will soon begin. Gravel roads without regular maintenance simply do not make sense.

Surface water management on the roadbed is the key to the durability of the road surface. This can be achieved by properly crowning the road to facilitate its drainage and constructing proper side drains and water bars where needed to carry the run-off away from the road (i.e., using BEPs). Routine maintenance of these structures to keep them free from built-up soil depositions and debris is needed on a regular basis and could provide an opportunity for local employment at the county and payam level.

Issue—Roads and Internally Displaced Peoples: Internally Displaced Peoples (IDPs) are expected to be returning to areas in the South in large numbers and clearly the improved road system will facilitate and may even induce such returnees. Many people are concerned that the improved roads will concentrate the potential adverse impacts of this repopulation process along these corridors or in the urban areas they serve.

Discussion: One of the scenarios under the Comprehensive Peace Agreement is the return of IDPs to their home areas and to urban areas in the South. Large numbers of people returning to their former homelands will mean large-scale clearing for agriculture and intensified demands for round wood products with which to reconstruct the family homestead.

The size of the towns in Southern Sudan could easily increase significantly causing heightened demands for land on which to build a home, as well as for building materials and domestic energy in the form of fuelwood or charcoal. There will be a great strain on the already limited water and sanitation services available in urbanized areas.

This scenario will take place regardless of the existence of improved roads. With improved roads, the goods and services, improved governance, urban-town planning, and control and management of natural resource use is more likely—i.e., the structures and institutions needed to plan for and manage urban and village areas rely on having the basic infrastructure in place. Return of IDPs will happen regardless of the state of the road network, and mitigation to minimize the effects of such a population shift is beyond the control and capacity of this program.

Controlling and managing where migrant populations settle is complex and is, in part, a natural process and in part controlled by government (through an urban-town planning process), private sector (provision of services) and history (returning to previously settled areas). Contracts to implement road rehabilitation activities have no control over or capacity to manage IDP returnees and the additional infrastructure that will be needed to provide for them.

RECOMMENDED MITIGATION MEASURES

A basic premise of this report is that good road engineering and sound environmental management can and must go hand-in-hand and when they do, the benefits are mutual for all concerned. The avoidance and mitigation recommendations which follow also start from the supposition that Best Engineering Practices have in general been carried out in a technically correct way, following the standards and guidance that are part of the road construction contracts for each of the road segments. One does not mitigate design, engineering or construction mistakes, one corrects them. That is not the point of this exercise nor, for that matter, any environmental assessment.

Similarly, this report limits its recommendations to the mitigation measures which address the impacts seen or confirmed on the ground as likely outcomes of road rehabilitation and assumes a reasonable degree of due diligence on the part of the contractors and consulting engineers who supervise them in Southern Sudan.

Another extremely important recommendation related to mitigation (which by definition includes avoidance) is the importance of considering environmental impact early in the road rehabilitation/reconstruction process, during the project planning phase, during the road segment assessment and as part of the process of choosing and contracting a road construction company.

BEST ENGINEERING PRACTICES – USEFUL REFERENCES:
The following documents provide extremely pertinent information and advice on road construction practices and environmental stability.

- *Roads and the Environment: A Handbook*. Transport, Water & Urban Development Department, The World Bank, Washington, D.C. 1997.
- *Low Volume Roads Engineering: Best Management Practices Field Guide*. Gordon Keller & James Sherar. Produced for USAID in cooperation with USDA, Forest Service, International Programs and Conservation Management Institute at Virginia Polytechnic Institute and State University, 2003.
- *SADC Guideline on Low-Volume Sealed Roads*. Southern African Transport and Communications Commission (SATCC) with funding support from DFID, NORAD and SIDA, 2003.
- *A Guide to the Use of Otta Seals*. Norwegian Public Roads Administration, Road Technology Department (NRRL) Publication No. 93, Oslo, 1999.
- Provision of Low-Volume Sealed Roads: Time for a Re-Think by Decision Makers. M.I. Pinard, InfraAfrica, Botswana, 2005.

Experience has shown, and this PEA has corroborated the fact that avoidance and minimization of impacts can start during the early stages of project planning. Clearly, there are choices that can affect the potential for adverse environmental impacts, for example, finding the correct road alignment or location to cross a watercourse or a wetland at the narrowest place; being aware of the boundaries of protected areas;

considering the possibility of a truck road diversion around an urbanized town to minimize the potential for traffic safety or dust issues; considering the quality and dimensions of a road going through an urbanized area, and the option to seal it, widen it, enhance the quality of the shoulders, create pedestrian lanes, etc.

Another important point is the recognition that mitigation is not the exclusive responsibility of the road contractor or the road agency. A wide variety of governmental authorities at various levels may play a role in dealing with the potential for adverse impacts.

The following table considers the mitigation measures associated with the environmental impacts outlined in the previous section.

Table 4. Mitigation and Monitoring Measures Associated with Road Rehabilitation Impacts in Southern Sudan

Issue	Impact	Mitigation Measures	Monitoring Requirements
Planning and Design Phase			
Design and assessment of priority road segments by the road engineering design consultants	At this early stage, environmentally sound design may not be considered along the target road segment; in preparing the design documents and the Bill of Quantities (BOQ), mitigation measures are not identified and budgeted.	• Ensure good collaboration among ministries so that activities can be coordinated—an understanding of the areas of ecological sensitivity • Road rehabilitation Environmental Design Checklist is used by those assessing construction needs for chosen road segments • Costs of environmental management becomes an explicit part of the BOQ • Those in charge of pre-tender site visits identify potential environmental issues for prospective bidders.	• GOSS Ministries of Transport and Roads and Environment review completed checklist and verify that it has been adequately completed • Possible field visit by environmental specialists to road segment in question
Construction Phase			
Soil disturbance from road building and associated excavation.	Soil erosion leading to soil displacement, slope failures, gullying, clogging of drainage ways and sedimentation in watercourses or water bodies.	• Preference for dry season construction • Avoid building roads in very steep terrain (>60% slope) • Spreading and/or compaction of disturbed soils incorporated into BOQ • Install sufficient number of water bars and/or culverts along the roadside ditches to minimize the amount of water that accumulates; more if the area is steep • On steeper slopes, line roadside ditches with riprap or sow grass or other cover crops to anchor the soil • Add splash aprons or energy dissipaters at the outlet of culverts • Add a requirement for the use of silt curtains or mulching for particularly important drainage areas • Ensure adequate maintenance of such drainage ways to prevent blockages and failure.	• Monitor sediment and debris buildup in road ditches or culverts • Measure stream flow, local hydrology and meteorology so as to increase understanding of local conditions and cause & effect

Issue	Impact	Mitigation Measures	Monitoring Requirements
Road construction crossing watercourses or wetlands.	Impeded stream flow or drainage patterns affecting human/livestock access to water or dry season grazing and/or effects on the stability and functions of aquatic ecosystems.	• Preference for dry season construction • Identify suitable crossing points and re-align the road if needed • Establish national riparian zone management policy and apply it • Ensure adequate size (diameter no less than 60 cms) & number of culverts passing watercourses or wetlands • Avoid cut & fill road construction adjacent to torrential or flashy streams that could wash away the toe slope and sink the road platform • Avoid constricting water flow with bridges or drifts • Suitably sized bridges, both volume and spread to accommodate natural flows	• Stream gauging stations at major bridges to measure flood history • Careful routine inspection of bridge, culvert and drift function, ideally during a rainfall event • Verify that road maintenance is being carried out as planned including cleaning culverts
Construction and operation of borrow pits.	Additional habitat for water borne disease vectors; safety issues for people and livestock (drowning in deep/steep pits); and blight on the aesthetic viewscape along road.	• Minimize the number of borrow pits by increasing free haul distance in BOQ • Establish conditions for borrow pit construction • Require contractor to establish and implement a borrow pit management plan • Engage local community authorities to take responsibility for long-term borrow pits in their areas	• Verify that subsequent use of borrow pit, whether for maintenance or by others, meets standards • Verify natural regeneration on restored borrow pit sites and if necessary, replant • Verify conformance with Borrow Pit Management Plan
Establishment, operation and decommissioning of construction crew camps.	Pollution from human wastes, garbage or fuel, oil and lubricants from motorized equipment…and possible competition with local communities for water supply, particularly in arid areas of the country.	• Proper siting with a preference for flat sites and standardized layout with adequate and clearly specified pollution safeguards • Careful attention to water supply issues so as not to disadvantage local communities with whom these are shared during construction • Consider leaving operational borehole for local community use after departure of the road crew • Full cleanup and decommissioning costs incorporated into BOQ	• Verify natural regeneration of restored camp site and if necessary, re-seed or re-plant, ideally using native species
Operations Phase			

