

The United Republic of Tanzania



The Lower Kihansi Environmental Management Project (LKEMP)

Consultancy to Conduct an Environmental Audit
of the Lower Kihansi Hydropower Facility

Environmental Audit Report – Final Version

November 2005

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List of Abbreviations

AgES	Agricultural Extension Service
AIDS	Acquired Immune Deficiency Syndrome
BOD	Biological Oxygen Demand
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMP	Catchment Management Plan
COD	Chemical Oxygen Demand
DG	Director General
DO	Dissolved Oxygen
DoE	Division of Environment (of the Vice Presidents Office)
EA	Environmental audit
EMA	Environmental Management Act
EAMCEF	Eastern Arc Mountains Conservation Endowment Fund
EMP	Environmental Management Plan
FBD	Forestry and Beekeeping Division (of Ministry of Natural Resources and Tourism)
HIV	Human Immunodeficiency Virus
IAP	Interested and Affected Parties
IDA	International Development Association
IREM	Immediate Rescue and Emergency Measures
JKT	Jeshi la Kujenga Taifa
KST	Kihansi Spray Toad (<i>Nectophrynoides asperginis</i>)
LKEMP	Lower Kihansi Environmental Management Project
LKHP	Lower Kihansi Hydropower Project
LWCP	Landscape Wide Conservation Plan for the Kihansi Upstream Catchment
masl	meters above sea level
MCH	Mother and Child Health
MSC	Multisectoral Steering Committee (LKEMP)
MTAC	Multidisciplinary Technical Advisory Committee
MUAJAKI	Participatory Public Health Project (acronym in Kiswahili)
MNRT	Ministry of Natural Resources and Tourism
MWLD	Ministry of Water and Livestock Development
NEMC	National Environmental Management Council
NORAD	Norwegian Agency for Development Cooperation
NPC	National Project Coordinator
NSSF	National Social Security Fund
PMU	Project Management Unit (LKEMP)
PRA	Participatory Rural Appraisal
RAMPO	Research and Monitoring Programme Officer
RAS	Regional Administrative Secretary
RBWB	Rufiji Basin Water Board
RBWO	Rufiji Basin Water Office
SEMAKI	Socio Economic Mitigation at Kihansi
SR	Safety Representative

STD	Sexually Transmitted Disease
TANESCO	Tanzania Electric Supply Company Limited
TASAF	Tanzania Social Action Fund
TAZARA	Tanzania-Zambia Railway
TAWIRI	Tanzania Wildlife Research Institute
TBA	Traditional Birth Attendant
Tsh	Tanzanian shilling
TPRI	Tanzania Pesticides Research Institute
VCT	Voluntary Counselling and Testing
VEO	Village Executive Officer
WCS	Wildlife Conservation Society
WD	Wildlife Division
WUG	Water User Group

Executive Summary

This report is the result of an environmental audit of the Lower Kihansi Hydropower Project (LKHP). The audit was conducted to assess whether the mitigation and monitoring measures identified under the Up-dated Environmental Management Plan (EMP) of the LKHP are achieving their intended objectives and to make future recommendations for the way forward. The EMP was formulated under the Lower Kihansi Environmental Management Project (LKEMP) in June 2004. The implementation period reviewed by this audit is therefore 14 months (June 2004 to September 2005).

The audit procedures followed are in line with the World Bank environmental audit guidelines and included standard steps of pre-audit, on-site audit and post audit guided by the audit protocol.

Audit criteria were derived from the EMP and agreed with the client during the pre-audit meeting. Since the EMP contains few quantifiable targets or indicators, the audit criteria are primarily a 'compliance check' verifying the extent to which the various monitoring and mitigation measures have been implemented to date. Physical field checks, however brief, allowed the audit team to comment on the efficiency of the various measures.

In addition, legislation and policies of key relevance were used for the assessment of compliance. These were in particular the 2004 Environmental Management Act, the 1974 Water Act, and the Tanzania Electric Supply Company Limited (TANESCO) 1995 Health and Safety Policy.

Based on the agreed audit criteria, checklists for the functional areas of the audit were developed to guide the collection of information and evidence by the various auditors. The findings from the functional areas provide the basis for this audit report.

An audit takes place during a short period of time and with limited resources. It is thus important to keep the inherent limitations in mind when using the audit results.

The principal findings of the audit are summarized below.

Gorge Ecosystem

- The sprinkler system is at the heart of the mitigation programme and thus is a most important aspect of the EMP. The fact that it is functioning, and that a team monitors and maintains the sprinkler system are indicative of the many positive aspects found. An Operations Manual has been formulated which guides the monitoring of the sprinkler system and related water quality monitoring in the Gorge. It follows the procedures of the EMP and the Gibb's 2004 monitoring protocol. There are some minor shortfalls, which need to be corrected.

- The construction of bridges, wooden stairways and stone walkways appears to have been effective from several points of view. These have improved the safety of all who visit the Gorge. The stone walkways in the spray wetlands appear to have reduced erosion on the paths. They also have made access in the wetlands much safer, and allow researchers and technicians to walk in the areas receiving spray without destroying the vegetation. The audit team noted some need for improvements to these structures.
- The impact of the sprinkler system on the ecosystem cannot be conclusively evaluated. The audit team found that on the upper and lower spray zone vegetation is regenerating, for example *Selaginella krausiana*. The current sprinkler zone covers a smaller area than the original spray zone and the unsprayed areas are transitioning into a dryer vegetation. The fact that no vegetation studies have been conducted since 2002 does not allow a systematic assessment of changes.
- The application by the Wildlife Division for the Water Right for the sprinkler abstraction has yet to be submitted. The present abstraction without a valid water right is not in compliance with the 1974 Tanzania Water Act.
- This audit was not meant to answer the question of survival of the Kihansi Spray Toad (KST). Nevertheless it should be noted that no KSTs were sighted during the on-site audit. However, others who have visited the Gorge in 2005 have seen one or two KSTs and the Gorge technicians heard toads calling.
- In context of the question of survival of the KST the prevalence and control of Chytrid fungi in the Gorge remains an important issue, which requires further attention. Further studies using a 'swabbing' technique on amphibians to monitor prevalence of Chytrids in the Gorge should be conducted.
- As long as safe reintroduction of the KST into the natural environment cannot be confirmed, the Captive Breeding Programme (CBP) must remain an important and on-going effort. Reports from the CBP should be analysed and made more widely accessible to interested parties. Verifying the feasibility of a national captive husbandry programme is an outstanding issue.
- The Kihansi scholarship programme by far extended the scope (qualitative and quantitative indicated in the EMP). In total two PhDs, ten Masters programme and 46 short-term training courses were supported. A shortfall of the MP is that it does not include any means of verifying whether or not this capacity building exercise is feeding into the knowledge base about the Kihansi Ecosystem and Biodiversity and Water Resources Management issues in Tanzania in general.
- While the focus was so far exclusively on high-level government and research institutions in Dar es Salaam, village communities and local government should be included as a target group into the scholarship programme.

Kihansi River Hydrology

- RBWO is fulfilling its role of monitoring the Water Right granted to TANESCO in June 2004 for abstracting water from Kihansi River for hydropower generation. This audit report contains several suggestions on how the RBWO monitoring functions could be further improved. These include ensuring that gauges and other equipment is working at all times, ideally through a resident technician based at the site.
- The bypass flow is a central issue of the EMP as it is of paramount importance to maintaining the ecosystem in the Gorge. The Water Right requires TANESCO to leave a bypass flow between 1.5 and 2.0 cubic meter per second. Based on RBWO reports and confirmed through an independent study commissioned by LKEMP, the current bypass flow at Kihansi indicate that 1.3 to 1.4 m³/s is being released depending on the reservoir level. This environmental flow does not comply with the specifications made in the Water Right.
- During the time of the environmental audit, this deficiency was in the process of being rectified by TANESCO. An international consulting firm (NORPLAN) has been contracted to carry out an independent check of the LKHP to establish the causes of the reduced bypass flow and other possible design features that may have contributed to the violation of the final Water Right conditions. The work had commenced and the final draft is expected for submission at the end of December 2005 or early January 2006.
- Monitoring of the dam by TANESCO needs improvement. Several dam monitoring tools, i.e. Piezometers, were not working. Furthermore, there is no standard procedure for monitoring of seismic events and stability of the dam. Reportedly TANESCO is in the final stages of engaging a Consultant of University of Dar es Salaam, Geological Department to investigate seismic events and come up with procedures of monitoring.
- Routine procedures for monitoring of sedimentation rate in the dam and release of sediments from the dam during flushing operation also need to be developed. According to TANESCO's comments on the draft audit report, LKEMP is responsible for the monitoring of sedimentation rate. Furthermore TANESCO commented that flushing operation is done mostly during high flow when there is spilling i.e. one of the big gates is always opened so some of sediments is taken out. The environmental auditors did not verify this on-site.
- A desk review of the report of TANESCO/LKEMP "*Support for data collection and hydrological modelling*" (date up to May 2004) revealed some inconsistencies, which have been clarified by TANESCO in the comments on the draft audit report but need to be avoided in future reports. In addition the comments provided by both RBWO and TANESCO on the draft have shown that the institutional responsibilities for the various gauging stations in the LKHP project area is very complex and not clear to all stakeholders involved.

Erosion, Fire Control and Waste Management

- The present appointment of the Civil Technician responsible for environmental mitigation measures at the LKHP works site needs to be reviewed. The present staff responsibilities are inadequate to address the most pertinent issues as well as more medium and long-term environmental mitigation as specified in the EMP. In particular with regard to waste disposal some commitment and immediate action of senior management is required.
- While existing erosion control and re-vegetation measures have been successful there is no evidence that standard procedures or a control system are in place. The digging up of buried scrap metal from the construction phase, observed during the on-site visit is counter-productive to previous re-vegetation efforts and presents a safety and health hazard. Management action to prevent such uncontrolled activities should be taken. We understand that LKEMP has raised this issue with TANESCO.
- The prevention and control of fires is currently not adequately addressed by TANESCO and needs attention. Although reportedly some fire-breaks have been created around the LKHP site and awareness campaigns on fire prevention conducted, frequent fire outbreaks reveal that these measures are not adequate. During the time of the on-site audit a fire was observed, which broke out from one of the fields cultivated by TANESCO staff and was subsequently brought under control by the villagers. On 17 and 18 October 2005 another fire burnt down large areas of woodland within the LKHP project area directly adjacent to the Gorge Ecosystem. Urgent action is required by TANESCO to implement a fire prevention and control plan. TANESCO should set a good example of management of its own land. This includes that cultivation of land by TANESCO staff on the fields directly adjacent to LKHP should be forbidden and stricter fire control measures should be implemented.
- The handling of solid waste at the LKHP works site lacks management and proper disposal procedures. The current practices pose health, safety and environmental risks and do not conform to the 2004 Environmental Management Act of Tanzania. In the comments provided on the draft Audit Report, TANESCO made the commitment that solid waste at the works site will be taken care of in 2006 and funds have already been set aside.

Occupational Health and Safety

- The occupational health and safety procedures at the Kihansi Hydropower plant are in substantive compliance with the January 1995 TANESCO Health and Safety Policy. Areas of deficiency are outlined in this report and need to be rectified. These include the tenure of the safety representative; the lack of a risk assessment programme; the lack of various measures required for emergency preparedness; the lack of availability of first aid and fire fighting equipment; as well as regular medical check-ups of staff and disease and accident reporting to the Ministry of Labour.

- As we were informed in their comments on the draft audit report, TANESCO is in the process of engaging a consultant to prepare the risk assessment of emergency preparedness plans not only for LKHP but for all of the company's activities, i.e. Hydropower plants, Thermal plants, Substations etc. Furthermore we were informed that a Red Cross team from Morogoro is scheduled to train LKHP staff during November 2005.
- Deficiencies noted pertaining to the overall safety management and control system are a lack of response from Headquarters to corrective actions suggested by the Kihansi safety representative; lack of clarity of institutional responsibilities with regard to occupational health issues; as well as lack of measures of pest control.
- Health and Safety issues that need attention in the Gorge refer to increased stability and safety of the suspension bridges; prevention of slipping on the wooden steps; improvement of the latrines in camps; as well as first aid and safety training. In addition some contractual issues were raised by the staff, which need to be reviewed by LKEMP.

Institutional Aspects

- The current monitoring and reporting practices are not fully in compliance with the arrangements foreseen in the EMP and may need to be reviewed. Some of the deficiencies might be an indication that the procedures outlined in the EMP were too complex in the first place and may hence need to be revised. Others refer to key elements of a monitoring system and would need to be rectified. These include for example the lack of an annual monitoring report summarizing all monitoring data collected in the Gorge Ecosystem and the implementation of a regular auditing cycle. Furthermore, the audit team notes that the EMP does not include any targets and indicators which makes monitoring difficult.
- Presently, there appear to be no institutional processes of data analysis and feedback into the system to ensure that mitigation and monitoring measures are adjusted according to the findings of studies and consultancy reports. This iterative process of implementation - monitoring – revision, is key to allow corrective action and lesson learning.
- Presently, the MSC and MTAC provide the coordinating bodies under the EMP. There are gaps with regard to full inclusion of all stakeholders of relevance to the LKHP and disclosure and dissemination of information. Concerns were raised in particular by Local Authorities and the RBWO.
- The long-term institutional responsibility and accountability for LKHP still needs to be clarified. Ultimate roles for mitigation and monitoring and the question of decommissioning need to be addressed. Presently, TANESCO is not building the financial reserves for decommissioning recommended under the EMP.

- The existence of a project to fund the monitoring and mitigation programme at Lower Kihansi seem to have flawed the need to make commitments by the responsible institutions. Such evidence was found in the Wildlife Division and TANESCO.

Socio-economic aspects

- There is poor continuance of activities initiated by the community programmes during the construction phase. District Governments bodies do not feel capacitated to assist here.
- Health issues are still an important area to be addressed, particularly HIV/AIDS and Malaria in both lowland and catchment villages. Similarly, community conservation and livelihoods activities initiated during the LKHP construction phase need further follow-up. While the LWCP and the LKEMP small grants scheme include such activities for catchment villages, lowland villages are not included.
- There are ill feelings amongst the communities as expectations have not been met due to falsely raised hopes during feasibility and construction. Furthermore, transparency on the issue of land conservation was lacking since the construction phase. The frequent fires breaking out from land cultivated by TANESCO staff seems to aggravate the situation. There is no platform for community concerns in the operational phase of LKHP, which is a shortfall that TANESCO needs to correct.
- The LWCP is meant to address the community related problems outlined in this report. The main objective of the LWCP is to ensure joint conservation of the resource base through full and committed involvement of the communities in upstream areas. Although the auditors agree that the LWCP has the potential to, at least partly, remedy some of the ill feelings of the communities, the restriction of the LWCP on upstream villages leaves a gap with regard to the downstream villages. Since these villages are also part of the wider LKHP landscape this gaps needs to be addressed.

Based on the comments received by the World Bank on the draft audit report, reminding the audit team that readers have the habit of going through the executive summary very carefully while browsing through the rest of the report, the executive summary was expanded by adding Table 1 overleaf. Table 1 is meant to provide the reader with a comprehensive overview of all audit findings and recommendations and easy follow-up by the implementing institutions. As such, the executive summary can now be a stand-alone document and the main report be referred to for detailed information.

Table 1 Detailed Overview of all Issues, Recommended Solution and Institutional Responsibility

No	Issue/problem	Recommended solution	Institutional responsibility
Kihansi Gorge Ecosystem			
1	Need to reduce sedimentation, lack of affordability and availability of mechanical filters	Introduction of a double tank system for all three spray wetlands	LKEMP
2	Large quantities of releases of water during the long rains	Fountain Jets: Measurement of pressure and installation of filters	LKEMP
3	Availability of spare parts	Mechanism to allow rapid purchase of spare parts	LKEMP
4	Flow metres as listed in the EMP are not installed	More frequent pressure checks on each sprinkler during the rainy season	LKEMP
5	The cleaning interval listed in the EMP (every 2-3 weeks) is not frequent enough	More frequent cleaning of sedimentation ponds, e.g. once per month	LKEMP
6	The current water abstraction for the sprinklers and fountain jets is illegal	Wildlife Division should abide with the Water Act of 1974 Section 15	Wildlife Division
7	The EMP notes that “for now sprinklers are to be maintained as is” (p.71). This raises the question on what would be a trigger for change	Introduce sprinkler precipitation measurement into the monitoring regime.	LKEMP
8	Suspension bridge, wooden steps and latrines are unsafe. First aid kit etc. is not available in the Gorge	Improve safety conditions of the Gorge maintenance	LKEMP
9	Potential environmental impacts from construction of research station	Conduct EIA for all planned research related infrastructure prior to the finalization of their design plans	LKEMP
10	Gorge technicians are not adequately trained	Further training of the Gorge Technicians on First Aid, water quality monitoring, and short courses on ecology and conservation	LKEMP
11	Availability of /Access to data and information	Reports of studies and consultancies should be routinely shared with the RAMPO office	LKEMP
12	The under-empowered status of the RAMPO is delaying progress	Give RAMPO more flexibility to take decisions relating to day to day management of activities in the Gorge, e.g. control over sufficient funds to purchase spare parts	LKEMP
13	The water quality meter is not working	The water quality meter should be repaired to facilitate measurement of turbidity	LKEMP
14	At the time of the on-site audit , four data loggers were not working	Repair and replace RBWO and LKEMP data loggers	LKEMP & RBWO
15	A study (Weldon Che: 2005) revealed that the Chytrid fungus is still present in the Gorge	Conduct Chytrid studies using ‘swabbing’ technique on amphibians to investigate prevalence of Chytrids in the Gorge	LKEMP
16	There is no control at the entrance to the Gorge as to whether the bleach foot baths are being used consistently	Improve enforcement of bleach foot bathing procedures	LKEMP
17	Equipment is being stolen by intruders to the Gorge	Take preventive measures to address theft of equipment	TANESCO & LKEMP
18	The information gathered through the Captive Breeding Programme and during the past 10 years	Ensure wider and timely sharing of information gained from Captive Breeding programme	LKEMP

No	Issue/problem	Recommended solution	Institutional responsibility
	in the Gorge has not yet been made accessible for the interested parties	Establish database and website to ensure accessibility of information to all parties	LKEMP
19	The Kihansi Scholarship Programme only focus on high level institutions	Extension of scholarship programme to include funding and activities for conservation education at primary and secondary schools in LKHP adjacent communities	LKEMP
Vegetation			
20	It was not possible to conclude how the current flow has impacted the vegetation	Further study is required to monitor if there are changes in vegetation characteristics with the current flow regime	LKEMP
21	The RAMPO is conducting vegetation monitoring without technical (botanical) support	The RAMPO should either be trained further particularly on aspect of plant identification and/or be provided with external (botanical) support	LKEMP
22	It is not possible to monitor the changes in the distribution of epiphylls without a baseline and scientific protocol	Establishment of the baseline and scientific protocol on epiphylls monitoring	LKEMP
Kihansi River Hydrology			
23	The bypass flow is lower than required in the Water Right	In addition to measures already undertaken through the NORPLAN consultancy, explore possibilities of using rectangular open channel to countercheck flow from the bypass pipe. This could be an additional way of monitoring the bypass flow.	RBWO
24	Monitoring of water flows is conducted irregularly	RBWO should download data from the loggers on monthly basis for effective monitoring of water flows in the Kihansi river	RBWO
25	Data loggers are down loaded on a irregular basis	RBWO need to improve reading and collection of data from the river gauge station by providing transport to the responsible staff	RBWO
26	The audit team hydrologist could not confirm that the staff gauges were used to calibrate the data loggers	Staff gauges installed at river stations need to be used to calibrate the data loggers	RBWO & TANESCO
27	The Gorge Technicians have not been trained in monitoring of water quality	Specific training is required for the RAMPO to carry water quality monitoring	LKEMP
28	The river water are not tested on a regular basis against sediments, BOD, COD, biological or organic substances	Make provision for periodic testing of the river water against sediments, BOD, COD, bio-monitoring, e.g. levels of phytoplankton, and monitoring of organic substances used as pesticides or fertilisers.	LKEMP
29		Field testing of water quality need to follow closely the Tanzanian Water Utilization Regulation. This will include monitoring of organic pollution introduced artificially and organic pollution of natural origin	LKEMP
30	No standard procedures for monitoring of seismic events and sedimentation rate in the dam	As proposed in the EMP it is important to have standard procedure for monitoring seismic events and structural stability of the dam, standard procedures for monitoring sedimentation rate in the dam and release of sediments from dam during	TANESCO

No	Issue/problem	Recommended solution	Institutional responsibility
		flushing operations	
31	Non working dam monitoring tools, e.g. piezometers, stream discharge V notch	Repair dam monitoring tools presently not functioning	TANESCO
32	Inconsistencies in report on hydrological modeling	Correct inconsistencies in the reporting on the total number of gauging stations	TANESCO
33	Several of the gauging stations are not labelled and the responsibilities/ownership is unclear.	A more consistent presentation responsibilities/ownership of the various gauging stations would be desirable	TANESCO
34	Part of the monitoring equipment is not working due to lack of spare parts, which are expensive and unavailable	Verify to what extent foreign technology can be replaced by simple, locally available technology so that parts and spare parts for various equipment can be obtained at more reasonable prices	TANESCO
35	Recruitment of resident technicians is outstanding; running hydrological model/system out of Dar es Salaam is less efficient and more costly in the long-run	Consider, a change in management structures, favouring those closer to the operations as it may yield efficiency gains. Including recruitment of resident technician	TANESCO
36	The auditors received inconsistent information from the various parties interviewed regarding the exchange of data between TANESCO and RBWO.	Clarify (or delete if not applicable) the requirement in the EMP that TANESCO and RBWO should exchange hydrological and hydraulic data on the Kihansi river on real time basis	MTAC
Erosion, Fire Control, and Solid Waste			
37	The monitoring of erosion and re-vegetation of excavated land is not standardized	There should be standard procedures for monitoring erosion and re-vegetation of the excavated land	TANESCO
38	Frequent outbreaks of fires	There is an urgent need to stringent prevention and control of fires; in this context the practices of cultivation of land surrounding LKHP area by TANESCO staff may also be reviewed	TANESCO
39	Environmental mitigation measures are not satisfactorily implemented	There is need to have a head engineer responsible for environmental mitigation measures at the LKHP work site	TANESCO
40	There are no standard procedures for solid waste management neither at the work site nor in the Gorge	There is a need to establish solid waste standard monitoring procedures, which will assist to improve solid waste management at the work site.	TANESCO
41		Waste disposal should be treated as a long-term issue and it is reasonable to expect that at least non-burnable, non-biodegradable waste be carried outside the Gorge. Certainly, all plastic waste should be carried out. This policy needs to be made clear to staff and visitors. Tins could be washed, collected, and another porter hired to carry down such a load	TANESCO
42	Scrap metal was being dug out from re-vegetated areas by a contractor during the on-site audit without permission of the LKHP Site Manager	Digging for scrap metal should stop as it destroys re-vegetation efforts and poses a health hazard. Clearance from TANESCO site management should be sought prior to sending contractors from Dar es Salaam.	TANESCO
43	Liquid waste from the camp dispensary and clinic is not being tested for appropriate treatment be-	Liquid waste from the camp dispensary and clinic need to be tested before entering to the domestic	TANESCO

No	Issue/problem	Recommended solution	Institutional responsibility
	fore entering to the domestic water treatment system	water treatment system	
Occupational Health & Safety			
44	Despite generally good compliance, there are several omissions, which need to be corrected in order for TANESCO to be fully in compliance with its own Health and Safety Policy.	Any areas of non compliance with the company policy described in Chapter 7 should be rectified	TANESCO
45	There is a Safety Representative but responsibilities for Health issues are not clearly assigned – both within the company Policy and at LKHP site.	Institutional responsibility for Health issues needs clarification within the company policy and at LKHP.	TANESCO
46	Reports from TANESCO LKHP Site Manager remain without follow-up from Headquarters in Dar es Salaam.	Reports from Field Office need swift follow-up action from Headquarters, or otherwise decision making responsibility decentralized in order not to delay important security measures	TANESCO
47	Presently, the suspension bridge is unsafe	The suspension bridge at the bottom of the Gorge needs to be strengthened and made more stable	LKEMP
48	The Latrines are inadequate facilities as they are unclean and can spread diseases	The Latrines need to have a basic roof and a “squatting plate” to be stable	LKEMP
49		The hole of the pit latrine needs to be kept covered	LKEMP
50	There is no first aid kit present in the Gorge, nor have the Gorge staff been trained in basic first aid	A first aid kit needs to be kept in the Gorge, as does a stretcher, thus facilitating evacuation. Staff needs to be given basic training in first aid	LKEMP
51	Gorge technicians and RAMPO are frequently exposed to numerous of tick bites and are not aware of the symptoms of Rickettsia	The RAMPO and Gorge technicians be made aware of the symptoms of Rickettsia and medical personnel associated with the project also receive this information, and on treatment	LKEMP
Institutional Aspects			
52	Lack of institutional process of data analysis and feedback into the system to ensure mitigation and monitoring measures are adjusted according to studies and consultancy reports.	The EMP should be adjusted to include monitoring system with quantifiable targets, verifiable indicators, clear reporting responsibilities and an annual review process	MTAC & NEMC
53	An annual monitoring report summarizing all monitoring data collected in the Gorge Ecosystem is not being prepared, neither by NEMC nor Wildlife Division	NEMC/LKEMP should prepare an annual monitoring report summarizing all monitoring data collected in the Gorge Ecosystem and disseminate widely, including to the public in LKHP locality (this requires a public version in Kiswahili for non scientists)	NEMC, Wildlife Division & LKEMP
54	Coordination and communication between the government agencies and the local stakeholders is inadequate	A review of the institutional set up of the LKEMP with a view of full inclusion of all relevant stakeholders and more complete and timely sharing of information	MTAC
55	Specialised reports have not been translated into Kiswahili and shared with the public	Public disclosure of environmental monitoring results and studies undertaken by LKEMP. The public includes not only the national and international research community but also village communities around Kihansi and elsewhere in Tanzania	LKEMP

No	Issue/problem	Recommended solution	Institutional responsibility
56	The long-term institutional responsibilities of LKHP, including the Gorge Ecosystem, are unclear	Long-term institutional responsibilities for the Kihansi area to be clarified	All stakeholders
57	TANESCO has not yet received the Land Title for the project area at Kihansi	The process of granting the land title to be finalized	TANESCO, Wildlife Division & Ministry of Lands
58	To date, TANESCO has not set aside any funds for decommissioning	TANESCO, involving other stakeholders, is encouraged to carefully plan and set aside funds for decommissioning incorporating lessons learned and best-practise from other projects	TANESCO
Socio-economic Aspects			
59	The LWCP merely focuses on the villages in the catchment areas	In addition to the LWCP, a conservation plan that focuses on the lowland communities would mitigate environmental degradation in the lowland	LKEMP
60	The local communities feel that they do not have a platform of discussion with LKHP	Employment of community liaison officer to deal with community concerns related to LKHP	TANESCO

Part 1 – Introduction and Audit Procedures

1 Introduction

1.1 Background

An environmental audit of the Lower Kihansi Hydropower Facility was conducted by COWI Tanzania during the period of 13 June (contract signing) until 29 October 2005 (submission of final report) with a total input of 78 person days. The COWI audit team comprised of the following team members: Ms. Kerstin Pfliegner, Lead Auditor; Ms. Flora Ismail, Local Liaison Officer; Prof. Kim Howell, Ecosystems Analyst; Mr. George Sangu, Plant Ecologist and Sociologist; Dr. Charles Msuya, Animal Ecologist; and Mr. Exhaudi Fatael, Hydrologist. Ms. Maj Forum, on internship at COWI Tanzania, provided additional support to the team.

A copy of the Terms of References (TOR) is included in Appendix 1. A full list of people interviewed during the audit is in Appendix 2.

As defined in the World Bank Sourcebook, an Environmental Audit is a “*methodical examination of environmental information about an organization, a facility, or a site, to verify whether, or to what extent, they conform to specified audit criteria.*” (The World Bank, 1995: 1). Audit criteria can be based on local, national and international laws and regulations, permits, or guidelines of organisations (The World Bank, 1995).

1.2 Objective

In the case of this environmental audit, the main objective was to assess implementation of the mitigation and monitoring measures specified in the updated Environmental Management Plan of June 30, 2004 (hereafter referred to as “EMP”). These requirements served as audit criteria. Additional audit criteria applied are listed in Section 2.2. below. The TOR, defined the overall objective of the audit as to:

“...assist LKEMP/Government to verify whether the environmental mitigation and monitoring measures recommended under the EMP are achieving their intended objectives of maintaining a sustainable eco-system in the Kihansi Gorge and its environs and recommend the best way forward”.

1.3 The Environmental Management Plan

LKHP is a World Bank Category A project. Hence a full EMP is required to define mitigation, monitoring and institutional measures to address adverse social and environmental impacts associated with the development.

Mitigation and monitoring measures of the EMO relate to four geographical areas or systems within the LKHP:

- The Kihansi Catchment
- The Kihansi Gorge Ecosystem
- The LKHP Works Site and
- The Kihansi River.

A bi-annual audit is a monitoring requirement defined within the EMP. Therefore two would have been expected in the year 2004, however this audit is the first one conducted under the EMP.

1.4 Structure of the Audit Report

The remaining Sections of Part 1 of the report describe the audit procedures. Part 2 of the Report will present the audit findings. Socio-economic aspects in the context of LKHP are described in Part 3, and finally recommendations and conclusions in Part 4 of the Report.

Part 1 will first present the scope and purpose of the audit (Section 2.1), then the audit process followed (Section 2.2) and finally the criteria applied (Section 2.3).

The audit findings presented in Part 2 of this report are structured according to the functional areas that formed the scope of this audit. Table 2 below shows how they relate to the four areas of the EMP.

Table 2 Audit Functional Areas and EMP Systems/Areas

Functional Area of Audit	Chapter in audit report	EMP System Area
Gorge Ecosystem Analysis, incl. sprinklers, infrastructure, amphibians,	3	Kihansi Gorge Ecosystem
Vegetation	4	Kihansi Gorge Ecosystem
Hydrology	5	Kihansi River
Control of erosion and wildfires, waste management	6	LKHP Works site
Health and Safety	8	Not covered in the EMP
Institutional Aspects	9	Chapter 7 EMP

The review of socio-economic aspects in Part 3 of the report is aligned with the structure of the Landscape Wide Conservation Plan (LWCP) for the Kihansi Upstream Catchment.

Recommendations for follow-up and rectification are presented throughout each Chapter of the report and have been summarised in Part 4.

2 Audit Procedures

2.1 Purpose and Scope of the Environmental Audit

Based on the TOR and the discussions with the Client, the Consultant understands that the purpose of the Environmental Audit of the LKHP is to provide a 'snapshot' of the environmental situation at the project site by

- a) assessing the implementation of the EMP against its own stated requirements; and
- b) making recommendations for corrective action, where needed.

The scope of the EA included all mitigation and monitoring measures identified under the EMP. In addition, the TOR required the audit team to conduct a health and safety audit, which was to cover TANESCO operations at the Hydropower facility, as well as LKEMP operations within the Gorge.

The audit team was also requested to review any on-going mitigation measures that started under the IREM project. The IREM project was put in place as an environmental emergency project under TANESCO to cover a bridging period (2001) during which a broader, long-term plan would be developed; which is the EMP. The most immediate and obvious adverse environmental effect of the abstraction of water by the LKHP for power production was the drying out of at least 80% of the spray wetland habitat required by the Critically Endangered Kihansi Spray Toad (KST). As such, the IREM components have formed the basis for many aspects of continuing the management and conservation of the Kihansi Gorge Ecosystem under the EMP.

As agreed with the client during the contract negotiation meeting, consultations with representatives of selected communities were to be included in the scope of the audit to get a comprehensive view of the environmental situation at and around the site, in particular because local health and safety hazards were identified as potential impacts of the project. However, since social and health related mitigation and monitoring measures are not included in the EMP no audit criteria could be derived from the EMP. Therefore, it was hence agreed with the Client that the main purpose of the social audit was to get a general overview on how villagers are affected by the hydropower project and to provide a 'crude' assessment as regards to the sustainability of activities funded under the community based programme of the LKHP construction phase; namely Partici-

patory Public Health Project (MUAJAKI), Socio Economic Mitigation at Kihansi (SEMA-ki) and the Catchment Management Plan (CMP). The social component of the audit is not to be confused with an evaluation of these programmes.