Issue	Impact	Mitigation Measures	Monitoring Requirements
Increased vehicular traffic during the dry season.	High dust conditions affect human health and quality of life, and also create traffic safety issues associated with passing on a dusty road	• Need for sealed roads within urbanized areas • Speed bumps to slow traffic and enforcement of speed limits • Construct wider shoulder widths or improved condition to allow for pedestrian use • Road signage alerting drivers to the dangers of passing on a dusty road plus "no passing zones"	• Verify that the traffic laws are being enforced • Roads liaison officer of MTR maintains continuous log of community inquiries and complaints
More traffic and higher average speeds.	Potentially higher frequency of accidents, among vehicles and with other users of the road	• Community education, particularly in primary schools ,to make people aware of the dangers of fast moving vehicles • Speed bumps to slow traffic and rigorous enforcement of speed limits • Road signage for drivers and pedestrians alike • Bypass roads to avoid bringing bulk of traffic through the most densely populated areas	• Road liaison officer of MTR maintains a continuous log of community inquiries and complaints.
Increased traffic and travelers using the improved road system.	The spread of sexually transmitted diseases (STDs) and HIV/AIDS along the road axis.	• HIV/AIDS awareness and prevention campaign working with road crews and adjacent communities • Health clinics along the roads get high priority, with special attention to danger of HIV/AIDS	• Monitor community health statistics at various points along the road network
Access to tropical forest and protected areas enhanced because of improved road network	Relatively undegraded natural tropical forests and/or protected areas are degraded through illegal or unsustainable use or increased hunting pressure affects threatened and endangered species	• Collaboration among GOSS ministries targets such areas for early redeployment of protection staff • Boundary re-establishment and demarcation of such areas is given priority • Signage along the roadside makes users aware of special status and regulations near protected areas • For each road segment, a site-specific investigation will be necessary, ideally by comparing the planned road alignment with a map of existing areas of undegraded forest or protected areas. • Initiate community-based natural resources management programs and co-management programs established in buffer zones around the Protected Areas.	• Monitoring routine reports of protection efforts by PA staff charged with managing the areas in question. • Control points along the road network make it possible to monitor the movements of natural products.
Improved access to natural resources leading to their destruction	Unsustainable use of natural resources, degradation of habitat and inappropriate land-use conversion.	• Cross-sectoral planning should link communities where this is a concern with programs for sustainable economic growth activities that will relieve pressure on the natural resource base and that can help devise sustainable use plans. • Intensify the present efforts at land-use and urban planning and eventually regulation.	• Both GOSS Ministries of Agriculture and Forestry and of Environment, Wildlife Conservation and Tourism monitor land-use change as part of their routine duties.

Issue	Impact	Mitigation Measures	Monitoring Requirements
IDPs return in large-numbers and destroy the environment to meet their basic needs	Unplanned and unguided development particularly in urbanized areas leads to large-scale environmental degradation.	• Promote a sense of the importance of environmental considerations in IDP assistance programs. • Ensure a balance in development programs that provide social services in both urban and rural areas to take pressures off the growing urbanized areas. • Avoid schemes that displace returning peoples from their ancestral lands forcing them to carry out agriculture on more marginal lands.	• Both GOSS Ministries of Agriculture and Forestry and of Environment, Wildlife Conservation and Tourism monitor land-use change as part of their routine duties.

AN ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PROCEDURE

It is very clear from both the written plans and the voiced aspirations of many that road reconstruction will be an important part of the investment and development scenario in Southern Sudan for years to come. The benefits of these reconstructed roads will be great, however, there is also a need to build in a set of safeguards that ensure that accumulating adverse impacts do not undermine these benefits for local people, the environment of Southern Sudan or contribute to weakening the sustainability of this critically important investment in vital infrastructure.

It is also important to recognize that individual and institutional capacity for assessing and addressing the adverse environmental impacts related to road rehabilitation and reconstruction within the GOSS is presently very limited and will likely continue to be so for some years to come, especially in light of the other human resources development priorities in Southern Sudan. Accordingly, this report recommends special emphasis be given to consultation and collaboration as the hallmark of the Environmental Assessment and Management (EAM) procedures.

To address this very evident need, the following section describes an **Environmental Management Procedure** for applying the **Environmental Management Guidelines** contained in the section above. The aim is to standardize an approach to avoiding and/or mitigating the potential for adverse environmental impacts from road reconstruction and rehabilitation in Southern Sudan. The authors believe that these Guidelines can be readily used to inform the discussion about and as **inputs for incorporation into the GOSS Ministry of Transport and Roads standards and specifications** for road rehabilitation in Southern Sudan. Procedurally, the assumption is that these guidelines will inform the project assessment, design and implementation process for rehabilitated gravel roads and, if properly applied, will obviate the need for additional environmental assessment except in exceptional cases where the conditions vary dramatically from those on which this study is based.

To that end, two tools have been developed as an outcome of the present PEA exercise and are primarily built on the experience of rehabilitating gravel roads in the country, as has been carried out since about 2002. The first of these is **a companion Environmental Design Checklist** (see **Appendix E**), based very much on the environmental management guidelines that has been prepared for use during the assessment/design process for each road segment being planned for rehabilitation. The purpose of the Checklist is to serve as the format for field-based efforts to "scope" out the specific environmental issues that will need to be addressed by those who carry out the rehabilitation (reconstruction) activities for the road segment in question. In effect, applying the checklist is corroboration that the environmental guidelines or standards have been applied.

The intention is that the resulting **environmental management and mitigation requirements** will be part of and fully incorporated into the Bill of Quantity for the road segment in question, either as part of a Design & Build Contract or in anticipation of a traditional tendering of the rehabilitation contract for the segment in question. With those requirements in hand, a contractor bidding on a road construction project would incorporate an environmental management plan into his proposal and include the costs for achieving it as well.

Secondly, this section references a series of **Standard Clauses** (see **Appendix F**) for environmental management that could be used in **contracts for construction companies** carrying out road rehabilitation on behalf of the GOSS and/or its partner agencies (USAID, World Bank/MDTF, other donors, WFP).

Table No. 5 illustrates how and when these various tools are applied and how the roles and responsibilities for applying them are shared among the agencies and stakeholders.

THE STAKEHOLDERS

The principal actors and stakeholders could include all of the following depending on how the road segment rehabilitation is contracted:

- **Ministry of Transport and Roads—Directorate of Roads and Bridges**, representing the Government of Southern Sudan (GOSS) as the executing agency in charge of sector policy and plans to expand the road network in the country.
- **Ministry of Environment, Wildlife Conservation and Tourism**, as the regulatory agency tasked with protecting the environment and avoiding adverse environmental impacts on behalf of society.
- **The Contracting Agency,** this could be WFP, USAID or the Multi-Donor Trust Fund implementers and/or with the association of the Ministry of Transport and Roads, as the agency responsible for the finance and administration of the road rehabilitation and construction.
- **The Consulting Engineers**, contracted to do the assessment of a chosen road segment scheduled for rehabilitation and to produce the basic design documents and Bill of Quantity.
- **The Construction Company,** being the successful bidders who will carry out the road rehabilitation activities on the road segment in question.
- **The Supervising Engineers,** working at the behest of the contracting agency, this entity monitors the construction efforts and is responsible for quality control and insuring compliance with standards and specifications. They are also responsible for preparation of regular progress report (usually monthly), which will include the degree to which environmental management expectations and goals have been achieved which are shared with the Ministry of Environment.

In addition to these principal actors, the environmental guidelines and oversight system takes into account the need and interests of other stakeholders, including the following:

- **Representatives of local government** at the State, County and Payam level, who have a role in representing the local people living in communities affected by the road rehabilitation activities and who should be the vehicle for transmitting messages related to health and safety along newly constructed roads.
- **The Ministry of Health,** whose monitoring services are critical to detecting the spread of infectious diseases, in particular, HIV/AIDS and who could take an institutional role in HIV/AIDS Awareness and Prevention along the road system.
- **The communities themselves**, of direct and indirect users who benefit from the services of the improved road network and whose views are generally sought to ratify the social acceptability of the road rehabilitation activities.

THE PROCEDURE

The following are some of the fundamental assumptions about this procedure based on the present understanding of the system for road rehabilitation and reconstruction. Firstly, there is an assumption that these activities will continue on a segment by segment approach, typically expressed as the road connecting point a to point b (e.g., as has been seen in the course of this PEA, from Rumbek to Faraksika, Rumbek to Yirol or Narus to Kapoeta). In each new case, the road reconstruction will be carried out to standards and specifications established by the GOSS Ministry of Transport and Roads.

The system for carrying out the road rehabilitation activities in Southern Sudan will be as follows:

- Road segments to be reconstructed are identified in the Ministry of Transport and Roads' work programs and budgets which are approved by the GOSS. The MTR selects the implementation approach (for example, a Contracting Agency), secures funding and instructs the Contracting Agency to go forward with the project and identifies its personnel who will be involved in the project, including a designated Community Liaison Officer (who may also have other local duties).
- The designated Contracting Agency hires a road engineering consultant or a design/build contractor to prepare the design documents for that segment.
- The Road Engineering Consultant or Design/Build Contractor using the GOSS/MTR standards, specification and the Environmental Design Checklist visits the road site, consults with the local authorities and communities, and prepares a Bill of Quantity for that segment and completes the checklist.
- Once the Road Engineering Consultant or Design/Build Contractor submits the design documents to the Contracting Agency, they in turn share the completed environmental checklist with the Ministry of Environment in order to verify its completion (with an option for inspection visits, especially if the road segment is found in new areas with potential environmental sensitivities).
- The Contracting Agency (or sometimes its agents mentioned above) prepares the tender documents for the road segment in question which includes the Standards, BOQ (including costing for known environmental management activities) and Special Provisions and Specifications.
- The environmental issues as identified for the road segment in question are pointed out to prospective bidders during the pretender site visit. Ideally, a roads engineer from the Contracting Agency designated as the person responsible for environmental compliance will be on hand during the site visit to discuss the issues and GOSS expectations for their mitigation (based on the Environmental Guidelines for Road Rehabilitation/Reconstruction).
- Prospective bidders prepare construction proposals which specify *inter alia* how they will meet the environmental guidelines and where necessary cost the environmental management activities specified in the BOQ.
- The Contract is awarded and work gets underway with a clear statement of the expected environmental management plan, its activities and anticipated costs for these activities included in the overall costs for this segment of the road.
- Supervising engineers report *inter alia* on compliance with environmental guidelines over the life of contract to the Contracting Agency which shares them with the MEWCT for monitoring purposes. The GOSS MTR Community Liaison Officer also maintains a record of interactions with the local authorities and communities regarding this road segment and its rehabilitation.
- At the time of project hand-over, the Contracting Agency, the Ministry of Transport and Roads and the Ministry of Environment field a joint inspection team to verify compliance with the environmental management plan, including decommissioning actions and certify that it has been built with the Best Management Practices in mind.

APPLYING THE ENVIRONMENTAL MANAGEMENT PROCEDURES FOR ROAD REHABILITATION IN SOUTHERN SUDAN

The following table provides a step-wise explanation of the application of environmental management procedures during the just described road rehabilitation project cycle in Southern Sudan and indicates the roles and responsibilities of the various agencies and stakeholders.

Table No. 5—The Road Rehabilitation Project Cycle and Environmental Management Procedures

Steps in Road Rehab Process	Applicable EMP Measures	Roles & Responsibilities
1) Project Identification	Environmental Policy imperatives to be taken into account when choosing road segments for rehabilitation	MTR (or GOSS Road Agency), familiar w/these imperatives because they were consulted in their development.
2) Project Design & Preparation	MTR Engineers (or their contracted consultant engineers) carrying out road assessment also complete the Environmental Design Checklist, including community consultation over the length of the road segment	MTR engineers must be thoroughly familiar w/GOSS environmental guidelines for road rehabilitation. MTR designates a Community Liaison Officer at this point to interact with County-level authorities and to guide community consultation process. MEWCT personnel are invited &/or choose to verify adequacy of completion of Environmental Design Checklist.
3) Preparation of Tender or Bidding Documents	Tender documents include environmental management activities in BOQ, standard environmental management clauses that are part of Special Provisions & Specifications of Contract	MTR in-house environmentalist verifies that tender documents include adequate information on environmental management requirements of the road segment in question.
4) Proposals responding to Tender reviewed and contractor chosen	Contractor applicants include an Environmental Management Plan in their technical proposals and identify the cost of EMP actions in their cost proposals	MTR committee considers adequacy of the EMP proposal w/ possible assistance from MEWCT personnel if needed. MEWCT registers/reviews EMP for this road segment.
5) Rehabilitation contractor implements mitigation measures specified in the contract EMP	Road rehabilitation activities proceeds as planned and periodic reports by Supervising Engineers include EMP compliance achievements	Selected construction contractor designates an engineer responsible for compliance with environmental management plan. MTR w/ MEWCT makes periodic inspections to ensure compliance.
6) Community liaison function in place and interacting with authorities/communities as road is rehabilitated	County authorities and concerned local communities have a source of liaison regarding road rehabilitation	GOSS MTR appointed Community Liaison Officer explains benefits and deals with issues such as traffic safety, the implication of the official right-of-way and maintains record of citizen interactions.
7) Completed road segment is inspected prior to handover to GOSS	Evaluation of adequacy of mitigation measures, all essential decommissioning and EMP compliance	MTR w/ MEWCT carry out final inspection before handover and prepare compliance report.
8) Regular and routine maintenance program is carried out	Maintenance program regularized according to the road category and systematically implemented. Monitoring is carried out according to the EMP to check against unforeseen adverse impacts and proper attention to environmental safeguards	MTR or another agency budgets for a contractor(s) who executes the maintenance program. Potential for localized maintenance crews operating at state/county level. Periodic monitoring reports prepared w/ copies to MEWCT.

APPENDIX A: BRIEF BIOGRAPHICAL SKETCHES OF THE PEA TEAM MEMBERS

Thomas M. Catterson, STEP Team Leader/Environmental Policy Advisor served as the Team Leader for this Road Rehabilitation PEA. Mr. Catterson has over 35 years of experience with environment and natural resources management-related work in 75 countries of the developing world. He has worked on a number of programmatic environmental assessments in different countries (Ethiopia, Guatemala and Guinea) and in different fields (small-scale irrigation and natural forest management). In addition, he is one of the co-authors of the USAID-Africa Bureau Environmental Guidelines for Small-Scale Activities in Sub-Saharan Africa. Mr. Catterson has a Masters degree in International Forestry (1973) and speaks several languages.

Karen Menczer, served as the Roads EIA Specialist Consultant on the PEA Team. Ms. Menczer has worked in international development since 1991, when she served as Natural Resources Advisor in USAID/Latin America and Caribbean Bureau. From 1997-2000 she worked at USAID/Uganda, also as Natural Resources Advisor and Mission Environmental Officer. She has been an independent consultant since early 2000, first in Uganda, and subsequently in Jamaica, Botswana, and currently in Ghana. Ms. Menczer has a Bachelor's degree in Biology, a M.S. in Ecology, and has done coursework towards a Ph.D. in Ecology and dissertation research in Galapagos, Ecuador.

Victor Wurda LoTombe, represented the GOSS Ministry of Environment, Wildlife Conservation and Tourism on the PEA Team. He currently serves as the Director General of Environmental Affairs of that Ministry. An agricultural and land-use planning specialist by training, Mr. Wurda has served in various government positions since 1973. He has a BA (Honors) in Geography and an MSc. in Environmental Studies, both from the University of Khartoum.

Jacob Marial Maker, represented the GOSS Ministry of Transport and Roads on the PEA Team. Mr. Marial is the Director-General of Roads and Bridges of the Ministry. During the war years, he has been involved in road rehabilitation and construction. From 1999, he has served as an SPLM Engineer with WFP, USAID and UN Habitat programs working on strategic road rehabilitation efforts around the country. He was also an active member of the Joint Assessment Mission (JAM). Mr. Marial is now representing his Ministry as a member of the budget sector working groups for preparation of the 2007-2009 GOSS Budget.

APPENDIX B: REFERENCE LIST

Anon. 2005. Road and Dyke Reconstruction and Rehabilitation in the Jonglei Area of South Sudan: The need for Environmental Impact Assessment –Abstract, pp.- 1 (Source—WIK CD Folder— Sudan WIK files- subfolder —Dike- Road Bor Co. Nile R.—Dike EA Process Steps).

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Brambhatt et al 2003. Sudan Infrastructure Program—Field Assessment Report, July 2003, by P. Brahmbatt, USAID civil engineer, E. Biar Kuol, SPLM telecommunications, N. Mwania, USAID transport economist,E. Wahome, USAID environmental advisor, D. Wani, SPLM infrastructure task force, J. Walsh, USAID program manager. Nairobi, July 2003, pp.- 43. (Source—WIK CD- Folder—Sudan WIK files-subfolder-Sudan Infrastructure)

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APPENDIX C: PERSONS CONSULTED

List of Persons Consulted during the PEA Exercise

Name	Position	Coordinates
USAID Staff		
Terry Kramer	USAID/SFO, Senior Engineer	Tel.- 254-20-862-2408; email- tkramer@usaid.gov
Jim Walsh	USAID/SFO, Development Program Manager	Tel. – 254-20-862-2427; email- jwalsh@usaid.gov
Gary Alex	USAID/SFO, Team Leader, Economic Growth & Food Security	Tel.- 254-20-862-2448; email- galex@usaid.gov
Walter Knausenberger	USAID/REDSO, Senior Regional Environmental Officer	Tel. – 254-20-862-2267; email- waknausenberger@usaid.gov
Ephantus Wahome	USAID/REDSO, Regional Environmental Specialist	Tel.- 254-20-862-2714; email- ewahome@usaid.gov
David Kinyua	USAID/REDSO Regional Environmental Specialist	dkinyua@usaid.gov
George O. Wagwa	USAID/SFO, Infrastructure Programs Engineer	Tel.- 254-20-862-2264; email- gwagwa@usaid.gov
Boutros Magaya	USAID/SFO	bmagaya@usaid.gov
Government of Southern Sudan Authorities and Staff		
James Loro Sericio	Minister of Environment, Wildlife Conservation and Tourism	Tel. +249 811 820-221
Alfred Akwoch Omoli	Acting Under-Secretary, Environment, Wildlife Conservation & Tourism	Tel.- +8821643332076; email- akwocchomoli@yahoo.com
Daniel Wani	Head, Secretariat, Physical Infrastructure & Town Planning (likely to change title w/new ministry decisions)	Tel.- 254-20-582-000; cell- 0733-684714; Sat Phone- +8821651119558; email- wanijuba@yahoo.co.uk
Gabriel Maker Amuor	D/Director for Admin & Finance, Roads, Bridges & Transport	Tel.- +8821643333902
Raymond Pite	Under-Secretary, Ministry of Housing and Lands	
Philip Yona Jami	Minister of Cooperative and Rural Development and Acting Minister of Agriculture and Forestry	Tel. (mob.) – 0912942280; Sat Phone- +8821651074412.
Waragak Gatluak Faguir	Under-Secretary of	