As per TOR and agreed with the client in the Pre-audit (Inception) meeting, the scope of the environmental audit is therefore as described in Table 3 below:

Table 3 Scope of the Environmental Audit

Area	Detail
Organisational	<ul style="list-style-type: none"> • Within the scope of the EMP • LKEMP/TAWIRI, Kihansi and Dar es Salaam • TANESCO, Kihansi and Dar es Salaam • RBWO, Iringa • One selected Local Authority; i.e. Mufindi District • Wildlife Division, Dar es Salaam • NEMC, Dar es Salaam
Time	<ul style="list-style-type: none"> • 14 months implementation period of EMP June 2004 to September 2005 • In addition any on-going mitigation measures that started under IREM: <ul style="list-style-type: none"> ▪ Sprinkler ▪ Access infrastructure, walkways etc. ▪ Captive breeding <p>To be evaluated for their entire duration.</p>
Functional	<ul style="list-style-type: none"> • Vegetation • Vertebrates, amphibians • Hydrological (by-pass flow, sprinkler system, implementation of Water Right by TANESCO) • Socio-economic and public health • Occupational Health and Safety • Institutional (Operational set up of EMP; site management; re-search programme, Kihansi Scholarship)
Compliance Hierarchy	<ul style="list-style-type: none"> • Compliance with EMP requirements • National Laws and Regulations • Standards • Policies • Guidelines and Procedures • International Conventions (Biodiversity Convention, CITES)
Locational	<ul style="list-style-type: none"> • TOR: <ul style="list-style-type: none"> ▪ Kihansi Gorge ▪ "Its environs": Area west of the Kihansi River owned by village government and Area east of the Kihansi River within Njerere Forest Reserve • Contract Negotiation: <ul style="list-style-type: none"> ▪ Upper Catchment Area: Social and public health issues in 2 villages (Uhafiwa and Ukami) ▪ Lower downstream Area Social and public health issues in 3 villages (Mlimba, Kalengakelu, Udagaji)

Area	Detail
	<ul style="list-style-type: none"> • EMP Focal area: <ul style="list-style-type: none"> ▪ LKHP works site (with regard to revegetation, waste management, Health and Safety) ▪ Kihansi Gorge (with regard to LKEMP activities) ▪ Kihansi River (upstream Uhafiwa village, downstream Tailrace focus on Hydrology and Water Quality)

2.2 Audit Process

The environmental audit was conducted according to systematic procedures and focused on verifying if the mitigation and monitoring measures specified in the EMP conform to the planned arrangements. The assessment relied on professional judgement of the auditors, their objectivity, and physical verification of the findings.

The environmental audit used primarily existing information and reports produced under LKEMP, interviews with staff, and personal observation at the site. Spot checks in the form of samples were included with regard to the water quality monitoring system and the sprinkler system to verify that equipment is operational and in compliance with requirements of the EMP and to triangulate information obtained through interviews.

Actual measurements, counts and physical tests, for example for water quality, turbidity, sedimentation, toad or vegetation counts were not conducted during the on-site audit. These would by far extent the time frame of an audit. The focus was rather to verify whether the tests and studies had been done according to the plans and management action taken with regard to the obtained results.

The process of the audit followed insofar as possible standard auditing procedures adjusted to the specific requirements of this particular audit and the client's needs.

The process was divided into three phases: pre-audit, on-site audit, and post-audit. An overview of the process followed is provided in Table 4 below.

Table 4 Audit Process

Phase	Activity
1. Pre-audit	Mobilize team and assign auditors
	Review of existing documents
	Formulate audit criteria
	Design checklists
	Prepare audit protocol (Inception report)
	Pre-audit (inception) meeting with the client
2. On-site audit	Site visit and consultation with relevant site personnel
	Conduct checklist audits in agreed functional areas
	Hold daily team meetings

Phase	Activity
	De-briefing of the site representatives of LKEMP and TANESCO
	Follow-up Meetings with EMP implementing agents based on Dar es Salaam, i.e. LKEMP; TANESCO; NEMC and Iringa Region, i.e. RBWO; Mufindi District Council.
	Short progress report to the client and data analysis
3. Post-audit	Team meetings to discuss audit findings and recommendations
	Data analysis and report writing
	Final report after comments from Client

2.2.1 Pre-audit

During the pre-audit phase, two consultants were assigned for the various functional areas of the audit. Appendix 3 contains the names of professional auditors and their area of responsibility for this audit. Each auditor was provided with a list of relevant documents for his/her respective technical area to review. A small temporary library was established for this purpose in the Consultant's office, which ensured that all team members had access to the documents and a working space. A full list of documents reviewed and references used is in Appendix 12 of this report.

After the review of documents, audit criteria were formulated and checklists designed and discussed in team meetings to ensure cross-reference between the various technical areas. A full set of checklists is provided in Appendix 4. The checklists provided for a systematic assessment during the on-site audit but did not restrict the auditors from exploring aspects not covered in the checklist.

The audit protocol was prepared to guide the audit process. It included the list of documents and compulsory reading for each auditor, a time schedule and a work plan. A copy of the audit protocol is included in the Inception Report.

A pre-audit (inception) meeting with the client was held on 5 September 2005 to clarify the objectives and scope of the audit, agree on the audit criteria and procedures and to finalize staffing and logistical arrangements. Minutes of the meeting were included in the Inception Report.

2.2.2 On-site audit

The on-site audit was over an elapsed period of six days (including travel) during which the team visited Kihansi. The itinerary and the plan for field operations showing division of labour and timing is provided in Appendix 5.

The on-site audit at Kihansi started with an opening meeting with the Acting TANESCO Plant Manager and the LKEMP Research and Programme Monitoring Officer (RAMPO). During the meeting the audit team was introduced, objectives, scope and criteria of the audit described and a work schedule based on the preliminary field plan agreed upon. The RAMPO acted as the main contact person during the on-site audit.

The meeting was followed by a tour of the site and areas subject to the audit to familiarize the audit team with the location and activities. Care was taken by the audit team to disrupt routine activities as little as possible and provide for a relaxed atmosphere during the interviews.

Audit findings were discussed amongst the audit team on a daily basis and the strategy for the next day planned. The team remained in constant touch by cell phone during the on site audit.

The on-site audit closed with a de-briefing meeting with the same people as the opening meeting. Results were presented in the form of main findings, split into good practice and non-conformities, as well as intended recommendations for corrective action to be included in the audit report. The closing meeting provided feedback on the results and some immediate management commitment for the corrective actions suggested by the audit team to the TANESCO plant manager and the RAMPO.

2.2.3 Post-audit

As part of the audit but subsequent to the on-site audit in Kihansi, additional meetings were conducted with TANESCO and LKEMP Headoffices in Dar es Salaam as well as the National Environmental Management Council (NEMC). Visits to the Rufiji Basin Water Office (RBWO) in Iringa and Mufindi District Council were also undertaken. The purpose of these visits was to complete the respective sections in the checklists that referred to those institutions and to close information gaps that emerged during the on-site audit.

A progress report (COWI, 27. September 2005) and the final audit report were prepared during the post audit phase.

2.3 Audit Criteria

The audit team collected information and documented evidence based on agreed audit criteria. The main criteria are compliance with the mitigation and monitoring measures listed in the EMP. This audit was conducted to assess whether and to what extent the various measures have been implemented successfully. The measures are listed in Table 5 below.

Table 5 Areas of Mitigation and Monitoring in the EMP

Area of Mitigation & Monitoring	Pages in EMP	Aspect to be assessed
Catchment	57 onwards and 76 onwards	<ul style="list-style-type: none"> • Human Health • Natural Resources Management • Water Resources Management and Abstraction • Awareness and Enforcement • Employment and Local Communities
Kihansi River	61 and 78	<ul style="list-style-type: none"> • TANESCO Water Right • Its monitoring and related reporting

Gorge Ecosystem	64 onwards and 80 onwards	<ul style="list-style-type: none"> • Sprinkler Systems • Fountain Jets and Alternatives • Maintenance Infrastructure • Ex Situ Captive Breeding Programme • Kihansi Scholarship
LKHP Works Site	72 onwards and 88 onwards	<ul style="list-style-type: none"> • Environmental mitigation measures • Fire prevention • Revegetation and prevention of land slides • Prevention of siltation of the dam • Curbing grazing on steep slopes • Social mitigation measures • Malaria prevention • General health programs • Sports events • Provision of Mlimba water supply • Solid waste management programme • Community relations programme
Environmental Impacts of Mitigation Measures	72 onwards	<ul style="list-style-type: none"> • Reduced wilderness • Visual impact of artificial sprinklers • Erosion by fountain jets • Accidental disease introduction • Studies on alternative water sources to substitute bypass flow
Monitoring of various habitats	81 onwards	<ul style="list-style-type: none"> • Spray wetlands • Forests • Spray Toad • Temperature & Humidity monitoring
Monitoring of water quality in the Gorge	86 onwards	<ul style="list-style-type: none"> • Monitoring system in place to assess changes and enable rapid response • Provide information to identify cause and source of threats • Sediments; turbidity; BOD; COD; organic and inorganic substances to be measured by LKEMP field staff

For each of the measures listed in the EMP the audit team assessed the

- Status and progress of implementation;
- Results and efficiency of the measures;
- Institutional communication and follow-up actions; and
- Existence of physical evidence.

Additional audit criteria were compliance with the following policies, laws and conventions:

- The 1995 TANESCO Health and Safety Policy;

- The 1974 Water Act;
- The 2002 Tanzania Water Policy;
- The 1998 Forest Policy and the 2002 Forest Act
- The 1998 Wildlife Policy and the 1974 Wildlife Conservation Act
- The 2004 Environmental Management Act;
- The International Convention of Biodiversity; and
- CITES.

The audit findings are presented in the following chapters in Part 2.

Part 2 – Audit Findings

3 Kihansi Gorge Ecosystem

This Chapter provides a detailed overview of the assessment of performance against the mitigation and monitoring measures outlined in the EMP for the Kihansi Gorge Ecosystem from page 64 onwards and page 80 onwards respectively. The assessment was conducted against the relevant checklists in Appendix 4 to verify the implementation progress; highlights strengths and weaknesses and identifies ‘gaps’ or areas of ‘non-compliance’. Areas of ‘non-compliance’ have been defined as activities that deviate from the planned activities in the EMP or areas that have not been implemented. In addition the audit team was asked to review the implementation of recommendations made under IREM. A table comparing the main IREM recommendations and audit findings regarding their implementation is included in Appendix 6.

3.1 Artificial Spray System

The artificial spray system consists of sprinklers in the upper, lower and mid wetlands as well as fountain jets in the upper wetlands. IREM studies recommended ensuring that the artificial spray systems are fully operational and that a minimum bypass flow of at least 1.5 m³ is continuously operated to maintain the spray wetlands ecosystem. The sprinkler system is a core element of the EMP and as such particular attention should be paid to it to ensure that it functions well at all times. This has been achieved by the maintenance system that has been established. It is described below.

3.1.1 Maintenance

Seven technicians are employed by LKEMP to maintain the artificial spray system in the Gorge. NORPLAN staff trained these technicians when the system was installed. The technicians work under direct supervision of a Head Technician and overall guidance of the Research and Monitoring Programme Officer (RAMPO). The RAMPO, a Tanzania Wildlife Research Institute (TAWIRI) employee, is permanently based at Kihansi to manage and coordinate the Gorge mitigation and monitoring program.

Overall, we found that the routine maintenance practices carried out by the Gorge technicians are in compliance with the measures described in the EMP and the TANESCO “*Instructions for the Maintenance of the artificial spray system in the Kihansi Gorge*” developed by NORPLAN in 2002, referred to by the technicians as ‘*the manual*’.

The manual includes a standard maintenance form, which is filled regularly by the technicians and forwarded to the RAMPO. This routine check includes the sprinklers in the mid-gorge, lower and upper wetlands; the filters; elevated basin; the intakes and the fountain jets.

Daily patrols are conducted to ensure that the sprinkler system is operating and also to check for intruders in the Gorge. Daily reports with all details (for example replacement of sprinklers, any intruders etc.) are made in a logbook with waterproof paper, referred to as '*the logbook*'. In case of any problems, the Gorge attendants fix the problem immediately themselves, or if they are unable to do so, they report the problem to the RAMPO for follow-up.

In addition, a systematic survey of the whole area is undertaken three times per week during which the maintenance form for the artificial sprinkler system is filled. The routine maintenance activities carried out are listed in Box 1 below.

Box 1 Routine Maintenance Activities

Routine Maintenance carried out on the Artificial Sprinklers

- Cleaning of nozzles after inspection;
- Checking of pressure and nozzle erosion;
- Replacement of nozzles;
- Pressure check on each sprinkler line with a pressure gauge at least three times per week;
- Cleaning of sedimentation ponds with tools and shovels, frequency depends on visual inspection;
- Cleaning of filters in sedimentation ponds; and
- Pipes from ponds to sprinklers systems checked for damage etc. during daily patrols and problems repaired through routine maintenance.

The two fountain jets were installed in December 2001. Due to erosion problems they are currently aimed at the river channel instead of the Upper Spray Wetland where they caused erosion and removal of vegetation. Maintenance (unclogging) of the Fountain Jets is carried out as part of the overall Gorge maintenance system.

Based on our interviews with LKEMP site staff and physical verification through records as well as site visit, the sprinkler system and fountain jets were working properly during the time of the audit. The assessment of the artificial spray system by the audit team is presented in Table 6 below.

Table 6 Assessment of the Artificial Spray System

Spray Zone	Findings
Mid Gorge spray wetlands	<ul style="list-style-type: none"> • Working properly • Flow 1.3 l/s – max pressure in pipes 6.2 bars • Cleaning is done when pressure drops below 4.5 bars • Almost all 42 nozzles are replaced in 3 months, especially in rainy season. • Source of water is Handaki stream
Lower spray wet-land	<ul style="list-style-type: none"> • Working properly • Flow 2.5 l/s and max pressure 7.2 bars • Cleaning is done when pressure in the upper spray wetland is between 3.4 and 3.6 bars • Replacement of between 1 to 3 out of 84 nozzles in 3 months • Source of water is Kihansi river (by-pass flow) and Jabali stream
Upper spray wet-land	<ul style="list-style-type: none"> • Working properly • Flow is 6.4 l/s and max pressure 4.2 bars • Cleaning is done when pressure drop is between 3.4 and 3.6 bars • Replacement of up to 10 out of 250 nozzles in 3 months • Source of water is Kihansi river (by pass flow) and Jabali stream
Jets	<ul style="list-style-type: none"> • Small jet gets water from 2 HDPE pipes 3 inch • Big jet gets water from 4 HDPE pipe 3 inch • Source of water is Kihansi river (by-pass flow)

The different quantity of nozzles that need replacement in the different spray zones is related to amount of sediment in water; the more sediment, the higher the frequency of replacing the nozzles due to fast wear out of the plastic nozzles. The rate of replacement is the highest in the mid Gorge because the water from Handaki stream is only filtered through a mechanical filter. These filters are expensive but not very effective. The Upper Spray zone gets water from Jabali intake and goes through a sedimentation tank first. Here the rate of nozzle replacement is lower than mid Gorge. The same water is going to another elevated basin, which acts like a second sedimentation tank before going into the lower spray zone sprinklers. This double tank system seems most effective in reducing the rate of nozzle replacement to only 1-3. The result is better water quality and better flow of water out of the sprinklers.

The audit team recommends the following issues for follow-up and/or rectification:

- Introduction of a double tank system for all three spray wetlands may reduce the need for mechanical filters. The cost of one mechanical filter is about Tshs 3 mill. and replacement is difficult as they need to be imported. For the same amount a good sedimentation tank could be built.
- Fountain jets: The pressure is not measured and they have no filters. This is acceptable under normal circumstances but can become a problem during

the long rains and if there is a big release of water from the dam. Hence, measurement of pressure and installation of filters would be advisable.

- Supply of spare parts: The technicians noted that there is delay to get spare parts, sometimes even to obtain a simple item like a cock (tap), electric drills etc. Therefore, the procurement procedures should be improved to allow the RAMPO to hold a cash fund (imprest) to cover such expenses, or manage a checking account for such contingencies.
- Flow metres as listed in the EMP were never installed. However, the pressure checks are used as an indirect method of assessing flow. These pressure checks on each sprinkler are a useful measure, as a drop in pressure indicates a nozzle or other blockage. This activity may be done more often during the rainy season.
- The EMP indicates that the cleaning of sedimentation ponds should be done every 2-3 weeks. Based on our physical inspection, this should be done more frequently, e.g. once per week.

3.1.2 Further Studies

The EMP mentions that two further sprinkler studies are to be undertaken: A study on tandem sprinklers as back-up and a study to reduce vulnerability to the piping system. The EMP foresees further trials by varying the size of fountain jets, change of angles etc.

We were informed that NORPLAN was awarded a contract to undertake these studies. The TOR of the assignment include also a mini catchment study to review the hydrology of new sources of water, options for backing up the existing sprinkler system, upgrading and maintaining the existing one and ecological considerations related to the proposed options.