	Agriculture, Ministry of Agriculture and Forestry	
USAID/SFO Partner Projects Staff		
Leslie Robertson	Louis Berger, COP, Sudan Infrastructure Program	Tel. – 254-20-273-3754; Cell- 0725785323; email- lrobertson@southsudanroads.com
Steven Crosskey	Lead Engineer, South Sudan Road & Dyke Rehabilitation Project	Tel.- 254-20-375-4937; Cell- 0733-602376; Sat Phone- +882161115255; email- steven.crossky@wfp.org
Catherine Kenyatta	USDA PASA, Kenya Manager	Tel. 254-20-374 4737; 0720 391172; email- ckenyatta@iap-mu.org
Saw Lwin	WFP, Road Engineer, Rumbek	Sat Phone- +8821654207687
Francis Karimi	Manager, Roads & Transportation Services, , Howard Humphreys Ltd. Consulting Engineers	Tel.- 254-20-444-5254; Mobile- 0724 158494; email- fkarimi@howardhumphreys.co.ke
Francis Gicheru	Asst. Resident Engineer, Rumbek-Yirol-Shambe Road, Howard Humphreys Ltd. Consulting Engineers	Sat Phone- +8821643334245; email- gicherufg@yahoo.com
Steve Davidson	Site Manager, Civicon, Rumbek-Yei Road	Sat Phone- +8821643339682; email- roads@civicom.org
Joseph Kanyugi	Supervising Engineer, Rumbek-Yei Road, Howard Humphreys Lts.	Tel.- +254-20-4445254; email- enquiries@howardhumphreys.co.ke
I.K. Mburu	Resident Engineer, , Rumbek-Yei Road, Howard Humphreys Lts.	
H. Schar	COP, Volunteers for Economic Growth Alliance (VEGA)	Tel. – 254-20-271-1590; email- hschar@winrock.org
Louis Kuot	Engineer, MTR Representative, Kapoeta	
Other Partner Projects		
Colin Rees	Environmentalist, World Bank Infrastructure Team	Tel. – (202) 458-0521; email- crees@worldbank.org
Andrew Morton	Project Coordinator, Post Conflict Environmental Assessment- Sudan, Post Conflict Branch, UNEP, Geneva	Tel.- 41 (0)22 917 8764; email- Andrew.morton@unep.ch
Michael Pinard	Managing Director, InfraAfrica (Pty) Ltd., Gaborone, Botswana	Tel. – 2673971281; Cell- 26771311629; email- mipinard@global.bw
Melissa Nielson	HIV/AIDS Field Officer, ARC International- Southern Sudan/Uganda	Tel. – 256 41 34909; Sat Phone- +8821651194779; email- Melissa.nielson@arc.co.ug
Local Government Authorities and Community Representatives		
Chief Marial Malual Arop	Chief, Akot	

(Community meeting with approximately 35 representatives)		
Martin Majak Makuac Thon Rangu Majok Maneshe Mayen Malolo John Murwell Makuei Theji Daduot John Majak Malok (Community meeting with approximately 12 representatives)	Commissioner, Eastern Rumbek County Town Mayor, Kawei, East Rumbek County SSRC Eastern Rumbek County Deputy Inspector of Police County Judge Deputy Executive Director, Eastern Rumbek County	Turn right onto track (feeder road) about 200 mts. south of Naam River bridge on Rumbek-Yirol road to reach Kawei Village
Abraham Mayom (Community meeting with 4 representatives)	Payam Administrator, Pachong, Eastern County	
Community meeting with approximately 40 representatives	Payam Administrator, Domalao	
Gideon Sulur	Wulu Community Commissioner	
Makur Pou	Wulu Cooperative, Acting Executive Director	
Solomon Anyak Mayom Malek	Executive Director and Acting Commissioner, Cueibet Deputy Executive Director, Cueibet	
Justin Otwane	Community representative, Bhar Gel	
Jok Ayom Majak Abraham Makokoi Bol Kodi	Minister, State Ministry of Physical Infrastructure, Central Rumbek Commissioner, Central Rumbek County	
David Nok Marial Kongor Deng Kongor	Lake State, Deputy Governor and Acting Governor and Minister of Education Commissioner, Cueibet County	

APPENDIX D: ENVIRONMENTAL MANAGEMENT GUIDELINES

These environmental management guidelines have been prepared as a separate appendix here with the intention that they be extracted and used for reference and training purposes on the field sites and in the headquarters of those involved in the road rehabilitation program. Each of the impacts identified during the PEA is briefly discussed along with suggested mitigation and monitoring measures.

ISSUE—SOIL EROSION PROBLEMS

In some areas, soil erosion and gullying may occur, particularly those with more rugged, sloping topography, resulting in loss of topsoil, diminished soil fertility, and ultimately, siltation of waterways and wetlands.

DISCUSSION

Although the general plan is to carry out road construction activities in the dry season, this is not always possible and feasible. During construction, with the earth movement and disturbed soil that occurs to rehabilitate roads, there may be potential for increased soil erosion. Similarly, in draining the cambered surface of the road, water channeled off into and along the roadside ditches can gain force and cause erosion in-situ or lead to adverse off-site consequences on neighboring lands. These consequences could be significant if homes are adjacent to the road or if the land is used to grow crops. Discharging culverts or cross drains onto fill-based slopes without protection will quickly erode the side hill. Even in the flatter areas, loose or disturbed soil can be washed into the road ditches or drainage ways, adding to the need for maintenance of these structures. In general, with the use of Best Engineering Practices (BEPs) which serve to control the velocity, flow and amount of water run-off, soil erosion could be kept to a minimum.

Mitigation Measures	Monitoring Measures
• Preference for dry season construction • Avoid building roads in very steep terrain (>60% slope) • Spreading and/or compaction of disturbed soils incorporated into BOQ • Install sufficient number of water bars and/or culverts along the roadside ditches to minimize the amount of water that accumulates; more if the area is steep • On steeper slopes, line roadside ditches with riprap or sow grass or other cover crops to anchor the soil • Add splash aprons or energy dissipaters at the outlet of culverts • Add a requirement for the use of silt curtains or mulching for particularly important drainage areas • Ensure adequate maintenance of such drainage ways to prevent blockages and failure.	• Monitor sediment and debris buildup in road ditches or culverts • Measure stream flow, local hydrology and meteorology so as to increase understanding of local conditions and cause & effect

ISSUE—ROAD CONSTRUCTION IMPACTS ON LOCAL HYDROLOGY

During construction, temporary, direct impacts to stream flow and drainage may occur. In some cases, wetlands may have to be filled to build causeways across them thus requiring culverts to allow water to pass through them in an unobstructed manner.

DISCUSSION

Road construction crossing watercourses and wetlands can alter the stream flow and drainage patterns with both ecological and socio-environmental effects in Southern Sudan. When road construction occurs in the wet season or when wetlands or watercourses are still holding water, hydrological conditions could be disrupted, affecting flow downstream and wetland functions. Heavy machinery operations at crossing points will leave soil and substrate prone to washing by renewed stream flow leading to sediment transport and alterations of stream hydrology. During the operations phase, the design and construction of culverts, drifts, and bridges may come into play. Although the expectation (when using BEPs) is that they have been designed and constructed in ways that retain the original hydrological characteristics, in Southern Sudan, there is frequently no accurate data on stream hydrology on which to base design considerations. Similarly, the cost of construction of such structures is directly related to their size and number and thus the "emergency" nature of the road rehabilitation may have under-specified the scale and number of these drainage structures to the point where they may not accommodate seasonal flooding.

Unimpeded drainage through a road causeway or under a similar road structure in a wetland is critical to both the durability of the road and to mitigating impacts of construction. Inadequate culvert size (or clogged culverts because of the lack of maintenance) can lead to a build up of surface water on the upstream side which penetrates and softens the road base. Drainage may also need to be spread rather than concentrated to maintain the former hydrological characteristics of a wetland. Although an individual wetland site sacrificed for the purposes of transportation infrastructure may seem insignificant, the cumulative impacts of many such sites, given the frequency of wetlands and swamps in Southern Sudan could lead to significant and unacceptable adverse socio-environmental impacts. In many parts of the country, the loss of wetlands would mean the loss of dry season grazing areas (the "toic") and thus additional conflict among pastoralists dependent on these areas. Southern Sudan's wetlands are also part of a regional system that supports the rich biodiversity of aquatic ecosystems in which hydrological disruptions at one point may have unpredictable and unintended consequences downstream.