The planned study on alternatives to the fountain jets is also part of the NORPLAN sprinkler study mentioned above.

The EMP further mentions that ‘...expansions [of fountain jets] offers perhaps the best opportunity for provision of some mitigation in adjacent wetlands’. So far no expansions have been planned. Based on information by the LKEMP office in Dar es Salaam, expansion of the mitigation activities in adjacent wetlands is part of the same NORPLAN consultancy.

A complex issue directly related to the possible extension of the sprinkler system is the question about the source of water. Although the bypass flow from Kihansi River, combined with the flow from Jabali and Handaki streams, are presently sufficient to operate the sprinklers, a future expansion of the system would need to take into account how it would affect the bypass flow or flow from other, additional sources. This issue has equally been raised in the NORPLAN Sprinkler back-up study.

The Consultant team has the following recommendation with regard to the Gorge infrastructure:

- Should the Gorge infrastructure be extended in the future based on the results of the studies on the sprinklers and fountain jet regime, there is a need to be budgeted for this possibility. The question of the water sources of the extension will need to be investigated with care. The current by-pass flow should not be reduced further.

3.1.3 Sprinkler Flow, Water Source and Water Right

The EMP mentions the bypass flow, and small tributaries to Kihansi without further specification, as the source of water for the Artificial Sprinkler System.

As specified in the NORPLAN Drawing No. 100-01 and confirmed during the on-site audit, these tributaries are Jabali stream for the Jabali intake feeding into the upper and lower spray zone, and Handaki Stream for the mid Gorge wetland.

We were unable to confirm the exact abstraction of water for the spray system and the sprinkler flow in terms of output. The EMP mentions “...*about 10 litres/second*”. We were also unable to establish if there is an even distribution of precipitation across the spray zone. It seems that this would be important information to establish the efficiency of the artificial spray system.

During the IREM studies, experiments were undertaken on sprinkler and flow manipulations to assess which increase, decrease, amount of bypass flows etc. worked to meet the spray demands. The EMP notes that “for now” sprinklers are to be maintained as is (p.71). This raises the question on what would be a trigger for change? There is a need to monitor sprinkler precipitation.

According to the EMP a separate Water Right was to be obtained for the abstraction of the water feeding into the artificial spray system. This falls under the responsibility of the Wildlife Division. We were informed that this Water Right has not yet been applied for. Although representatives of the Wildlife Division (WD) agree that it falls within their mandate at Kihansi we were informed that application for Water Rights is an activity where the WD has no prior experience. We were told that the application for the Water Right is not relevant during the lifetime of the project and will be dealt with after the project has expired and will be institutionalised.

The audit team recommends the following issues for follow-up and/or rectification:

- The current water abstraction for the sprinklers and fountain jets without valid Water Right is illegal and the WD should abide with the Water Act of 1974 Section 15.
- Studies on spray system output and distribution need to be conducted.
- Additional intensive monitoring of the spray input in the upper wetland ecosystem has not yet been effected as foreseen in the EMP and should therefore be prioritised.

3.2 Gorge Maintenance Infrastructure

Infrastructure has been established at some places in the Gorge and includes bridges, ladders, small shelter for Gorge technicians and a campsite. These structures are inspected and maintained by the Gorge attendants on a daily basis. Records are kept in the logbook.

There is also off-site infrastructure, comprising storage and facilities for spares and monitoring equipment. An indoor work area, office and housing for the maintenance team has also been established. The planned UHF radio network is present and its operation has been verified by the audit team in the office and in the Gorge at the Upper Spray Wetland Station. The vehicle is in working order.

The audit team recommends the following issues for follow-up and/or rectification:

- During the physical inspection of the Gorge maintenance infrastructure some safety concerns arose. These are outlined in Chapter 7 of this report and recommendations for corrective action is made.
- The construction of the research station planned in the EMP for 2004 has not yet been built. According to the March 2004 – March 2005 progress report, a contract with the Civil Works consultant was signed 29 September 2004. We recommend that an EIA be undertaken prior to the completion of the design.

3.3 Habitat Monitoring

As foreseen in the EMP, TAWIRI is carrying out the monitoring of various habitats within the Gorge Ecosystem through the RAMPO, who is a TAWIRI employee, seconded to LKEMP.

The basis for habitat monitoring is laid out in the IREM reports, which note that it is important to continue monitoring the various aspects of the Kihansi Gorge Ecosystem, including the Spray Toads, vegetation, insects and micro-climate so as to detect changes and trends. Methods have been laid down in Gibb's 2004 Monitoring protocol.

We were able to confirm that the habitat monitoring largely follows the procedures described in Gibb's protocol, IREM and the EMP - with some gaps. Our detailed assessment is presented in Table 7, which is reproduced from the EMP (p. 85).

3.3.1 Kihansi Spray Toad Surveys

With regard to the Kihansi Spray Toad (KST), IREM recommended that monitoring be conducted 4 times annually, in January, March, June and October over the next 3-5 years. Because the counts used by IREM appeared to be damaging the vegetation, rock plot counts were suggested instead of counting the toads along vegetation transects in the wetlands. Control areas were established. These areas that were previously bare rock have become covered with

vegetation, including the stainless steel markers. To ensure continuous monitoring the position of the bolts marking the plots needs to be visible.

The KST counts conform generally to Vol. III IREM report with a few exceptions:

- Daytime permanent rock plots have been established but are not maintained;
- Plots along the vegetation have been established but not always monitored;
- There is a standard sheet available to the team but are not always filled;
- Counts in spray wetlands are undertaken.

We were informed that due to the occurrence of ‘all zero counts’ the systematic counts have been replaced by opportunistic searches, which means that forms were not filled and not every plot may have been checked to make sure of a negative count. Consequently the data will not be there to analyse, unless one assumes a zero count for all plots.

During the on-site audit, no toads were sighted.

An issue to consider is that if the toad recovers, this might be a unique case in which the continued existence of species is entirely dependent on a simple, gravity fed sprinkler system that requires constant attention and maintenance.

The survival question of the KST has been linked to the spread of *chytrid* fungus in the Gorge. The LKEMP office in Dar es Salaam reported that in 2005 a study was commissioned on *chytrid* fungus.¹ The study has revealed the presence of the fungus in the samples collected. However, such information was not available on site.

With regard to the *chytrid* fungus, it is important to note that there is a protocol for sampling chytrid on amphibian skins just by taking a swab. The frog does not have to be killed to cut up its skin. This would be suitable in the Kihansi context.

If KSTs have survived, the question of whether these survivors have become or were resistant to the fungus, or if the fungus became less virulent, or simply less abundant after the outbreak, is of direct management relevance to Kihansi and also of global importance. We therefore recommend that a protocol be established and implemented for the toads, which are detected, as well as other amphibians in the Gorge. This example illustrates the importance of LKEMP not acting in isolation and to have scientific links and partnerships. It is through those that technical ability will be built up that might help to solve scientific management problems.

¹ Weldon Che, 20 May 2005, Chytridiomycosis Risk Assessment in the Kihansi and Uda-gaji Gorges with special reference to the KST, Final Report.

3.3.2 Precipitation measurement

According to the EMP natural precipitation is measured daily but the field team had to reduce the frequency from daily to weekly due to technical and logistical reasons. Gauges distant from the falls are measured twice per day (8am and 4pm) and gauges close to the falls 3 times per day (8am, 12 pm and 4pm). In addition to natural precipitation, the artificial precipitation generated by the sprinkler system needs to be monitored according to Gibbs monitoring protocol. This had not been done but was introduced as a result of the on-site audit (based on personal communication with the RAMPO on 4. October, the measurement started on 19. September 2005).

Table 7 Assessment of Habitat Monitoring Activities

As per EMP		Results of on-site audit	
Variable	Frequency	Findings	Responsible
Physical Characteristics / Sprinkler System Operations			
Precipitation (mm)	Daily	We were unable to confirm. Whereas one person said yes, another said in the upper spray zone only. Measurements written in logbook, transferred to computer by RAMPO.	LKEMP
Kihansi River Discharge (m ³ /S)	Daily	Is measured (report from the power house)	TANESCO
Air temperature (C°)	Daily	Yes. Dataloggers present. Logger downloaded at varying 3,2, 1.5 months intervals. Problem with logger, must be moved to office to download data.	LKEMP
Wind speed (km/hr), 1 site	Continuous	Not measured.	LKEMP
Water Temperature (C°), 2 locations	Daily	On weekly basis as reported by RAMPO	
Relative Humidity (%), 1 site	Daily	Not measured. Technical problem. Readings all one figure, constant.	LKEMP
Sprinkler system Flows (liters/s)	Continuous	Not measured. No suitable gauge. Pressure is monitored and forms a kind of indirect measurement of flows	LKEMP
Sprinkler System Water Temperature (C°)	Daily	Yes. Weekly. Gauge present. Data verified on data sheets.	LKEMP
Kihansi River Water Temperature (C°)	Daily	On weekly basis. Every Friday. Started in April 2005.	LKEMP
Sprinkler System Water pH	Daily	Is measured once per week as part of the routine water quality monitoring.	LKEMP
Kihansi River pH 2 sites	Daily	On weekly basis	LKEMP
Sprinkler System Water Conductivity (μ-ohms/s, two sites)	Daily	On weekly basis	LKEMP
Kihansi Water Conductivity (as above)	Daily	On weekly basis	LKEMP
Soil Moisture mbar (10/wetland)	Daily	Not measured. No capacity on site to do so.	LKEMP
Erosion deposition around soil cracks: mm/month, 25/wetland	Monthly	Not measured.	LKEMP
Suspended Solids/sediment/turbidity of Kihansi River flow through Kihansi Gorge; 2 sites	Daily/Continuous	On irregular basis. No regular monitoring.	TANESCO
Suspended Solids/sediment/turbidity of applied sprinkler system water, 2 sites	Daily/Continuous	Not measured. Technical problems, turbidity meter not functioning.	LKEMP
Droplet density, size, 1 site	Monthly	Not measured. Lack of capacity. Needs training.	LKMEP

As per EMP		Results of on-site audit	
Variable	Frequency	Findings	Responsible
Biological Monitoring			
Wetland Vegetation Characteristics – Species composition and coverage	Annually, using IREM techniques	The planned annual monitoring of wetlands towards the end of the dry season using protocols devised by IREM and elaborated by Gibbs (2004) are not being conducted regularly. The last report dates 2002. Another monitoring study is expected to take place this year.	LKEMP
Kihansi Spray Toad Surveys – IREM and the Panel of Expert Monitoring Techniques	2-5 times/yr	Measured through daily observation. Rather informally. Reports verified. RAMPO holding data sheets. Any toads noted in logbook. RAMPO reports to head office. Toad surveys were being conducted during World Bank Supervision missions in April and September 2005. See more comments in text.	LKEMP
Remote Imaging/Aerial photography/ multispectral digital satellite imagery, to evaluate vegetation/land use and land cover changes over time	Once, repeated every 5 years	First aerial photograph done in 1999 to set baseline for vegetation and land use. Second aerial survey was done in 2003 under LKEMP for the preparation of the LWCP. Compared changes to 1999. We were unable to confirm if future images are planned to allow systematic assessment of changes in a 5 year cycle.	NEMC/ LKEMP
Forest Woody Vegetation Characteristics – Kihansi Gorge and Udagaji Gorge PSP re-measurements; 28 sample plots: 20 in Kihansi Gorge, 8 in Udagaji. This program includes monitoring of the endemic plant species in the Gorge	Annually	<ul style="list-style-type: none"> <input type="checkbox"/> Irregular monitoring due to contractual difficulties and specialist availability; <input type="checkbox"/> Last monitoring study in 2002 (Taplin & Ndagalasi) <input type="checkbox"/> Consultant contracted for monitoring study in October 2005 	LKEMP
Epiphylls (50 leaves per woody vegetation plot)	Annually	Not monitored. Epiphylls monitoring is included in TOR of forthcoming vegetation study. However, no baseline and protocol established.	LKEMP
Dipterans, in the wetland vegetation communities; no pupae and adults, 5 plots per wetland	Annually	Has been done once by Mweka African Wildlife College. From June 2004 to June 2005.	LKEMP

3.3.3 Water Quality Monitoring

LKEMP is presently responsible for the monitoring of water quality in the Gorge. We found that the RAMPO and Gorge Technicians are familiar with the “*procedures to follow in case of sudden changes of water quality*”, outlined in Appendix 8 of the EMP. Reportedly such a case has so far never occurred.

Field-testing of water quality is coordinated with the overall maintenance program of the Gorge. Indicators tested include Dissolved Oxygen (DO), pH, Conductivity, Turbidity, Temperature, and Salinity. The water testing includes samples from sprinkler system water sources, the dam, and the Kihansi River as foreseen in the EMP.

One of the Gorge technicians has been appointed to fill all measurements into standard forms. A water quality testing metre is used to perform the water quality measurement. Some samples are taken to Tanzania Pesticides Research Institute (TPRI) for further analysis. Pressure measurements are undertaken at the mid Gorge and upper gorge.

The Operations Manual (see section 3.3.1. above) foresees that water quality checks are performed three times per week (Mondays, Wednesdays, Fridays) but it is only practiced once per week (every Friday). This timing was chosen so that the water quality monitoring coincides with the inspection of the spray equipment i.e pipes, joints, valves and nozzles. Although the Manual is not followed, the audit team believes that weekly checks are sufficient and it is hence not an area of concern other than that the manual should be revised to reflect this change.

Ten Data loggers were installed, data from which are downloaded once per month, providing information on time, day, relative humidity (%) and temperature (degree C). Physical inspection revealed that only six out of the ten data loggers are working. The data loggers at Mhalalala and two at mid Gorge are broken.

There is no routine water quality monitoring for organic substances, BOD, COD etc. as foreseen in the EMP. However, one toxicological survey was conducted by Machiwa, J. (2003) through LKEMP with the objective to establish the level of pesticides residues at the gorge and its catchment area.² This survey was meant to help understand the extent to which these agro-chemicals impact the biological and ecological integrity and diversity of the area. Another objective of the survey was to establish whether or not pollution of the water source through agricultural practices and economic activities may have contributed to the crash of the KST population.

The audit team recommends the following issues for follow-up and/or rectification:

² Machiwa, John (2003): Levels of some toxic metals and organochlorine pesticide residues in the Lower Kihansi River water and sediments.

- No specific training of the Gorge Technicians has been conducted for monitoring of water quality. The head technician has a background in automobile mechanics and would need further training on hydrological and ecological basics.
- The RAMPO is competent to evaluate the monitoring data that is being collected at site but is not empowered to make use of the data to change operations or make necessary adjustments without authority from LKEMP Dar es Salaam. This is delaying adjustments and the authorities granted to the RAMPO may therefore need to be reviewed.
- Representatives from TPRI, TAWIRI, and the University of Dar es Salaam have been at Kihansi to take samples of soil, water and sediments but reports of the findings have not reached the RAMPO office. This should be rectified as quickly as possible.
- Turbidity cannot be measured, as the water quality checker is not working. The water quality checker should therefore be repaired.
- Sediments, BOD, COD, and bio-monitoring, i.e. levels of phytoplankton are to be tested at regular intervals. Apart from one toxicological survey by Machiwa, J. (2003), there is currently no routine monitoring of organic substances used as pesticides or fertilisers. Provisions for testing and monitoring should be made.
- When the first two data loggers broke, they were sent to Dar es Salaam in April 2005 for repair. There was no follow-up. Later, another two were broken and they are at the site. Action to repair and replace data loggers is therefore highly warranted.

3.4 Gorge Access and Safety Protocol

The EMP requires that the number of visitors to the Gorge is kept to a minimum. It is limited to mitigation and monitoring teams and study teams and others visiting Kihansi on official business and with permission of NEMC, TAWIRI or WD. Tourism is presently not promoted.

The audit team was given different information about access to the Gorge from different sources. At the site we were told that access to the Gorge is controlled by LKEMP through Dar es Salaam and the RAMPO on site. Permission of access is usually obtained in person or by letter from the LKEMP Project Coordinator, sometimes by phone or fax. TANESCO in Kihansi refers access to the Gorge to LKEMP. The LKEMP office in Dar es Salaam informed us that access to the Gorge is obtained through an access permit from NEMC and TANESCO.

It appears that a procedure to obtain access to the Gorge has not been adequately communicated, which may lead to confusion. This was confirmed by the RAMPO who reported that there is a problem as people usually do not know that they need permission from Director of LKEMP. Some people go directly to the TANESCO office at Kihansi but they are always referred to LKEMP. Subsequently, the RAMPO has to seek permission from the LKEMP office in Dar es Salaam.