Mitigation Measures	Monitoring Measures
• Preference for dry season construction • Identify suitable crossing points and re-align the road if needed • Establish national riparian zone management policy and apply it • Ensure adequate size (diameter no less than 60 cms) & number of culverts passing watercourses or wetlands • Avoid cut & fill road construction adjacent to torrential or flashy streams that could wash away the toe slope and sink the road platform • Avoid constricting water flow with bridges or drifts • Suitably sized bridges, both volume and spread to accommodate natural flows	• Stream gauging stations at major bridges to measure flood history • Careful routine inspection of bridge, culvert and drift function, ideally during a rainfall event • Verify that road maintenance is being carried out as planned including cleaning culverts

ISSUE—BORROW PITS AND DRAINAGE FEATURES AND ENVIRONMENTAL HEALTH, SAFETY AND AESTHETICS

The construction of borrow pits and drainage features (e.g., sumps at the end of mitre drains) may create habitat for water borne disease vectors; and pose a safety issue for people and livestock. Also, there are matters of aesthetic or visual impact, loss of natural habitat, run-off and erosion, loss of productive lands, including grazing lands along the road corridors as a result of over-zealous borrow pit construction.

DISCUSSION

Road construction crews create borrow pits along the roadway to mine road construction material. In some locations, borrow pits seem to be spaced close to each other. During construction, the borrow pit will remain open and operational, and during rainy seasons, it will collect water. The borrow pit can then become a breeding ground for mosquitoes and other water-borne disease vectors. Also, if water is collected in the borrow pit, people and livestock may drown—there have been cases, cited to the PEA Team during community meetings, of livestock getting mired in mud, unable to climb up the side of the borrow pit due to the steep slope, and drowning.

Of similar concern are the drainage features in flatter areas, such as mitre drains and sumps, used to remove water from around the road ditches. If they are too deep, and sides too steep, people and livestock could be injured falling into them or even drown; if they hold water for lengthy periods, they can become breeding grounds for vectors. Borrow pits close to towns may create additional concern since a greater number of people may have access to them and because disease vectors are more of an issue.

Mitigation Measures	Monitoring Measures
• Minimize the number of borrow pits by increasing free haul distance in BOQ • Establish conditions for borrow pit construction • Require contractor to establish and implement a borrow pit management plan • Engage local community authorities to take responsibility for long-term borrow pits in their areas	• Verify that subsequent use of borrow pit, whether for maintenance or by others, meets standards • Verify natural regeneration on restored borrow pit sites and if necessary, replant • Verify conformance with Borrow Pit Management Plan

ISSUE—CONSTRUCTION CAMP IMPACTS

Creation of construction camps may result in environmental pollution from waste material, including human waste and garbage, and from fuel, oil, and lubricants from associated machinery.

DISCUSSION

Road camps are constructed along an individual road segment to house the road crew and the equipment and supplies to rehabilitate the road. The construction camp becomes a small village—housing many people, usually in temporary accommodation, with latrines, and food preparation areas and common eating areas. Often, motorized equipment is kept, fueled and serviced at the camp.

When clearing land for a construction camp, there will be direct impacts on the environment at the camp site. In most cases, a camp can be easily sited to minimize direct effects of camp construction and operation. In arid areas of Southern Sudan, road construction demand for water for camp use and for wet compacting of road layers or for concrete work can compete with local human needs causing hardships and/or conflict.

During operation of the road camp, measures are needed to minimize the potential for pollution from human waste, solid waste and from fuel, oil, and lubricant spills to ensure adverse effects do not occur. Every effort must be made to avoid activities which could contaminate the water supply, especially if, as is recommended, these boreholes be left in an operational status to avail more water supplies needed by local communities.

Mitigation Measures	Monitoring Measures
• Proper siting with a preference for flat sites and standardized layout with adequate and clearly specified pollution safeguards • Careful attention to water supply issues so as not to disadvantage local communities with whom these are shared during construction • Consider leaving operational borehole for local community use after departure of the road crew • Full cleanup costs incorporated into BOQ	• Schedule a visit to all decommissioned road camps with the responsible contractor to ensure compliance and a thoroughly cleaned-up site • Verify natural regeneration of restored camp site and if necessary, re-seed or re-plant, ideally using native species

ISSUE—ENVIRONMENTAL HEALTH AND SAFETY HAZARDS OF HIGH DUST CONDITIONS

Dust is generated by vehicles driving on the road, resulting in human health concerns, affecting livelihoods, affecting vegetation (crops and natural vegetation) adjacent to the roadway, and causing traffic safety hazards from blind passing.

DISCUSSION

During road rehabilitation, construction equipment is plying the road, churning up an enormous amount of dust. Vehicles using the road while it is still under construction are doing likewise. During operation, the increased traffic on the road combined with the likelihood of increased average speeds will likewise, increase the amount of dust. This is particularly true on the laterite road surfaces which are more easily subject to pulverization of the wearing course than the stone-based gravel wearing courses.

Communities, particularly in the more urbanized areas, can be highly susceptible to the effects of constant dust along the roads. Respiratory diseases are already common in Southern Sudan and being subjected to continuous exposure to fine dust from the road surfaces will exacerbate the environmental health hazards for local people. High amounts of dust also create a major traffic safety issue: blind passing through dust clouds. Faster vehicles attempting to pass a slower moving truck raising a lot of dust will not be able to see on-coming traffic nor pedestrians or Non-Motorized Traffic (NMT) in the road ahead.

Mitigation Measures	Monitoring Measures
• Need for sealed roads within urbanized areas • Speed bumps to slow traffic and enforcement of speed limits • Construct wider shoulder widths or improved condition to allow for pedestrian use • Road signage alerting drivers to the dangers of passing on a dusty road plus "no passing zones"	• Verify that traffic laws are being enforced • Roads liaison officer of MTR maintains continuous log of community inquiries and complaints

ISSUE—TRAFFIC SAFETY ON IMPROVED ROADS

With improved roadway conditions encouraging more vehicular traffic and higher average speeds, there is increased possibility for accidents between vehicles and non-motorized transport such as bicyclists, and with pedestrians and animals.

DISCUSSION

Improved road conditions will encourage more vehicular traffic and allow vehicles to travel at faster speeds. Although the rehabilitated road will be wider in certain areas, and may straighten dangerous curves, making it

safer to travel at higher speeds, there are likely to be more collisions between vehicles and bicycles, pedestrians, and livestock (and wildlife).

Local people in Southern Sudan have lived so long without good roads that there is a lack of awareness of the dangers of the roadways and fast moving vehicles. People, animals, NMTs, and particularly children are unaware of the danger of a fast approaching vehicle and may cross the road in front of it. Livestock wandering semi-attended by herd boys is a very common feature of much of the country and these animals too often wind up in the road. Stopping a vehicle on these gravel faced roads takes time and space, as there is a possibility of skidding.

Mitigation Measures	Monitoring Measures
• Community education, particularly in primary schools, to make people aware of the dangers of fast moving vehicles • Speed bumps to slow traffic and rigorous enforcement of speed limits • Road signage for drivers and pedestrians alike • Bypass roads to avoid bringing bulk of traffic through the most densely populated areas	• Road liaison officer of MTR maintains a continuous log of community inquiries and complaints • Verify that traffic laws are being enforced • As towns and villages expand, extend mitigation measures to new limits

ISSUE—THE SPREAD OF DISEASE ALONG ROADS

Increased traffic on the roads, and construction crews who work on the roads could introduce diseases, especially HIV/AIDS into the area.

DISCUSSION

With the improved roads, there will be an increase in the traffic coming in from outside the area. This situation is expected to continue. Interior areas of Southern Sudan now have very low infection rates for HIV/AIDS as compared to neighboring countries or even the fringe areas along the border. Given the proximity and close ties to Uganda there will be a renewal of the flow of commerce and trade carried by truck deep into Southern Sudan on these rehabilitated roads. It is well-known that truck drivers have played a significant role in the spread of HIV/AIDS in East Africa and thus the improved roads could pose a significant threat to health in the region. Similarly, during the construction phase, road crews, often strangers to the area in which they are working, may bring contagious diseases to local populations, perhaps not previously affected by some of the diseases.

Mitigation Measures	Monitoring Measures
• HIV/AIDS awareness and prevention campaign working with road crews and adjacent communities • Health clinics along the roads get high priority, with special attention to danger of HIV/AIDS	• Monitor community health statistics at various points along the road network

ISSUE—IMPACTS ON TROPICAL FORESTS AND PROTECTED AREAS

Road rehabilitation activities may improve access to relatively undegraded tropical forest and/or protected areas. This could result in unsustainable/uncontrolled resource extraction, land use/forest conversion, and a decrease in biodiversity richness. As a result too, threatened or endangered species (TES) which previously were difficult to access could be put at risk.

DISCUSSION

Proposed road rehabilitation will take place along existing roads, with minor modifications in some areas where safety or engineering concerns warrant limited road realignments. Undoubtedly there will be segments where the road will pass adjacent or even through protected areas, including national parks, forest reserves, and game reserves.

There is presently limited information available on the existence, habitat, and extent of TES in Southern Sudan. Areas along the roads the PEA Team visited are unlikely to contain habitat for TES, especially since these roads are existing, and traffic has filtered down these routes for decades. In the past, decisions on which roads to rehabilitate have not taken into account the existence of or impact on sensitive habitats, undegraded tropical forest, PAs, and TESs. The ideal process, would be that at the planning stage—which takes place at the GOSS and MTR level—when roads to be rehabilitated are identified, the location and potential impacts to these ecological landscapes and systems should be considered. However, it is unlikely that the presence of critical ecological features and potential impacts will influence the road planning process at the Ministry level, and therefore, significant impacts could result if roads are rehabilitated near these areas. Hence there will be a need to be sensitive to these situations and put in play actions that could avoid affecting the protected areas or mitigation the consequences of easing access to these areas.

Mitigation Measures	Monitoring Measures
• For each road segment, a site-specific investigation will be necessary, ideally by comparing the planned road alignment with a map of existing areas of undegraded forest or protected areas. • Collaboration among GOSS ministries targets such areas for early redeployment of protection staff • Boundary re-establishment and demarcation of such areas is given priority • Signage along the roadside makes users aware of special status and regulations near protected areas • Initiate community-based natural resources management programs and co-management programs established in buffer zones around the Protected Areas.	• Monitoring routine reports of protection efforts by PA staff charged with managing the areas in question. • Control points along the road network make it possible to monitor the movements of natural products.

ISSUE—INCREASED ACCESS TO NATURAL RESOURCES, THE POTENTIAL FOR LAND-USE CHANGES AND THE RATE OF HABITAT LOSS

By definition and intent, rehabilitated roads will improve physical access to natural resources across the landscape in Southern Sudan. Concerns have been expressed that this will lead to large-scale degradation of the natural environment as people exploit these resources without controls.

DISCUSSION

Road rehabilitation in Southern Sudan will occur across a range of ecosystem types and through urban, peri-urban, towns and villages, and small settlements, and into areas with sparse populations, through landscapes most suited for livestock grazing or agriculture, and through dry, tropical forest, wetlands, and degraded landscapes, burned for agriculture or previously settled but abandoned. Habitat loss as a direct result of road rehabilitation is unlikely as these are existing roads. However, as an indirect result of increased traffic, settlements, and new enterprises, habitat may be lost. Land-use conversion (from agricultural land to settlements, from grazing land to agricultural land, etc.) may occur.

Improved roads will also help to guide development and town/village planning so that growth may occur in a more organized fashion, and thereby may decrease the impact on natural habitat. Similarly, regulatory and/or

development agencies would gain improved access to the resources they are charged with managing and be able to access local communities, to work with local people and promote sustainable use, while discouraging resource mining; and to enforce regulations.

Mitigation Measures	Monitoring Measures
• Cross-sectoral planning should link communities where this is a concern with programs for sustainable economic growth activities that will relieve pressure on the natural resource base and that can help devise sustainable use plans. • Intensify the present efforts at urban planning and eventually regulation.	• Both GOSS Ministries of Agriculture and Forestry and of Environment, Wildlife Conservation and Tourism monitor land-use change as part of their routine duties.

ISSUE—LACK OF ROUTINE MAINTENANCE OF GRAVEL ROADS

A gravel or murram surfaced road without routine maintenance will quickly degrade. Unfortunately, such maintenance is often overlooked/not budgeted, resulting in hardships for local people who rely on the roads for goods and services. This lack of maintenance, failure to clean ditches and culverts can cause increased erosion and consequent siltation of waters and wetlands and will lead to further damage to the road.

DISCUSSION

Although road maintenance or the lack of it is by definition a part of sound road engineering an programming, the issue bears mention here because unmaintained roads often lead to adverse environmental consequences. The present lack of routine maintenance is a primary concern for the sustainability of the road rehabilitation work. Longer and more durable repair work (permanent roads) would require less maintenance but for the emergency road repair, laterite will continue to be the surface material used, and routine maintenance will be needed. Typically, road construction contracts include a minimum "defects liability period," in some countries of up to 24 months, to ensure that the road is maintained until a replacement maintenance contract can be put in place or governmental authorities can take full responsibility for the road segment in question.

Unless road maintenance can be assured, the efforts at environmentally sound design and construction will be quickly undone and a chain reaction of adverse environmental impacts, associated with degradation of the quality of the roads will get underway.

APPENDIX E: ENVIRONMENTAL DESIGN CHECKLIST

	GOVERNMENT OF SOUTHERN SUDAN **MINISTRY OF TRANSPORT AND ROADS** **Road Rehabilitation Environmental Design Checklist**

Road Segment:
Date (s) Assessment Conducted:
Assessment Conducted by:
(This form should be accompanied by a longitudinal sketch map of the road segment and a digital photo record of the most salient features of the route that will affect environmental sustainability)

Name	**Title**	**Organization**
Email Address	**Telephone Number**	**Sat Phone Number**

In collaboration with:

Name	**Title**	**Organization**
Email Address	**Telephone Number**	**Sat Phone Number**

Road Segment Location and Basic Information:

Details	**Origin**	**Destination**
State		
County		
Closest Town or City		
GPS Reading (Lat & Long)		
Total Distance of Segment	Kms.	
Total Driving Time 4WD	Minutes	
Map References Available		
Total Number of Stretches		

Completing the Environmental Design Checklist: The remainder of this form is a "Stretch by Stretch" response to the questions of the Environmental Design Checklist. The "Stretches" are the same ones used for the Road Engineering Assessment to which this Environmental Design Checklist is a companion. The "Stretches" are determined from the starting point to the first significant feature where there is a change in road condition (for example, at a major river bridge or a major town), at which point the next "Stretch"

begins. Some of this information will be the same as the data and information collected on the Road Engineering Assessment form but will be repeated here because of relevancy to an understanding of the environmental conditions through which the road passes.

Stretch No. 1

Stretch No. 1 of _____ Feature at Start: _____ Feature at End: _____					
Distance from origin at beginning of stretch	0+000	Lat-GPS:		Long-GPS:	
Distance from origin at end of stretch		Lat-GPS:		Long-GPS:	
Total distance of this stretch	Kms.				
Total travel time for this stretch	Minutes				
Towns + Mileage Marker along the Stretch					
Class of Road (check one)	Major Trunk		Trunk		Feeder
Present Surfacing (check one)	Gravel		Dirt		Sand
Present Road Condition (check one)	Smooth	Rough	Distorted	Loose	Muddy
Grade	Level		Rolling		Steep

Environmental Conditions/Management-Mitigation Recommendations along the Stretch					
Predominant Land-use categories (rough estimate) (% per category)	Forest	Bush	Farmed	Pasture	Wetland
Indicate sources of water for construction purposes (wet compacting or for mixing concrete)	Indicate each potential source (with milepost) and availability and plan for avoiding conflict with other users				
Road passes through or closely adjacent to Protected Area (PA)	Indicate approx. mileposts and name of PA and whether there is any presence of authorities: - - Specify measures to minimize impact on the PA: - -				
Note areas of potential erosion problems	Indicate approx. mileposts and reasons why erosion is considered a problem - - Estimate need for additional erosion control measures, discuss type of measures and costs to be added to the BOQ as a result - -				

Note each crossing of perennial stream or river	Indicate exact milepost of each bridge, its condition, whether it might be possible to minimize the impact of the crossing by road re-alignment - - Indicate if bridge reconstruction is likely to adversely affect water course in question and how those impacts can be mitigated - -
Note each crossing of a seasonal watercourse	Indicate exact milepost for each crossing (drift), proposed methods to minimize impact of the crossing point if necessary - -
Note each wetland area being crossed	Indicate exact mileposts and length of crossing, whether there is a perennial watercourse as part of it, describe present crossing, whether it might be possible to mitigate impacts by road re-alignment - - Where a causeway must be constructed, provide description (length, width, height) and indicate number, size (diameter) and configuration of the culverts - -
Indicate sources of murram from probable borrow pits along the stretch	Estimate allowable minimum haulage to optimize the use of existing sources of murram from borrow pits along the stretch - - Estimate the number of borrow pits to be opened and specify setback/siting requirements - - Prepare a comprehensive borrow pit management plan for the road segment with cost estimates to be included in the BOQ - -
Identify likely site (s) for road camp along this stretch, if any	Indicate exact milepost, present land-use of the site, distance to nearest town or village, area to be cleared, proximity to any watercourse, availability of water, type of camp - - Estimate clean-up & decommissioning costs to be added to the BOQ - -

Which towns, villages or establishments along the road may be affected by dust	Indicate each of the towns, villages or establishments (schools, hospitals, clinics) with their exact mileposts (approximate length through the urbanized area) - - Indicate alternatives considered to mitigate the dust problem: community relocation, road diversions or bypasses around urban areas, speed bumps to slow traffic, temporary road watering during construction phase, sealed coating and estimate additional costs to be added to the BOQ for measures chosen - -
Note probable areas of traffic safety issues	Indicate each of the towns, villages, establishments (schools, hospitals, clinics) or traffic intersections with their exact mileposts (approximate length through the urbanized area) - - Indicate the measures chosen to mitigate the traffic safety problem: wider, smoother road shoulders w/i the urban areas, speed bumps, road signage, traffic police outposts, and estimate the additional costs to be added to the BOQ for the measures chosen - -
Note the potential for the spread of contagious diseases, particularly HIV/AIDS	Indicate whether this is likely to be an issue along this stretch as a result of urbanized areas or truck stops where long distance traffic might overnight; indicate mileposts for these areas - - Indicate if a HIV/AIDS Awareness and Prevention campaign is planned for this road segment and indicate the resources earmarked to fund it - -

Stretch No. 2 Through Stretch No. X…..format repeats as many times as there are stretches along a road segment.