3.4.1 Safety protocol

Anyone who wishes to visit the Kihansi Gorge must walk in, and those who are involved in maintenance, monitoring and/or research must do this on a regular basis. No physical entry barrier has been erected but usually visitors are accompanied by Gorge attendants.

Security checks in the Gorge to prevent poaching, logging and fuel wood collection are undertaken through daily patrols by the attendance crew. Records of any infringements are kept in the waterproof logbook. There has been no reported incidence of logging or fuel wood collection since June 2004.

The Safety Protocol for Disease Prevention in Appendix 7 of the EMP has been implemented and is enforced. This includes footwear and equipment sterilization, waste water treatment, handling of the Kihansi Spray Toad (KST) and replacing of sprinkler systems parts. Simple facilities have been erected for shoe/foot-bath with bleach at the entry and exits points above and below the Gorge, as well as prior to entry into the spray zones. We were told the bleach is changed twice per month.

The audit team recommends the following issues for follow-up and/or rectification:

- It appears that the enforcement of the bleach foot bathing procedures, as observed during the on-site audit, can be improved.
- Despite the patrols, we were told the problem of theft of equipment persists by people entering the Gorge. Preventive measures should therefore be taken.

3.5 Ex-situ Captive Breeding Programme

We were informed that the ex-situ captive breeding programme of the Kihansi Spray Toad started as planned in December 2000. The results of the captive breeding programme as reported in the reports received from the U.S. Zoos between 2002 and 2005 have been summarized in a table in Appendix 7

The responsible institutions and their roles in the captive breeding management programme are detailed in the Breeding Loan Agreement between the US-Based Wildlife Conservation Society and the Government of Tanzania (LKEMP, 2004). It appears that the operation of the programme is complex: A captive breeding basket fund was set up with elaborate financial and accounting procedures. A review of the Breeding Loan Agreement brings out the following issues:

- Data capture: Relevant data gathered through scientific studies were supposed to go into Tanzania's database for use by Tanzanian Specialists. We were informed that all information received from the captive breeding institutions and relevant ecological information gathered in the past ten years in Kihansi Gorge will be entered in the NEMC/LKEMP ecological monitoring database, which is currently being established. This database and a corresponding website, which is to be maintained by NEMC, will be available

for use by both national and international individuals. The expected date of finalisation is December 2006.

- **Reporting:** The Wildlife Conservation Society (WCS) is required to report to Tanzania twice a year on the current propagation, health status of the specimen/progeny and disbursement of funds remitted by Tanzania. We were informed that reports are being submitted as planned.
- **Domestic captive breeding programme:** For the 2004 financial year it was planned to engage a consultant to undertake a feasibility assessment for KST ex-situ conservation in Tanzania and to develop a strategy and a programme for reintroduction of KST in Tanzania. We were informed that capacity building and a feasibility study for a domestic captive breeding programme are work in progress. Two trips (2003; 2004) have been made by Tanzanian scientists and government officials to visit the American captive breeding zoos with a view to getting practical experience and understanding of captive breeding husbandry. A consultancy to undertake a feasibility study of a domestic captive breeding programme of the KST is planned for early 2006.
 - While theoretically it would be highly desirable to conduct the Captive Breeding programme in Tanzania, given the immense costs and the technological limitations, it would not seem advisable to maintain the only captive population in Tanzania. We hence recommend that a risk assessment of various combinations of captive breeding efforts be made.
- **Timeframe:** The EMP outlines that Tanzania remits funds to WCS "... until the species can be returned to Tanzania...." However it is not specified when this will be. The EMP mentions that the captive breeding programme is to be continued permanently (p. 68). IREM studies indicated that it would be unlikely that there would be suitable translocation sites and that there is a real risk associated with translocation. If translocation is not an option, re-introduction in Tanzania can only be considered when the habitat at the Kihansi Gorge returns to a state where the threats to the survival of the KST, including the Chytrid Fungus, have been removed. A decision is outstanding with regard to the continuation of the captive breeding husbandry programme in the U.S.A. keeping in mind the high resource demands in terms of money and technology. The annual cost is over US\$ 200,000 out of which LKEMP is transferring US\$ 75,000 annually to the Zoos, while the Zoos cover the balance. The above mentioned feasibility study is meant to be established if captive breeding will be feasible and more economic in country.
- The EMP requires the Captive Breeding Programme to be reviewed by NEMC on the basis of annual report (p.69). The Breeding Loan Agreement is currently under review to take on board new developments (e.g. reduction of captive stock, development of a live cell line of KST) as well as to appropriately revise the old articles of the agreement.
- The staff from the captive breeding programmes only visited the site after the toads had been hit by the decline from the Chytrids, so the purpose of their visit, to see the "natural" conditions so these could be mimicked in captivity, was not met.

- The Captive Breeding Programme is quite unique. It is the first instance of an African species of toad on Appendix I of Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) being brought into a captive breeding programme. We note that it is difficult to find information about the captive breeding programme from LKEMP. It is not on the website. In general, we observe that the website has few links that lead to data and information.
 - We hence recommend that scientific information be shared on a wide basis. For example by having a regular public update on a website.

IREM specifically mentions that there is a need to incorporate knowledge from the captive breeding into the studies in the Gorge. However, we could not ascertain the flow of information from the captive breeding programme to in situ conservation and management. The RAMPO on-site handles all the field programme activities and is presently not involved in the captive breeding programme nor did she have any information at hand.

3.6 Kihansi Scholarships

IREM suggested further studies on the biology of the Kihansi Spray Toad, insects and vegetation. Supporting doctoral students to work on different aspects of the ecology of the Kihansi Gorge and spray wetlands was considered an effective means of increasing levels of knowledge and understanding about the Kihansi Gorge and spray wetland ecosystems.

The EMP recommends that scholarships for up to four MSc. and Phd. programmes and funds for competitive research be made available through LKEMP. It appears that the implementation of this component deviated from what was foreseen in the EMP. Table 8 presents an overview on the studies that were planned in the EMP and their status to date, while Appendix 7 provides a full overview of all training activities sponsored and other support provided undertaken under the Kihansi Scholarship component.

Table 8 Studies Conducted under the Kihansi Scholarship Programme

Planned Study (EMP p. 71)	Status
1. Maximising habitat, spraying 'toad rock' etc.	This is included in the consultancy on sprinkler back up design and installation
2. General diurnal behaviour, predation, reproduction	Conducted in the Zoos in the U.S. Captive Breeding Consortium
3. Longevity of the toad	Is being conducted under the captive husbandry programme
4. Pathogens of KST, Chytrids fungi in the Gorge	Conducted and finalized by a Chytrid Fungus Expert from South Africa.
5. Food preferences and preferences of the indicator insect species, <i>Ortheziola</i> and <i>Afrosteles</i>	Conducted by P. Hawkes and team but so far only draft report.

The list of training activities actually provided by LKEMP far exceeds what was planned in the EMP. In summary, two PhD and ten MSc Scholarships were provided, mostly for studies abroad, to students from the University of Dar es Salaam and Tanzanian Government Agencies. The majority of these degree programmes are presently still on going.

In addition 46 short-term skills training courses, and support to attend workshops and professional seminars were sponsored by LKEMP (see Appendix 7). Two lecturers were recruited, one for Conservation Biology and one in Water Resources Management, for the University of Dar es Salaam. Additional support provided included the donation of laptops and other IT equipment as well as motorvehicles and motorcycles. The drafting of the Environmental Management Act (EMA) of 2004 with respective regulations and guidelines was also financed under this LKEMP component.

According to the EMP, further funds were supposed to be made available for competitive research grants and students invited to submit proposals. We were informed, that a Competitive Research Grant Panel was established by NEMC and the LKEMP for the purpose of advertising and selecting Expressions of Interest from among national and international scientists.

According to the EMP, the funding for the Kihansi Scholarship Programme should have been provided by TANESCO after 1. January 2005. However, we were informed, this has not yet happened. A decision was made by both the Government of Tanzania and the World Bank that the LKEMP funds should be used for shouldering TANESCO cost until the end of the project.

In summary, the support provided under the Kihansi Scholarship component of LKEMP exceeded by far what was planned under the EMP. This is both with regard to the quantity of scholarships issued but also with regard to the type of support. The procurement of IT and other equipment was not originally foreseen, neither were professional short courses and workshop attendance, nor funding of the drafting of the EMA. How the results of this capacity building exercise will be captured to feed into the knowledge about the Kihansi Ecosystem and Biodiversity and Water Resources Management issues in Tanzania in general remains to be seen.

In addition it is noted that the Kihansi Scholarships Programme only focused at high level institutions in Dar es Salaam. However there is considerable scope for engaging primary and secondary schools in the LKHP project area.

4 Vegetation

The mitigation and monitoring measures recommended in the EMP form the basis for the audit criteria included in the vegetation checklist (see under Appendix 4). Vegetation impacts highlighted in the EMP are associated with the plant communities in Kihansi Gorge, Udagaji Gorge, along Kihansi River upstream of the dam site, down stream of the tailrace area and in the adjacent woodland in the LKHP area. These areas have hence formed the scope of the vegetation audit. Some findings regarding vegetation monitoring activities were already presented in the overview table on habitat monitoring in Section 3.3.2 above.

4.1 Size of Spray Area and Vegetation Changes

The most significant mitigation measure is the maintenance of a by-pass flow of 1.5 - 2.0m³/s in the Kihansi Gorge. This flow was predicted in the IREM report to be sufficient to maintain the vegetation communities with little loss of biodiversity. As will be explained in Chapter 5, RBWO and LKEMP data suggest that this minimum bypass flow has so far not been maintained by TANESCO.

Obviously, the by-pass flow in combination with the sprinklers and the fountain jets is only a viable mitigation measure provided that the sprinkler and fountain jets are working properly. This would need to be ensured at all times. However, during our site verification we found that there is no gauge to monitor the sprinkler flow. Pressure is used as an indirect measure for estimating flow.

The amount of vegetation cover in the original spray zone has been divided into a control area and an area to be maintained under the artificial sprinkler system. The LKEMP study selected an area of 400m² in the center of the wetland (upper spray) from which six (10x10m) random sample plots were measured. The IREM studies extended this area by 100m². Of the plots, three are permanently sprinkled, three are control plots in the wetland but not under the sprinklers and two are also outside the sprinklers on the wetland fringes (Gibbs, 2004: 24).

Onsite verification during this audit showed that the vegetation in the control plots, which is largely grassland, is reduced. This is due to the invasion of fringe species specifically *Aframomum* sp, *Costus afer*, which are opportunistically colonising the area following dry spells. These plots rely on the remaining natural moisture available mainly during the wet season.

4.2 Vegetation Monitoring

Despite the recommendation to conduct annual vegetation monitoring surveys (Gibbs, 2004 and EMP) the most recent survey was conducted in 2002 (Taplin and Ndangalasi, 2002). Since the hand over of the project from NORPLAN to NEMC no vegetation monitoring has been conducted.

As described in Chapter 3 above, vegetation monitoring is supposed to be included in the routine habitat monitoring activities. These monitoring activities include the spray zone vegetation, forest woody vegetation and indicator species, in particular Epiphylls. We found that there are gaps in the implementation of these monitoring activities.

We were informed that the next vegetation monitoring exercise will be carried out in early October 2005 by a team of Norconsult experts. For reasons of consistency in the monitoring protocol, the same time period as for the previous vegetation study was chosen.

Due to the lack of vegetation surveys it is not possible to conclude how the current flow has impacted on vegetation changes. The physical spot checks of the audit team revealed that on both upper and lower spray zone the vegetation is doing well. In both areas *Selaginella krausania* is regenerating, which is an indication of sufficient spray in the area for this indicator species to regenerate.

4.2.1 Monitoring of Spray Vegetation

There has been no sampling of the eight vegetation plots in the spray zone since Taplin and Ndangalasi (2002). The RAMPO, who is responsible for monitoring the vegetation plots is not a qualified botanist. We were told that recording presents difficulties in the absence of a botanist, as the monitoring has to rely on the infrequent visits of experts for guidance. The control plot established by the RAMPO and her team in the lower spray wetland receives maximum spray and may not be scientifically well chosen.

4.2.2 Monitoring of Forest Vegetation

According to the EMP forest woody vegetation characteristics are to be monitored annually in 28 sample plots in Kihansi and Udagaji Gorges. Similar to other vegetation zones, the annual monitoring of woody sample plots has not been undertaken since 2002 but is planned for October 2005.

We found that the plots in Kihansi Gorge have been demarcated and given numbers. The trees are numbered as well. However the plot markers are fading and need re-establishment. A few fallen markers were collected by the audit team and placed back on the trees.

The audit team found no obvious change in the *Filicium* forest vegetation. Similarly the humidity data observed (>100) were high enough to sustain this vegetation. No change in size of the area covered by this vegetation type was observed.

During the on-site audit we observed a number of dead trees in one plot close to the camp-site. The reasons for this could not be established.

4.2.3 Monitoring of Indicator Species

The habitat monitoring within the Gorge Ecosystem includes checking on indicators species, to allow conclusions on vegetation changes due to a change in moisture levels.

The audit team did a random check to verify the presence of these species. However more systematic studies would need to be required to make conclusions presence and distribution of species.

- *Kupea jonii*, *Kihansi lovettii*, and *Stenandrium grandiflorum* were not recorded during the on site audit. All these species require high moisture levels, thus it was difficult to find them given the season during which the audit was conducted. During the most recent visit by Ndangalasi (May 2005), it was reported that the indicator species were present (pers. comm..with the audit team).
- *Epiphylls* were sighted on leaves along the river but not in the forest. This implies that the forest is relatively dry. Gibbs (2004) recommends monitoring of the epiphylls as an indicator of changes of the microclimate. Monitoring of Epiphylls is included in the forthcoming 2005 vegetation study, however the consultant requested for it to be taken out, as there is no base line study on epiphylls and no protocol has been established (H. Ndangalasi, pers. comm.)

4.3 Related Studies

We understand that no party has been assigned responsible to conduct a mini catchment study, neither in the Gorge nor in inundated areas, as planned in the EMP. It was also not included in the Landscape Wide Conservation Plan for the Upstream Kihansi Catchment (LWCP). Similarly no additional studies have been conducted to assess the improved use of fountain jets on vegetation and their alternatives.

There has been no recent land cover monitoring study to check changes in vegetation. However, the RAMPO has used photographs taken regularly to monitor the changes of vegetation over time. The RAMPO noted an invasion of plant species characteristic to dry area into the spray wetlands. This is undocumented and requires further confirmation.

Based on the above findings, the following recommendations are made:

- A further study is required to monitor if there are changes in vegetation characteristics with the current flow regime.
- The RAMPO should either be trained further particularly on aspect of plant identification and/or be provided with external (botanical) support.
- The establishment of a baseline and scientific protocol on epiphylls monitoring is required.

5 Kihansi River Hydrology

The hydrology audit included the verification of the implementation progress of the mitigation and monitoring measures listed in the up-dated EMP (p.61f & 78f).

5.1 Final Water Right

The Final Water Right (No. RBWO 16) was granted to TANESCO on 30 June 2004 based on the Water Act of 1974 Section 15 by the Central Water Board of the MWLD. It allows storage of 1.6 million cubic metres and abstraction of 2,151,360,000 litres of water per day for 180 Megawatt hydropower generation, while leaving between 1.5 and 2.0 cubic meter per second for environmental flow. Reservoir sediment flushing is only allowed with approval of RBWO and NEMC and has so far not been practised.

Based on the Water Right, the following daily records are to be kept:

- Water level
- Storage of reservoir
- Turbine discharge
- By-pass flow
- Spills

We were told that this data is being measured by TANESCO at the site and daily reports are sent to the Director of Hydropower Generation in Dar es Salaam. Reports to RBWO are sent weekly containing the water discharge values. Receipt of these reports was confirmed by the RBWO.

There is a requirement in the EMP that TANESCO procedures and records have to be modified to conform to those of RBWO. We were told that TANESCO is not aware of this requirement and it is unclear to what extent a modification is required.

→ This issue needs to be clarified or if no longer applicable to be deleted from the EMP.

5.2 By-pass flow

TANESCO is monitoring the bypass flow as required by the Water Right and prepares hourly, daily and weekly reports, which are sent to TANESCO Headquarters and to RBWO. Hydrological data generated in the powerhouse control panel shows that a bypass flow of between 1.5 and 1.9 m³/s has always been released depending on the water level (meter a.m.s.l) in the dam.

Measurements carried out by RBWO and an alternative consultant study commissioned by LKEMP indicated that 1.30 – 1.40 m³/s is being released depending on the reservoir level.

We confirmed that TANESCO has commissioned NORPLAN, who is responsible for the initial design, to resolve this discrepancy. The contract for “*remedial works to augment the minimum bypass flow releases at the Kihansi pond*” was signed 13 June 2005 and is currently running for a 19 weeks period. The scope of work includes the design of a facility capable of releasing a minimum of 1.5 m³/sec at all times by lowering the discharge point of the existing bypass pipe by a few metres and the recalibration of the by-pass display metre at the power station control panel.

Site level work had not yet started at the time of the on-site audit. We were informed that pipes had just been procured and are about to be cleared at customs.

The audit team recommends the following issues for follow-up and/or rectification:

- TANESCO has not commissioned any study for alternative sources of water to substitute for the bypass flow as stipulated in the EMP. We were informed that this activity had not been given a budget allocation and was given low priority even by the World Bank representatives when the EMP was discussed. The reason given is that using an alternative source would lead to a ‘replacement effect’ since the water for Kihansi would need to be taken away from a different source. If this activity is not considered relevant anymore, the EMP should be revised accordingly.
- There is no evidence of unusual events, such as uncommon high or low flows, being reported immediately to RBWO and NEMC via UHV radio as required in the EMP. However a discharge report is sent to RBWO on weekly basis.
- RBWO should explore the possibilities of using a rectangular open channel downstream of the dam to periodically verify the amount of bypass flow. This could be established as a routine procedure to provide an alternative to the measurements from the TANESCO powerhouse.
- RBWO should download data from the loggers on monthly basis for effective monitoring water flows in the Kihansi river.
- RBWO need to improve reading and collection of data from the river gauge station by providing transport to the responsible staff.

- Staff gauges installed at river stations need to be used to calibrate the data loggers.
- The gauging station (1KB28) at the Chita-Mlimba bridge should be rehabilitated and put to work. In the comments received on the draft Audit Report, RBWO disclosed that this station is now functional.
- The requirement in the EMP that TANESCO and RBWO should exchange hydrological and hydraulic data on the Kihansi river on real time basis needs clarification. Both institutions commented to the Auditors that they are not clear on how to comply with this requirement.

5.3 RBWO – Hydrological Monitoring

RBWO is the institution responsible for the monitoring of the Water Right. There is evidence, through reports and interviews, that this is being done. RBWO has installed data loggers and staff gauges to monitor water flows and levels in the Kihansi River. Water levels are read twice daily.

The EMP requires monthly downloading of the loggers. The local readers reported that RBWO data loggers by RBWO staff are down loaded on an irregular basis, i.e. sometimes after one month, sometimes three to four months or more. Evidence during the on-site audit confirms that data downloaded during the audit had not been read for the last two months. The NEMC “Oversight Monitoring Report of LKEMP” dated December 2004 states that regular monitoring of water flow is hampered by lack of funds by the RBWO.

Five RBWO river gauging stations were physically inspected as part of the on site audit. These were:

1. 1KB28 – Kihansi river at Lugoda, downstream
2. near TANESCO quarry, downstream (no label)
3. Under bridge, near dam, downstream (no label)
4. 250 m downstream of dam (no label)
5. NC1- Kihansi River at Kilatu – upstream

The stations without label could not be named in accordance with RBWO reporting by the local water gauge reader who accompanied the audit team member.

In the comments received on the draft audit report, RBWO informed the auditors that stations 3., 4. and 5. listed above are not monitored by RBWO. In contrast the local water gauge reader informed the audit team that he reads the data and sends it to Iringa, where RBWO is located.³ Due to this conflicting information, the audit team cannot conclude on this issue.

A summary of the audit team’s assessment of the RBWO monitoring system at Kihansi is presented in Table 9 below.

³ This is Mr. Makaba Rubida from Ukami Village, who informed us that he has been trained by NORPLAN.

Table 9 RBWO Hydrological Monitoring at Kihansi

Monitoring tool	Findings
Gauging stations no. 2 to 5. above	<ul style="list-style-type: none"> Working properly and readings are taken twice per day.
Gauging station (1KB28) at the Chita-Mlimba bridge (no. 1)	<ul style="list-style-type: none"> Lowest river gauge missing at the time of the site verification. As reported by RBWO on 17.September 2005 a staff member visited the station and installed the gauge.
Data loggers	<ul style="list-style-type: none"> 3 data loggers have been fixed and are reportedly working Loggers use batteries and sometimes when out of charge, there is no replacement and no record is taken.
Piezometers (PZ)	<ul style="list-style-type: none"> PZ at Uhafiwa Bridge is not working
Automatic level recorder	<ul style="list-style-type: none"> Is not working
Rain gauge	<ul style="list-style-type: none"> Is not working
Institutional	<ul style="list-style-type: none"> RBWO Staff from Iringa office does visit the site on irregular basis Data are supposed to be collected monthly but according to field staff this is not the case

Similarly to the comments received by RBWO described above, RBWO does not claim responsibility for the rain gauge. However the audit team was informed by the local gauge reader⁴ that he sends the data from the rain gauge to Uhafiwa village weather station where RBWO collects the data.

It appears that the institutional responsibility of the different gauges is not clear and we hence recommend that

- The institutional responsibilities from the various gauging stations in the LKHP project area are reviewed and clarified.

5.3.1 Responsibility and Training

RBWO assigned a principal technician (hydrologist) responsible for monitoring at Kihansi. We were told that the monitoring is taking place once per month and if sufficient funding for travel is available even every two weeks. It appears from our verification of evidence that the reporting of the technician back to RBWO is not regular, as only three reports were found.

RBWO staff at site has been trained on reading the instruments, however not as outlined in the EMP on:

- Reporting procedures (when to report emergencies, reporting formats etc.);

⁴ Mr. Onasi Rubida, NC1 reader.

- Use of radio communication for reporting; and
- Procedure for responding to breaches in Water Right agreement.

5.3.2 Data Collection

The EMP requires RBWO to download data loggers to a card on a regular basis (once per month). Based on our evidence, data is downloaded irregularly. Data was found at the RBWO office from June and July 2005, but was missing for the period 27 September 2003 to 18 July 2004 as well as from mid August 2005. As reported by RBWO this was due to malfunctioning of the data logger.

It was reported to the audit team by RBWO that the staff gauges are used as a control to calibrate the data loggers. However, the hydrologist on the audit team could not verify this on-site.

Based on the EMP, monitoring of diversions for the Kihansi domestic water supply and spray wetlands irrigation is to be done according to RBWO procedures. RBWO specified towards the Auditors that what is meant by 'standard procedures' is that the abstraction needs to be based on a valid Water Right. However, this Water Right has not yet been established, which deprives RBWO of a basis for monitoring.

5.3.3 Reporting

A quarterly report is prepared for the Rufiji Basin Water Board (RBWB) and Ministry of Water and Livestock Development (MWLD) providing flow measurement data for the various gauging stations. No separate annual report summarising and bringing together all data recorded during the previous year is prepared. The absence of an annual report may hint at a lack of analysis of annual changes. RBWO reports that analysis is taking place despite the lack of a formal annual report, however this could not be verified by the auditors.

The EMP requires that regular reports are being evaluated by the RBWB and a brief analysis is submitted to its stakeholders.

As reported by RBWO meetings are held on a quarterly basis with RBWB. The Permanent Secretary of the MWLD also attends these meetings. At this meeting they submit the report and discuss it. On basis of the report RBWO are advised by RBWB and at the next meeting they follow-up on the implementation of the advice. Evidence in form of minutes was provided for a first meeting held in December 2004 and the latest in August 2005. No further evidence was provided to support if the meetings are held as required.

5.3.4 Financial Viability

According to the EMP, the RBWO monitoring is supposed to be fully financed by TANESCO and paid via the MWLD as part of the Water Right. We were told that Water User fees are being collected from TANESCO and that RBWO receives no funding directly from TANESCO. TANESCO pays Tshs 165 million each year to the MWLD in Water User Fees of which RBWO receives be-

tween 10-40 million Tsh. This is not considered sufficient for monitoring. In addition there is a budget allocation to RBWO of Tshs 10 million from LKEMP each quarter. Although the amount was received for the first two quarters of 2005, the third transfer had not yet been effected at the time of the audit.

The following recommendations are made:

- RBWO should repair any non-functioning measuring instruments and implement a timely routine maintenance practice. The reading of gauges needs to be undertaken regularly.
- Training of RBWO staff at site needs to be provided as foreseen in the EMP.
- The monitoring of diversions for the Kihansi domestic water supply and spray wetlands by RBWO needs to be done in accordance with specifications outlined in a valid Water Right. This Water Right needs to be acquired in order to establish the basis for monitoring.
- The financial viability of RBWO monitoring needs to be reviewed.

5.4 TANESCO – Monitoring at the Dam

The EMP refers to monitoring of siltation and sedimentation rate in the dam to be undertaken by TANESCO under the sections of mitigation and monitoring at the LKHP works site (p.72f & 88 f respectively).

As required in the EMP, Piezometers have been integrated into the hydrological data collection and TANESCO staff take readings one per week. The assessment of the TANESCO Dam Monitoring Tools by the audit team is summarized in Table 10 below.

Table 10 Dam Monitoring Tools

Monitoring Tool	Assessment
Piezometers	<ul style="list-style-type: none"> • Measurements are taken once per week • Around the dam PZ 401,402,403,407 and 305 are working; whereas PZ 404 and PZ 306 are not working • Along the headrace tunnel HT 31, HT 32 and HT 33 are working
Stream Discharge V Notch	<ul style="list-style-type: none"> • No. 1, No. 3, No. 4 and No. 5 are working; No. 2 is not working
Seepage Chambers	<ul style="list-style-type: none"> • No. 1, No. 2 and No. 5 are working • No. 3 is not there (was never constructed) • No. 4 is dry, i.e. not working
Drain holes measured	<ul style="list-style-type: none"> • No. 1 at 1st abutment • No. 2 at 2nd abutment

The audit team recommends the following issues for follow-up and/or rectification:

- A standard procedure for monitoring seismic events and structural stability of the dam should be introduced, as required in the EMP. Purchase of equipment for monitoring and staff training will be required.
- Standard procedures for monitoring sedimentation rate in the dam and release of sediments from dam during flushing operations should be developed.

5.5 TANESCO – Hydrological Modelling

The hydraulic sub-component of the Catchment Management Plan (CMP) formulated by NORPLAN included hydrometric data collection and the development of a hydrologic model for the Kihansi Catchment. The objective of the model is to describe, quantify and facilitate monitoring of the impacts of land use changes on sediment load and water balance in the catchment. While TANESCO was responsible for the data collection, NORPLAN was responsible for model development. After the end of NORPLAN's contract, LKEMP continued to support TANESCO in the continuation of this activity.

As part of the on-site audit we were only able to visit the gauges listed in Section 5.3 above.⁵ A full on-site inspection of the hydrological stations was not possible. Our observations in this Section are based on a desk review of the report of TANESCO/LKEMP "*Support for data collection and hydrological modelling*" (date up to May 2004).

The report was provided to the team by TANESCO in Dar es Salaam as an example illustrating the Hydrological Model. The most recent report was not available during our visit. While some of our comments below might be outdated, others relate more to issues of principal and will hence still be of relevance.

- We note inconsistencies in the reporting on the total number of gauging stations. While some pages mention 11 stations, others mention 12. In some paragraphs there are 2 downstream gauges, in others 3. These inconsistencies should be corrected. TANESCO in its comments provided on the draft audit report clarified that the number of gauging stations upstream of the dam is 10 and downstream are 4.
- The responsibilities/ownership of the various gauging stations is unclear. Sometimes Maji is mentioned, at times RBWO, or TANESCO. A more consistent presentation based on the actual ownership would be desirable. In its comments provided on the draft audit report TANESCO clarified that NC1 and NC3 are owned by RUBADA; 1KB28 by the Ministry of Water and Livestock Development; and a gauging station monitoring by-pass flow is owned by RBWO. The remaining stations are owned by TANESCO.
- On page 3 it is mentioned that the 3 Automatic Weather Stations are not working. While this might have been rectified by now, we note the high rehabilitation cost involved (Euro 2,269.00). As a general issue, it might be

⁵ Due to an accident of the LKEMP driver, the planned verification of catchment gauges had to be cancelled.

recommendable to verify to what extent foreign technology can be replaced by simple, locally available technology so that parts and spare parts for various equipment under LKHP can be obtained at more reasonable prices. The current set up is not financially sustainable and therefore needs to be revised.

- Page 3 mentions the outstanding recruitment of a resident technicians. Their recruitment should be given priority.
- 12 manned rainfall stations are mentioned. TANESCO at site is not aware of the rainfall stations. They only download data from data loggers. We were unable to verify who the 'manned' person is. It appears that there is a gap in local staffing and responsibility for reading, maintenance and regular reporting on Kihansi River Hydrology.
- Running the system out of Dar es Salaam will be less efficient and more costly in the long-run. Hence, a change in management structures, favouring those closer to the operations may yield efficiency gains and operational improvements.

The EMP requires that TANESCO and RBWO exchange hydrological and hydraulic data on the Kihansi River on real time basis. The auditors received inconsistent information from the various parties interviewed regarding the exchange of data between the two institutions. While during the on-site audit it was confirmed that real time data exchange is presently not achieved, in the comments received to the draft audit report, the information was transmitted that TANESCO and RBWO maintain the same database. At the same time RBWO reported that information is exchanged but not on a regular basis. This audit can therefore not make a conclusive recommendation regarding the extent and speed of data exchange between the two institutions.

Both institutions raised towards the auditors that they were unclear of what is meant by 'real time' exchange. It is therefore recommended that the requirement in the EMP that TANESCO and RBWO should exchange data on real time basis be clarified or removed (if not applicable) in a revised version of the EMP, should it be prepared.

6 Erosion, Fire Control and Solid Waste

Other issues at the LKHP Works Site listed in the EMP include re-vegetation and other erosion control measures, control of wildfires as well as waste management.

6.1 Control of Erosion and Fires

Re-vegetation in previously excavated areas is practiced. As part of the re-vegetation efforts, *Vertiver* grass was planted and terraces were constructed. Other erosion control measures include gabion boxes, stone pitching on road sides for storm water open channels. These measures are being maintained by TANESCO through casual labourers.

With regard to erosion of the riverbed, an assessment of the river channel downstream of the tailrace during the on-site audit indicates absence of erosion problems.

The uncovering of scrap metal from the construction site by a local contractor at the LKHP works site, observed during the on-site audit, is counterproductive to the on-going re-vegetation activities and presents a potential health hazard.

Furthermore of relevance to the environmental audit are frequent outbreaks of fires in the LKHP project area. During the on-site audit a fire broke out that had been started on one of the fields cultivated by TANESCO staff and the villagers had put it out. It was reported by TANESCO that despite disciplinary action the prevention of bush fires is a problematic issue. The villagers, through their environment committees, are perceived to have better means of fire prevention and control than TANESCO. On 17 and 18 October 2005 considerable fire damage was caused in the woodlands directly adjacent to the Gorge (D. Mtui, pers. comm.). Although the auditors were informed that a number of measures for fire prevention and control are under implementation through the EMP, including provision of fire breaks and sensitisation and awareness raising campaigns, the frequent fires outbreaks show that these measures are not sufficient and more effective prevention and control measures therefore need to be established.

The audit team recommends the following issues for follow-up:

- Although erosion control and re-vegetation of excavated land have been practised there are no standard procedures for monitoring and it is dealt with on an ad-hoc basis. A more systematic system would allow further improvements.
- Active prevention and control of fires by TANESCO is needed on an urgent basis.
- Cultivation by TANESCO staff on TANESCO land should not be allowed.

6.2 Solid Waste Disposal at LKHP Works Site

The EMP under mitigation measures at the LKHP Works Site mentions solid waste management programmes, among others, without providing further specifications. During the on-site audit we therefore assessed the waste management practices at the TANESCO camp and in the Gorge.

Overall, we note that there are no standard procedures for solid waste management neither at the LKHP Works Site, nor in the Gorge.

There is no Head Engineer responsible for environmental mitigation measures at the LKHP work site. There is one TANESCO staff, at Civil Technician level, who has been assigned these responsibilities, however based on the findings of on-site visit this appointment does not seem adequate to address the most pertinent issues as well as more medium and long term environmental mitigation. In particular with regard to waste disposal some commitment and immediate action of senior management is required.