APPENDIX F: STANDARD ENVIRONMENTAL CLAUSES FOR ROAD REHABILITATION CONTRACTS

(A WORK IN PROGRESS TO BE COMPLETED IN ASSOCIATION WITH THE GOSS MINISTRY OF TRANSPORT AND ROADS AND THE LOUIS BERGER GROUP)

INTRODUCTION

Road construction or rehabilitation contracts typically include specific language regarding the contracting agency's expectations related to avoiding adverse environmental impacts or managing the environment as part of the construction efforts. In the case of the WFP Emergency Road Repair Program (ERRP), these requirements were found in the "Special Specifications" addendum (Section 1231 Pollution Control and Section 1300 Contractor's Establishment on Site and General Obligations) to the contract and were considered supplemental to the overall specifications adopted and adapted for the program, i.e., the SATCC Standard Specification for Road and Bridge Works (1998). These "Special Specifications" were generic, applying to all contracts and were the subject of some effort to update and improve them on the part of WFP. This effort was inadequate and accordingly, this Appendix represents a continuing effort to prepare a set of environmental management clauses for inclusion in the road rehabilitation and reconstruction contracts to come.

Pinard (2006) concluded that "a number of sections from each of the eight Series of the document have been omitted" and as an example, he drew specific attention to the lack of adequate guidance on the environmental management requirements for borrow pits. The PEA Team similarly found these Special Specifications to be lacking and too general, leaving both requirements and the responsibilities for addressing them unclear. In the ideal case, these Special Specifications related to environmental management would be taken fully into account during the assessment of the road segment in question, included in the Bill of Quantities (BOQ) and, as Pinard also notes "carried over into ….the related Method of Measurement and Payment" (ibid).

This Appendix attempts to provide some standard clauses for inclusion in road rehabilitation contracts, in particular in the section called Special Specifications. The materials that follow have been generated out of the experience of the PEA and also through reviewing the existing specifications (the "pollution control" specifications mentioned above) and similar specifications proposed by other entities, in particular as part of an effort by the World Bank in Zambia and Yemen in recent years (personal communication and materials from C. Rees).

Although these draft "standard clauses" are on the whole fairly comprehensive, the intention is not that they be adopted wholesale into the contractual process for road rehabilitation and construction in Southern Sudan today. In actuality, it is the hope of the PEA Team that this Appendix might serve to inform an existing dialogue and effort at the GOSS Ministry of Transport and Roads, in conjunction with the activities of the

Louis Berger Group, building standard clauses for road construction (and even as potential material for consideration under their efforts to assist in drafting transport sector policy). A collaborative approach to developing these clauses is considered much more likely to be embraced by the road construction professionals offered a chance to contribute their own views about the environmental regulations under which they operate. Ownership rather than imposition is the goal.

The clauses which follow, some of which are drawn from the existing contractual materials and others elaborated as a result of this PEA, are divided into a series of sections for both general and specific concerns related to road rehabilitation and reconstruction.

Other Parties to the EMP: Lest there be any mistake, the introduction of standard clauses for environmental management as part of the Special Specifications of road rehabilitation contracts does not imply and should not be construed to mean that environmental management is the sole responsibility of the road construction contractor. On the contrary, and as discussed elsewhere in this report, both the GOSS Ministry of Transport and Roads and other GOSS ministries, local authorities at State and County (and perhaps even at Payam level but this remains to be discussed and considered in light of local capabilities) will have possible roles in mitigating and monitoring the adverse environmental impacts of road rehabilitation and reconstruction. It is suggested, for instance, that the MTR working in collaboration with State, County and town authorities would take charge of developing an awareness and education campaign about the issues of road right-of-way and its local implications and about traffic safety. This would be directly related to their functional responsibilities as local liaison officers dealing with citizen and community concerns related to the road rehabilitation. The police authorities have a role to play as well in applying traffic regulations related to speeding, careless driving, traffic safety in general and possibly in controlling axle weights or road usage during the rainy season to avoid damage to road infrastructure. In this same regard, even the general public has a potential responsibility for ensuring that their views related to the impacts…both positive and negative…of the road rehabilitation activities are known.

Other ministerial interventions might be expected as a result of indirect impacts. For example, the Ministry of Health might be charged with implementing an HIV/AIDS awareness and prevention campaign rather than having this funded by the roads program itself with locally operating NGOs. Because of potential impacts of improved access to natural resources, one might expect enhanced protection and control activities by the Ministry of Agriculture and Forestry (related to timber, fuelwood and charcoal and non-timber forest products) or by the Ministry of Environment, Wildlife Conservation and Tourism (related to biodiversity conservation).

Over the short to medium-term, the challenge will be ensuring a degree of collaboration among all these parties while at the same time maintaining a separation of powers that will build a cohesive program of roles, responsibilities and authority founded on the expertise each player brings to the mix. The environmentalists should not feel it is their duty to enforce the speed limits and the police should not be applying environmentally related sanctions.

Introducing the EMP to the Contractor: It is essential that the Special Specifications for the environment open with a section or series of clauses that explicitly introduces the contractor to the policy, procedures, players and their roles and responsibilities, and the environmental guidelines related to his work. There should be a direct reference to the requirements that the contractor will have to fulfill…essentially implementing the Environmental Management Plan that was developed for the road segment in question.

The process and procedures should be spelt out so that the contractor understands his role in implementing it and to whom he reports achievements related to environmental management and who will be measuring the accomplishment of the environmental management activities specified in more detail in the BOQ. Eventually, in Southern Sudan, these Special Specifications will reference the established regulatory

instruments put in place for road rehabilitation…a future Environmental Protection Act or something similar as well as the official environmental guidelines for road rehabilitation.

The Government of Southern Sudan (GOSS) Ministry of Environment, Wildlife Conservation and Tourism (MEWCT) has as yet to release standards for wastewater quality and air quality. In their place, international environmental quality standards will be applied as may be necessary— primarily those of the World Health Organization (WHO).

Other Generic Clauses:

Many such contractual instruments contain **an over-arching environmental restoration clause** that underscores the importance of avoiding and/or mitigating the adverse environmental impacts and/or restoring the disturbed environment to "acceptable standards and to abide by environmental performance indicators specified under the EMP" (Roads Department Zambia). This "catch-all" phraseology is intended to demonstrate intent and a policy position of the contracting agency, whether the Government or the donor agency funding the activities.

Similarly, these standard clauses should eventually contain language requiring the Contractor to comply with any relevant laws and regulations that will be developed and implemented by the GOSS through either its Ministry of Transport and Roads and/or its Ministry of Environment, Wildlife Conservation and Tourism.

Similarly, another measure for ensuring compliance with environmental standards and expectations while dealing with the oft-repeated issue of lack of maintenance is to **extend the construction contract to include a year of operation and maintenance** of the road segment in question.

Issue Related Clauses:

Borrow pits (quarrying): Borrow pits are an essential part of road building. However, they represent a potential cost to society in terms of their adverse environmental impacts. In general, the contractor will be expected to carry out the construction works in such a way as to minimize the need for the use of borrow materials, including careful attention to re-use of excavated material as sub-base/base where technically feasible (FIDIC Secretariat 1992). Similarly, and following the recommendations of Pinard, the Contractors shall "Observe a minimum allowable offset of borrow pits from the road (set back out of sight of the road) and minimum longitudinal spacing in relation to the allowable free-haul in the BoQ" (Pinard 2006).

The above notwithstanding, the contractor is, however, required to **prepare a borrow pit management plan** which takes account of these activities and follows them through to handing over. These plans need to take account of the need for safety (beveled edges and maximum depth so as to avoid creating drowning hazards for people and livestock); the potential for becoming centers of water-borne disease vectors; and their general impact on local land holdings, land-use and visual impacts. Borrow pits for long-term maintenance purposes should not be maintained too close to urban areas as this would add to the chance for children drowning in them, local people using them as sources of unclean water, or increased water-borne disease vector populations.