The current disposal practice is to transport the waste to an open dump-site at about 1 km distance from the TANESCO camp, where there is irregular open air burning. More recent waste materials are mixed with solid waste that remained from the construction phase, including used oil filters, batteries, scrap metal, scrap plastic and rubber materials. The current disposal practices present a problem for the following reasons:

- These wastes continue to persist long after disposal;
- The wind is spreading the waste around;
- The dumpsite is not fenced and hence creates a public risk due to chemical or infectious exposures;
- Wastes can breach and contaminate groundwater; and
- The dump site is frequented by animals (scavengers) who feed on the biodegradables, as well as people.

The 2004 Environmental Management Act (EMA) prescribes, under Sections 116 (1) and (2), that industries provide adequate spaces and facilities for managing solid waste generated from such industries. 'Adequate' is specified under Section (2) as 'refuse bays' or 'areas are set aside by industries for the collection of solid waste' that are 'clean, protected from flies, animals and scavengers'. TANESCO is presently not in compliance with these requirements at LKHP.

Furthermore, Section 110 of the EMA “prohibits the discharge of any hazardous substance, chemical, oil or mixture containing oil in (...) any segment of the environment (...)”. A person or organisation doing so, commits an offence and may be ordered by the court apart from the general punishment provided under the Act to a) to pay cost of removal and b) the cost of third parties in form of reparation or compensation.

- We therefore recommend that TANESCO appoint a resident head engineer responsible for solid waste management and implement and monitor safe procedures for waste disposal.

6.3 Solid Waste Disposal in the Gorge

The maintenance of the sprinklers will require the presence of a team of workers over a long time period, essentially indefinitely. It is important to view the problem of human waste disposal from a long rather than a short perspective. We noted batteries thrown into the latrine. When these disintegrate, they are likely to eventually leach into the Gorge system and cause problems.

Visitors need to bring in plastic water bottles, food in tins, paper and plastic wrappings and containers. When asked how these were dealt with, two different answers were given. One individual said that all of the waste was carried outside the Gorge and deposited in a dump (presumably at the TANESCO camp). A different individual responded that the waste was burned (for paper) and other waste was buried in the Gorge.

On this issue, the audit team has the following recommendation:

- Waste disposal should be treated as a long-term issue and it is reasonable to expect that at least non-burnable, non-biodegradable waste be carried out of the Gorge and properly disposed. Certainly, all plastic waste should be carried out. This policy needs to be made clear to staff and visitors. Tins could be washed, collected, and another porter hired to carry down such a load.

7 Occupational Health and Safety

The Health and Safety Audit included a verification of the compliance of the Kihansi Hydropower plant with TANESCO's Health and Safety Policy of January 2005. In addition a number of health and in particular safety issues emerged during the on-site visit of the Gorge, currently managed by LKEMP. These are also reflected here.

7.1 Compliance with TANESCO Health and Safety Policy

On the basis of the audit, the occupational health and safety procedures at the Kihansi Hydropower Plant are in substantive compliance with the January 1995 TANESCO Health and Safety Policy, with the exceptions stated below. The findings below warrant follow-up and rectification.

- Tenure of Safety Representative (Policy item: 2.1.1). The policy requires that for major field operations a Safety Representative (SR) be appointed for a term not exceeding 12 months. A SR was appointed through official communication from TANESCO Headquarters on 5 November 2002 but there has been no re-appointment since then, leaving the current officer in charge for a period much longer than 12 months.
- Attendance at Safety seminars (2.12). The Policy requires that the company's field staff attends at least 5 seminars per year without specifying which category of staff or scope and duration of seminars. On the basis of the interview with the Kihansi TANESCO SR, we understand that staff does not attend 5 seminars per year. Although the SR reported that he attended various training courses conducted both by TANESCO and external trainers, such as the Red Cross, he had not yet attended any course this year. In 2004 he attended 4 seminars.
- Safety Audit (2.16). The Policy stipulates that as part of safety monitoring an annual Safety Audit is conducted with a maximum period of two months to take corrective action on any defects. We verified through physical evidence that internal audit reports are prepared quarterly and sent to TANESCO Headquarters. However reportedly, there is no follow-up on these audit reports.
- Running Risk Assessment Programme (2.7.2.). Station Safety Representatives are appointed and station accidents are recorded in an Accident Record Book, the presence of which was verified. However, beyond that there is no comprehensive risk assessment 'made to employees regularly',

as the policy requires. The wording of the policy is not clear, but it is assumed that risk assessment of stations is meant and not individual employees.

- Emergency preparedness (2.23). The Policy requires ensuring emergency preparedness (for dam failure, tower failure, generator failure etc.) in the chain of command. This includes that emergency drills are being conducted regularly. It was reported to us that emergency preparedness is not achieved for the following reason:
 - No emergency drills have yet been conducted;
 - The emergency telephone system in the powerhouse not working; in case of an emergency the staff would need to call externally for rescue;
 - The various facilities, office area and residential area are not in walking distance to each other, however no emergency transportation is available and sirens are missing.
 - There are no radios for the security guards. The non-availability of a radio at the dam presents the largest risk. As we were told, the security company was supposed to provide radios but they have not delivered. The SR at Kihansi has no means of enforcement as the company is contracted through TANESCO Headquarters.
 - An emergency evaluation is outstanding.
- First Aid equipment at key locations and in vehicles (2.1.4) The policy requires provision of First Aid equipment at every workplace and in each vehicle. First Aid kits were found in 12 key locations, however, they are not well equipped and not refilled regularly. In some instances the key for the kit was not available. A problem of theft of first aid items among workers was reported. There are no First Aid boxes in vehicles.
- Fire fighting equipment (2.14). The requirement is that fire fighting equipment be available and serviceable at all installations and in motor vehicles. Although fire extinguishers are available in most installations and some (not all) vehicles, the service of fire fighting equipment is overdue. The SR requested fire blankets. Reportedly the request remained without follow up from Headquarters.
- Regular medical check-ups of staff (2.7.3). Although required by the policy, there are no regular health checks of staff.
- Disease and Accident Reporting to Ministry of Labour (2.17). We were informed that reporting of diseases and accidents to the Ministry of Labour is not undertaken.

From the comments provided by TANESCO on the draft audit report, the auditors note that TANESCO is in the process of engaging a consultant to prepare a risk assessment and emergency preparedness plan for all of the company's activities, i.e. Hydropower plants, Thermal plants, Substations etc. Furthermore a Red Cross team from Morogoro is scheduled to train LKHP staff in November 2005. Lastly, TANESCO informed us that TANESCO and Ministry

of Labour officials inspect TANESCO infrastructures including all Hydro-power plants to check on safety and health compliance as part of the Disease and Accident Report submitted to the Ministry of Labour. This information could not be verified as part of the audit.

7.2 Safety Management and Control System

The observations on the overall managerial approach and the Kihansi TANESCO safety control system refer to matters that are not specifically required for compliance with the company safety statute. However, they relate to areas of potential concern that, in the audit team's judgement, need attention or improvement:

- Follow-up and Enforcement. The managerial procedures for safety concerns pertaining to TANESCO are formal and centralized and have to go from Kihansi to the Headquarters in Dar es Salaam. While this is often the case in site-level operations it can, in the event of slow response from the central decision making organ, make an otherwise well established safety system at site function only sub-optimally. Although all of the exceptions from the policy have been noted by the Safety Representatives and are reflected in Safety Audits and various communication between the Kihansi plant and Headquarters, lack of authority for local decision making and delayed feed-back from Headquarters have led to non-compliance. The system therefore needs to significantly revised to provide for more effective and direct response to the various security concerns.
- Institutional Responsibilities. The TANESCO 1995 Health and Safety Policy is inconsistent with regard to the institutional responsibilities for health and safety issues. While being a joint policy for health and safety issues, it requires only the appointment of a SR. Although Health and Safety Committees are supposed to be established it remains silent about where the overall responsibility for health issues lies. Our observation during the on-site visit was that this separation of responsibilities is reflected in the field level implementation of the policy. While the SR deals with safety issues only, health issues have been delegated to the clinical officer at the dispensary, who is also a member of the health and safety committee. There is no officially appointed Health Representative. Although, as mentioned above this is not required by the policy, it might be an advantage to have such an appointee to ensure better enforcement of the health related aspects in the policy.
- Pest control. There are no measures of pest control and rats have invaded the facilities at various places, most importantly in the switchyard. This presents a hazard and should be addressed as a priority.

7.3 Health & Safety Issues in the Gorge

The steps taken under the IREM project to improve accessibility and safety for visitors to the Kihansi Gorge are commendable, as are the continued efforts at maintaining the walkways, bridges and ladders (see section 3.2 above.).

However, it appears that there are some improvements to be made in the interests of safety. These are described below.

7.3.1 Suspension bridges

- The suspension bridge at the bottom of the Gorge needs to be strengthened and made more stable, possibly by the addition of a third longitudinal support cable. Currently there are only two. The spacing between the horizontal planks also needs to be re-examined. It is possible for someone's foot to slip between the gap between the planks if this is too large. The presence of two handrails on the lower bridge is a positive feature.
- However, the suspension bridge in the Upper Spray zone needs some attention. Two handrails are needed, and in the areas receiving spray, especially on the west side, the boards were extremely slippery. The addition of chicken wire mesh nailed to these boards would provide much needed traction for feet. On the western portion of the Gorge, the area immediately adjacent to the bridge is a slippery, wet rock area. There needs to be a safety railing here to prevent visitors from slipping on the rock and falling into the Gorge.

7.3.2 Wooden Steps

- The steps are very useful and well constructed, but the handrails need to be sanded to avoid that splinters injure peoples' hands. This also applies to the ladders going up the steep rock faces to the water intakes and the top of the falls.
- We noted that boards of the steps had recently been replaced, but that the older unusable boards had simply been thrown aside. Such materials should be removed from the gorge.

7.3.3 Latrines at Visitors Camp and Gorge Technician Camps

- The Latrines need to have a basic roof. This does not need to be of metal sheeting, it could be simply plastic sheeting. This will improve the facilities for users but also to keep water out of the latrine.
- It is important that each "squatting plate" is stable. The easiest way to do this may be to use a preformed squatting plate, or to cast one at the site.
- The hole of the pit latrine needs to be kept covered. A simple lid would be sufficient. It would be useful and low cost to obtain information on standards used to build latrines in other wilderness or ecologically sensitive areas and see that those at Kihansi conform to these.

7.3.4 First Aid, Health and Safety Training

- A first aid kit needs to be kept in the Gorge, as does a stretcher, thus facilitating evacuation. Staff needs to be given basic training in first aid. In addition to falls, sprains, broken limbs, accidents involving sharp edges (knives, pangas) as well as fire (cooking, hot liquid spills) can be expected. We were not provided with information as to what potentially hazardous chemicals might be used as part of the work routine (examples are battery acid, caus-

tic substances, Jik), however training in how to deal with harm from these needs to be addressed.

- We were told that the RAMPO has been requesting a first aid kit since 2004 from LKEMP but without response. We recommend this request be met.
- There are no medical check ups for Gorge technicians and no training on safety and emergency measures is provided. Regular check-ups and capacity building seems warranted
- We understand that there has been no type of accident response or rescue training. There are a number of potential situations, e.g. a fall from a ladder, or into the river, snake-bite, scorpion sting etc., for which such training would be useful. We consider it important for LKEMP to think proactively and anticipate rather than respond to potential accidents.
- A further issue to take into consideration is the risk of infection from Rickettsia (Tick Fever), a general term used to describe the symptoms caused by a certain group of bacteria that are carried by ticks. Apparently it is not possible to confirm its presence using existing facilities in Tanzania, and their blood samples had to be sent to a specialised research facility in South Africa. Gorge technicians and the RAMPO indicated that they frequently were exposed to numerous tick bites. We recommend that as a minimum, the RAMPO and Gorge technicians be made aware of the symptoms of Rickettsia and medical personnel associated with the project also receive this information, and on treatment. The most effective and sure way to deal with the issue would be to regularly test the blood of those who work in the Gorge for Rickettsia causing organisms and treat them if these are found to be present (a specific group of antibiotics can do this if used properly). Since the time of LKEMP, it is possible that facilities in Tanzania for the detection of Rickettsia have become available; it is worth investigating this option. This issue could also be important for TANESCO staff.
- The Gorge Technicians raised contractual concerns towards the audit team. Employee terms and conditions need to be adequate to recruit, retain and motivate staff. It is important that they have medical insurance and work under adequate health and safety conditions.

8 Institutional Aspects

The institutional arrangements of the EMP are complex. The four areas, Catchment, River, Gorge, and LKHP Works Site require the involvement of a range of stakeholders. Monitoring and reporting responsibilities for the various actors are defined in the EMP. Table 11 provides our compliance check against the EMP.

8.1 Monitoring, Reporting and Training

Table 11 shows that while some crucial monitoring and reporting responsibilities are fulfilled as planned, overall the current monitoring and reporting system is not fully in compliance with the arrangements defined in the EMP. Two particular areas warrant action from the authorities:

- First of all, the lack of compliance may be an indicator that some of the reporting requirements may be too cumbersome or not rational. In those cases, the EMP should be adjusted to include monitoring system with quantifiable targets, verifiable indicators, clear reporting responsibilities and an annual review process. The EMP (p. 91) notes that “it is expected that the institutional arrangements will need to be revised”.
- Similarly, the institutional roles have changed from what was foreseen in the EMP. One such example is that the EMP mentions that the responsible institution to subcontract habitat monitoring activities, including vegetation monitoring is TAWIRI (p.84). In practice LKEMP/NEMC has subcontracted all consultants. Such deviations either need to be corrected or the EMP revised.

Some other shortfalls are key deficiencies as they present crucial components of a monitoring system and hence need to be rectified. Without those, the iterative nature of a monitoring system through the cycle of monitoring, auditing, review and revision of the mitigation measures, cannot unfold. These issues are described below.

8.1.1 Annual Monitoring Reports

The EMP states that NEMC is in charge of monitoring the EMP, including the commissioning of environmental audits. NEMC has direct responsibilities to undertake spot checks and prepare monitoring reports with regard to the catch-

ment. The institutional chapter of the EMP specifies that with regard to the Gorge Ecosystem however, an annual monitoring report is to be prepared by the Wildlife Division and not by NEMC. This system is not followed in practice and may hence need to be reviewed.

Presently, the WD is not preparing an annual monitoring report summarizing all monitoring data collected in the Gorge Ecosystem. The annual report, if provided, would fulfil two important functions in the monitoring system:

- The compilation of the data collected through the various specialized studies throughout the year;
- The review process, allowing for a comparison of current vis-à-vis previous years to assess change.

The lack of an annual monitoring report is an indication that data is not systematically collated on an annual basis, analysed and reviewed to verify whether an adjustment of mitigation measures is required.

As pointed out by the World Bank in the comments received on the draft environmental audit report, the improvement of the implementation of the EMP and achieving the desired results will to a very high extent depend on application of survey, research and other findings to help adjust targets and measurable indicators. In the absence of these the reintroduction of the KST for example will be difficult as there will be no way of measuring the readiness of the ecosystem for reintroduction. Improvement of the system to resemble its original status is an important indicator but this is only possible if ecosystem monitoring and data analysis are regular.

We were told that NEMC is conducting regular oversight monitoring visits twice per year and verified this through three sample reports (August 2003, February 2004, December 2004). A brief review of the sample reports does not show a systematic verification of activities against the EMP. This might be due to the lack of targets in the EMP, which makes systematic monitoring and reporting difficult. We were unable to confirm what happens with the recommendations of the NEMC monitoring visits and where and if follow-up action is taken.

In addition to the evaluation reports, NEMC is (per EMP) supposed to prepare an annual monitoring report for the Kihansi Catchment. No such reports were available during the audit. An annual monitoring report on catchment issues will become even more important once the LCWP is moving into implementation so that its progress and efficiency can be verified. Therefore this is an important part of the EMP that should be adhered to.

Another deficiency is that environmental audits were not carried out bi-annually as foreseen in the EMP. The EMP does not specify if the bi-annual audits are supposed to be internal or external audits. It is the view of the audit team that for external auditing, an annual cycle may be sufficient. In contrast, internal audits, may be required more frequently, as there is a need for regular management feedback and internal control. Internal audits are also relatively straightforward and low cost.