In order to ensure restoration of borrow pit sites after decommissioning, topsoil layers should be removed and carefully stockpiled on site. If monitoring determines that natural regeneration is insufficient on restored sites, the contractor should use direct seeding of native leguminous species, such as some of the leguminous creepers that exist in Southern Sudan or a perennial shrub species like *Sesbania sesban* (common to the area and a prolific seeder). Where borrow pits are to be left open, for their use in regular maintenance programs, the responsibility for their management should be assigned to the government entity in charge of road maintenance and compliance with the borrow pit management plan monitored.

Road Construction Camps: Sections 1301 and 1302 of the existing Special Specifications discuss the requirements for the contractor to establish a road construction camp on site; they are broad ranging and comprehensive and are quoted here in full for that reason.

"1301 SCOPE

This section covers the establishment of the contractor's organisation, camp and constructional plant on the site and their removal on completion of the contract. It also covers payment for certain general obligations, risks and liabilities and general items of cost not covered elsewhere.

1302 GENERAL REQUIREMENTS

Prior to commencement of any camp establishment activities, the Contractor shall provide the relevant Local Authorities with details of his proposed arrangements and shall obtain all necessary permits and consents, copies of which shall be supplied to the Engineer.

The Contractor shall take all reasonable precautions to prevent spillage and leakage of substances with the potential to pollute land or water resources at his base camp and all worksites. Particular care shall be taken to ensure that no fuel, oil, lubricants, chemicals or cement dust or fresh concrete contaminate groundwater or surface water.

Fuel, oil and lubricants shall be stored in liquid-tight containers kept on an impervious base. The edges of the base shall be raised to prevent spillage leaking off the base, which shall be provided with a drainage system. Earth bounds shall be constructed around each fuel storage area to contain major spillage. The Contractor shall provide equipment to clean up any major spillage before fuel or oil has soaked into the ground.

The Contractor's vehicle and plant maintenance areas shall be provided with an impervious base to collect any spillage of fuel, oil or lubricants, and shall be provided with suitable drainage systems. The edges of the base shall be raised to prevent spillage leaking off the base. The Contractor shall mop up any spillage as soon as they occur.

Oil and grease traps shall be installed in drainage systems associated with vehicle and plant washing facilities, service, fuel storage and fuelling areas, and kitchen wastewater disposal facilities. The drainage systems shall be maintained in an effective condition throughout the construction period.

No maintenance or repairs, other than emergency maintenance or repairs, shall be carried out on the site other than in designated plant maintenance areas, approved by the Engineer.

Re-fuelling of vehicles, plant and machinery shall be conducted, as far as is practicable, at the fuel storage area. If re-fuelling is carried out elsewhere, leak-proof trays made of impervious material shall be so positioned during re-fuelling as to catch any fuel spillage. The material, capacity and dimensions of trays shall be approved by the Engineer. Spilled fuel collected in the trays shall be disposed of as waste or returned to the fuel store.

The Contractor shall provide suitable ablution/sanitary facilities for the use of his base camp staff, with separate facilities for male and female staff. All such facilities shall be provided to the satisfaction of the Engineer. The numbers of male and female toilets shall be appropriate to the peak numbers of staff of each sex working at the base camp. The toilets shall be provided at all times with adequate supplies of toilet paper and paper towels, and provision

shall be made for suitable hand washing facilities, together with a water supply for hand washing which at all times is adequate in quantity for the numbers of employees at the base camp. The toilets and ablution facilities shall be maintained in a clean and hygienic condition at all times, to the satisfaction of the Engineer.

Toilets shall be of the flush WC type, and the Contractor shall ensure that adequate water supply for flushing is available at all times. In the event that connection to a municipal sewer is not feasible (something presently highly unlikely in Southern Sudan, note added by authors for emphasis), sanitary wastes shall be treated in septic tanks of adequate capacity, with the outflow directed to a soakaway. Waste water from ablution facilities shall be directed to soakaways. Septic tanks and soakaway arrangements shall be such as will not allow the direct ingress of rainwater or drainage waters.

The Contractor is reminded of the importance of minimising waste generation and maximising recycling of wastes where this is practicable.

All wastes arising directly and indirectly in connection with execution of the works, with the exception of waste oils or fuels, shall be disposed of only at sites approved by the Engineer. Different types of waste shall be stored separately and mixed loads shall not be dispatched for landfill disposal, unless agreed otherwise in writing with Engineer. Disposal of shredded/macerated vegetative waste arising from site clearance and excavation spoil shall be carried out in accordance with Clause 3306f of the specification. Waste oils and fuels shall be stored in liquid-tight drums on impervious bases as approved by the Engineer.

Concrete waste shall be broken into fragments whose maximum dimension is 350mm. Protruding reinforcement rods shall either be cut off flush with the concrete surface or shall be bent parallel with the surface so that they do not unduly protrude. Soil material contaminated with bitumen shall be considered equivalent to bituminous pavement material.

The Contractor shall give 24 hours prior notice to Engineer of his intention to dispose of diesel or oil contaminated soil or any other form of waste contaminated by petroleum products, and shall comply in all respects with Engineer requirements regarding their delivery to a landfill site.

In the event that the Contractor or any of his sub-contractors can be proven to have caused disposal of any form of waste in an unauthorised place, the Contractor shall be required to remove such wastes and make good the site, to the satisfaction of the Engineer, at his own expense.**"** (FIDIC Secretariat 1992).

Water Resource Use: Road rehabilitation and reconstruction in Southern Sudan uses reasonable quantities of water for various activities, including concrete works and most importantly for wet compaction of applied layers to the road surface. Finding adequate sources of water for these purposes can be a major challenge. The Contractor is enjoined from using existing water sources, both surface and groundwater, to the detriment of the existing community. Abstraction of water for road construction use from wetlands is to be avoided. In many places in Southern Sudan, it will be essential for the Contractor to construct their own boreholes to meet their needs. Even here, however, caution is required.

If borehole water is used in big quantities, a record will be kept of the ground water level in the surrounding of the borehole and sufficient care will be given to avoid any effect on other boreholes used by surrounding local communities. The water table level will be reported in the Contractor's Journal and continuation of pumping will be subject to the Engineer's approval. The Contractor is encouraged to ensure that the water

quality of the borehole be maintained over the life of his use of the facility, with appropriate measures to isolate it from run-off draining down into it. This will facilitate leaving the borehole operational for local community use after decommissioning of the road construction camp.

Removal of Mines and Unexploded Ordinance: Removal of mines and unexploded ordinance (UXO) is a prerequisite to safe road rehabilitation and reconstruction activities and subsequent operation of the road itself. However, demining operations typically disturb the soil over large areas, particularly when they are mechanized, for example, by use of machines like a "Minewolf". Measures need to be taken to ensure that sites so treated are not heavily eroded by rainfall on the loosened soil or that large quantities of sediments and silts are not transported by run-off into nearby watercourses. A variety of erosion control measures will be applied, similar to those recommended for the actual road construction to minimize soil transport on demined sites.

Discovery of Cultural or Historical Sites: Section 1232 of the existing Special Specifications on Discoveries raises this issue adequately, to wit: "The Contractor shall give immediate notice to the Engineer of any remains or artefacts of potential archaeological, historical or scientific interest discovered during the site clearance, excavations or any other construction activities. In the event of any such discovery, work shall be stopped immediately, and all necessary steps shall be taken to protect and secure the site and finds against further disturbance, either by the workforce or others…" (FIDIC Secretariat 1992).

The version in question, however, suggests that it is incumbent on the "Engineers" to give instructions to the Contractor on how to proceed within 24 hours of notification. This seems extraordinarily short given the difficulties of communication in Southern Sudan and the matter clearly deserves further attention.

Hunting, Fishing and other Use of Natural Resources: The Contractor is required to prohibit his workers from hunting, fishing, trapping, killing or other use of natural resources (with the exception of vermin) on the site or on adjacent lands. Fuelwood or charcoal as well as rustic construction wood required for fencing or general construction should preferably be harvested from dead trees or groundfalls.

General Site Restoration Requirements: Restoring the natural landscape as much as possible is a policy goal of the GOSS Ministry of Transport and Roads. Accordingly, the Contractor is expected to take every precaution to avoid excess site disturbance and for restoring the road construction site progressively as he proceeds along it. Special requirements include the following:

- Temporary stockpiles and spoil materials should not be deposited where they can wash into the water courses.
- Compacted surfaces such as within the boundaries of a road construction camp or on the periphery of a borrow pit should be deep ripped to ensure natural regeneration.
- Topsoil should be removed and stockpiled for subsequent rehabilitation, with care taken to avoid it being eroded or contaminated.
- The progress of natural regeneration on restored sites should be monitored and if necessary, revegetated through direct seeding of local species.

Avoidance of Dust: The laterite based murram currently in use in road rehabilitation and reconstruction in Southern Sudan requires the Contractor to take special actions to avoid dusty conditions, particularly in built-up areas which these roads traverse. A sealed coat approach to containing dust within the boundaries of urban areas is recommended along with speed bumps to slow traffic which also diminishes dust generation. During road construction, the Contractor should "apply water at regular intervals in high traffic and/or high population areas" and also consider some of the road treatment alternatives (enzymes) where they might be cost effective (Pinard 2006). Diverting a main road to avoid town or city centers should also be considered.