Based on the above the following recommendations are made:

- In order to remedy the abovementioned shortcomings regarding data analysis and utilisation of the results to review the EMP a number of key steps are required:
- Revise/Amend the EMP to include a clear monitoring plan in the form of a logical framework. This would include clear targets to be achieved, time-frames, quantifiable indicators and clear institutional responsibilities for monitoring and evaluation.
- Establish an annual monitoring cycle with institutional work plans that define the responsibility for data collection for the agreed indicators, and institutionalise an annual review process.
- During the review process the key parties involved in the EMP implementation submit their annual monitoring reports.
- The outcome of the review process should be that
 - ✓ annual changes of key indicators have been assessed and documented
 - ✓ recommendations for any required adjustments of the mitigation and monitoring measures have been made,
 - ✓ agreement on key outputs for the institutional work plans for the forthcoming year has been reached.
- Although for example the RAMPO is currently preparing and submitting an annual monitoring report, it is not based on a strategic logframe and as far as we could ascertain the report is not scrutinised as part of a systematic review process.
- Establish and up-date regularly a repository for all data collected through studies and consultancies conducted under the framework of the LKHP. Make data widely available through a website and distribute hard-/soft copies to immediate users, i.e. RAMPO, TANESCO field staff etc.
- Annual monitoring reports of the catchment need to be routinely prepared by NEMC.
- A regular cycle of annual external and bi-annual internal audits should be implemented.

Table 11 Monitoring and Reporting Responsibilities in the EMP

Management Unit	Institution	Responsibility	Assessment
Kihansi Catchment	NEMC	Key responsibility for mitigation and monitoring	
		<ul style="list-style-type: none"> Produce evaluation reports and spot checks 	<ul style="list-style-type: none"> Being done. Evidence found for 3 reports
		<ul style="list-style-type: none"> Evaluate AgES, RBWO, FBD 4 monthly reports 	<ul style="list-style-type: none"> Not being done.
		<ul style="list-style-type: none"> Produce annual monitoring report, copies presented to AgES, MoA, RBWO, MWLD 	<ul style="list-style-type: none"> No evidence found
	Ages, RBWO, FBD	<ul style="list-style-type: none"> Submit regular 4 monthly progress reports to line ministries, copied to NEMC 	<ul style="list-style-type: none"> Not being done
Kihansi River	RBWO	<ul style="list-style-type: none"> Monitoring of flow 	<ul style="list-style-type: none"> Is being done, though with short-falls (see Chapter 5) Financing of monitoring activities not sufficient
		<ul style="list-style-type: none"> 4 monthly reports to RBWB and MWLD with flow measurements 	<ul style="list-style-type: none"> Reports submitted to RBWB. Flow measurements sometimes incomplete.
	RBWB	<ul style="list-style-type: none"> Analyse RBWO reports and send to NEMC and TANESCO 	<ul style="list-style-type: none"> No evidence found.
	TANESCO	<ul style="list-style-type: none"> Send discharge and flow data to RBWO 	<ul style="list-style-type: none"> Is being done on weekly basis.
Gorge Ecosystem	NEMC	<ul style="list-style-type: none"> Overall monitoring responsibility Bi-annual auditing 	<ul style="list-style-type: none"> So far only 1 audit (this one).
	TAWIRI/RAM PO	<ul style="list-style-type: none"> On-site habitat monitoring Sub-contract specialised elements 	<ul style="list-style-type: none"> Is being done Sub-contracting being done through LKEMP
	TANESCO	<ul style="list-style-type: none"> Fully financing of Gorge monitoring based on bilateral agreements with implementing agencies. After regulations of EMA have passed, fundings needs to be transferred into Environmental Management Fund 	<ul style="list-style-type: none"> Not done.
	TAWIRI Monitoring and Mitigation Team at Gorge	<ul style="list-style-type: none"> 4 monthly progress reports provided to Wildlife Division After each visit of MNRT provide monitoring reports copied to NEMC; providing information on the performance of mitigation measures, prioritising actions 	<ul style="list-style-type: none"> Reports prepared but provided to LKEMP No evidence found.
	WD	<ul style="list-style-type: none"> Prepare annual monitoring report summarizing all compiled data, copies to each line ministry and NEMC; 	<ul style="list-style-type: none"> Not being done.
LKHP Works Site	TANESCO, Head Engineer	<ul style="list-style-type: none"> Monitoring of activities Reporting based on internal procedures 	<ul style="list-style-type: none"> Is being done. Reporting is done.

8.1.2 RAMPO Annual Workplan and Progress Reports

We verified quarterly reports sent to LKEMP and TAWIRI. There is no institutionally agreed workplan for the RAMPO but she develops one for her own purposes. We were told that there is usually no follow-up on the reports.

While the RAMPO is preparing an annual work plan and provides the required quarterly progress reports, these reports are currently provided to LKEMP and not the WD as outlined in the EMP. This, in our view is however not the most crucial issue. More importantly, the work plan is currently based on the RAMPO's own initiative and not institutionalised. For example, it is not based systematically on the objectives of the mitigation programme and the review of progress. We therefore recommend that

- Progress reports are reviewed regularly, work plans are formulated subsequently and action is taken in a timely manner.

8.1.3 TANESCO Funding of Mitigation in the Gorge

TANESCO is presently not funding the mitigation and monitoring activities in the Gorge as required per EMP. We were informed, TANESCO is planning to budget for this in the next financial year 2006/07.⁶

- TANESCO needs to take responsibility for the monitoring and mitigation programme in the Gorge and budget accordingly.

8.1.4 Training Provided

The EMP foresees that various implementing institutions, i.e. RBWO, Health Department, Agricultural Extension Service (AgES), Forestry and Beekeeping Division (FBD) and TAWIRI field staff; undergo training on reporting procedures. Such training was not provided. However, we could also not establish evidence that uniform reporting procedures have been developed.

- There is hence a need for clarification if such procedures need to be formulated and training to be provided accordingly.

8.2 Coordination

The EMP outlines two areas of coordination, government agencies amongst themselves, and coordination with local stakeholders.

The LKEMP Multisectoral Steering Committee (MSC) and the Multi-disciplinary Technical Advisory Committee (MTAC) provide the basis for coordination activities within government.

We note that two of the implementing agencies of the EMP are not included in either the MTAC or the MSC. These are the Ministry of Agriculture Extension Service responsible for land use, encroachment and use of agrochemicals; and the RBWO. Similarly, none of the District Councils participate in the LKEMP

⁶ Pers. Comm. With TANESCO on 07.07.05

Coordination bodies. Districts are represented by their respective Regional Administrative Secretary (RAS). Whilst the inclusion of the RAS of Morogoro and the RAS of Iringa Region in the MSC is based on the assumption that information is shared systematically with the relevant District Councils, it seems that this is not always the case. Mufindi District recommended to the audit team that regular meetings should be held with LKEMP and TANESCO to increase information sharing.

All the above institutions are classified as 'local stakeholders' in the EMP. This may explain their exclusion from the MSC and the MTAC. Since these institutions are however mentioned as implementing agencies under various components of the EMP, a problem arises if they do not have sufficient access to information.

With regard to coordination with local stakeholders we note that the EMP includes requirements for public disclosure of environmental monitoring results. Specialised reports will need to be translated into Kiswahili and shared with the public. Whilst we found no evidence to support that this has been done, we note that the EMP remains silent about 'which' data needs to be published and which form of public disclosure/consultation is recommended. This needs to be clarified.

It is against this background that we recommend:

- A review of the institutional set up of the LKEMP with a view of full inclusion of all relevant stakeholders and more complete and timely sharing of information.
- Public disclosure of environmental monitoring results and studies undertaken by LKEMP. The public includes not only the national and international research community but also village communities around Kihansi and elsewhere in Tanzania.

8.3 Ultimate Responsibility for Mitigation and Monitoring

Presently, the implementation responsibility for the mitigation measures in the Gorge lies with LKEMP/TAWIRI through the RAMPO. The EMP mentions the "*agency ultimately responsible for mitigation*" without clarifying who this is.⁷

The minutes of the LKEMP Midterm Review Process state that the ultimate responsibility for the Kihansi Gorge environmental management and monitoring system remains with the developer, TANESCO. This responsibility has been confirmed to us in our meeting with TANESCO staff as part of this audit. The question remains to what extent TANESCO is building capacity and financial reserves to prepare for the take over after December 2006, when LKEMP closes.

⁷ in footnote 17 on page 71

In this context the aspect of decommissioning is also relevant, which is dealt with in Section 8.4 below.

It is also important to note that TANESCO has not yet received the Land Title for the project area at Kihansi. Although the process has been initiated in 2001/02 it is still pending with the Ministry of Lands.⁸

Hence, recommendations to be made are that

- the long-term institutional responsibilities for the Kihansi area need to be clarified and formalised in documents and through the creation of job responsibilities; and
- the process of granting the land title needs to be finalized.

8.4 Decommissioning

The EMP (p.72 and p 105) under mitigation measures at the LKHP Works Site requires that a decommissioning fund be set up within TANESCO to cover for the cost of the decommissioning of the dam after the project's lifespan. The estimated financial cost for decommissioning is about US\$ 35,000 annually over the expected lifetime of the dam of at least 50 years. The cost and negative environmental impacts (in particular reservoir silting) associated with decommissioning are large.

In addition, the Environmental Management Act, 2004 Section 102, sets the legal basis, requiring TANESCO to “*undertake safe decommissioning, site rehabilitation and ecosystem restoration upon the expiry of a project.*”

We were informed that, to date, TANESCO has not set aside any funds for decommissioning. This is due to the misconception that building these financial reserves is not required as long as there is LKEMP/World Bank support to the project.⁹

A question arises also regarding the long term responsibility for the Kihansi Area, even after decommissioning. There might be long-term environmental impacts associated with the hydropower project. It is important for the managers of the Kihansi area, that only TANESCO, but others, study cases from other countries in which dams have been decommissioned and to learn from their experiences, not only for LKHP, but for other hydropower projects.

In conclusion, the team would like to make the following recommendation:

- TANESCO, involving other stakeholders, is encouraged to plan for and set aside funds for decommissioning, incorporating lesson learned and best-practise from other decommissioning projects. Careful planning needs to include Human Resources planning and development.

⁸ Pers. Comm. With TANESCO on 07.07.05

⁹ Pers. Comm. with TANESCO on 07.07.05

- Since TANESCO has no prior experience of decommissioning a hydro-power dam, we recommend that several key TANESCO staff receive training in the complexities of this topic. This shall include among others impacts on public health, socio-economic impacts, risk assessment, and biodiversity related impacts.

Part 3 - Socio-Economic Aspects

9 Introduction

This part of the report deals with socio-economic aspects in the villages adjacent to the LKHP area. While the EMP does not include any socio-economic mitigation or monitoring measures for the adjacent communities, it does refer to a Landscape Wide Conservation Plan for the Kihansi Upstream Catchment (LWCP) as an instrument to operationalize such measures. As the LWCP had only just been finalised at the time of this audit, the assessment of the implementation of social mitigation measures is limited to a theoretical verification of the extent to which the various potential social impacts identified in the EMP have been addressed under the LWCP.

In addition, it was agreed with the Client during the pre-audit meeting that a wider assessment of socio-economic aspects would be included in the environmental audit. The focus would be twofold: firstly to verify if the activities of the previous community programmes conducted during the LKHP construction phase have been continued by the Local Authorities; and secondly, to provide a 'quick-scan' assessment of how the communities are being affected by LKHP during its operation. Conclusions on both, have been based on interviews with the communities during the site visit and future recommendations have been formulated accordingly in this Chapter.

9.1 Scope

Previous community-oriented projects operational during the feasibility study and construction phases of LKHP included MUAJAKI (*Mradi wa Ushirikishwaji Afya ya Jamii*), SEMA-Ki (*Socio-economic Mitigation and Monitoring at Kihansi*) and the CMP (*Catchment Management Plan*). All three projects ended in 2003. The objectives of these projects were to mitigate adverse impacts of LKHP and ensure that the communities had the capacity to take over any initiated activities when the projects ceased. An overview of the project objectives and the residual impacts expected during the operation of LKHP are presented for each MUAJAKI, SEMA-Ki and CMP in Appendix 9 .

With regard to the question of sustainability of the MUAJAKI, SEMA-Ki and CMP activities, Appendix 10 provides three tables, which describe the extent to which activities initiated under the respective projects have been continued by the local governments after project closure.

The timeframe of the on-site audit was brief and not sufficient for an in-depth socio-economic study or project evaluation. Thus, this Chapter can only serve as an overview on the presently prevailing socio-economic aspects and is hence not meant to be taken as a detailed social or poverty audit.

In addition to the fieldwork, the socio-economic analysis included a desk review of the LWCP. The purpose of the desk review was to establish if the LWCP had taken up all social monitoring and mitigation measures as planned in the EMP.

While section 9.2 outlines the methodology followed during the fieldwork in the villages, chapter 10 presents the results of the socio-economic analysis. Section 10.1 contains the results of the desk analysis comparing the LWCP with the planned measures in the EMP and all following sections present the findings of the fieldwork. Section 10.2 deals with public health issues supported under the MUAJAKI programme; Sections 10.3 and 10.4 with water supply and livelihoods issues, which were the focus of the SEMA-Ki programme. Additional aspects raised by the villagers during the interviews are presented in sections 10.5 and 10.6. Section 10.7 contains the results of the interview with District officials and section 10.8 summarizes the findings with a few recommendations.

9.2 Methodology

This Chapter is based on findings from five sample villages selected for inclusion in the scope of this audit of the LKHP. Two of these villages are located in the catchment area of the Kihansi River and three are on the lowland (see Box 2). The village selection was based on the vicinity to LKHP and the expected level of impact from the project. Meetings with government representatives were held in all five villages. For a list of names see Appendix 2. In addition to these villages, one of the two Districts in the LKHP area was visited. Mufindi District Council was selected as it also features in the LWCP and is crucial for the operation of LKHP.

Box 2 Brief Description of Sample Villages

Mlimba, Kalengakelu and Udagaji are the lowland villages. Mlimba is the closest business centre to LKHP. It also serves as a train stop for the TAZARA railway. Kalengakelu is the next closest village to Mlimba and along the road to LKHP, thus a number of LKHP staff reside in this village. Udagaji is a sub-village of Chita, which was initially only a few households prior to LKHP and has rapidly grown to a sub-village category due its direct vicinity to the LKHP gate.

The two villages in the catchment visited are Uhafiwa and Ukami. Uhafiwa is at the reservoir edge and Ukami is at the dam site. With the exception of Uhafiwa all the villages visited experienced population increases by influx of migrants looking for income from LKHP. Udagaji has had the greatest level of impact from LKHP with regards to migrant population influx. The catchment villages rely mainly on subsistence agriculture for their livelihoods. LKHP has, to a considerable extent, changed the land use patterns in the area by inundating the River, taking arable land from the villagers and by advocating conservation practices that focus on the availability of water for hydropower generation.

The auditors interviewed members of the Village Government and relevant District Council personnel. A pre-formulated checklist (see Appendix 4) aided the information collection in the villages and at the District office. The checklist was developed to cross check the achievements of the three community oriented programmes mentioned above, based on the desk review of relevant project documents. The interviews were semi-structured and provided opportunity for the informants to provide feedback, recommendations, raise concerns and add issues of interest. Personal observation by the auditor provided triangulation of findings and additional results.

10 Findings

10.1 Socio-Economic Aspects in the LWCP

The LWCP translates the recommendations of the CMP into a long-term catchment plan with the aim of ensuring a sustainable catchment management system.

As expressed by the World Bank in the comments received on the draft audit report, the LWCP is expected to play a fundamental role in addressing community related issues arising in the context of the LKHP. The main objective of the LWCP is to extend the environmental and natural resources management planning processes to the wider landscape and upstream areas. Central to the plan's implementation is the full and committed involvement of the communities and as such ensuring joint conservation of the resource base.

In the EMP the LWCP is referred to as a 'long term plan that embodies the EMP and furthers the scope to a landscape wide setting'. While, the LWCP generally addresses the various issues mentioned in the EMP, the scope of geographical coverage, mitigation and monitoring appear to have altered slightly from what was foreseen in the EMP. For example, in the EMP a number of lowland villages, considered to be part of the Kihansi impact zone, were to be included in the LWCP but this has not been the case. Also, certain studies that were to feed into preparation for the LWCP have not been conducted. Table 12 overleaf presents a detailed account of the socio-economic issues in the LWCP (September 2005) compared to what was planned in the EMP.

In brief, the comparison between EMP and LWCP shows the following discrepancies:

- A time delay of about one year in the finalization of the LWCP;
- The nature and extent of involvement of NEMC in the preparation of the LWCP is not clear;
- Downstream villages of *Mlimba*, *Kalengakelu*, *Chisano* and *Udagaji* of *Kilombero* District are not included.

Table 12 Reflection of Socio-Economic Issues in the LWCP

EMP on LWCP	LWCP	Consistency with EMP
Formulation: (pg 9) in 2004 with assistance from NEMC	Final version handed to LKEMP in September, 2005	Time delay
Focus: (pg 9) Socio-economic issues and health in Kihansi River catchment	(pg xiv) Protection of water body in Kihansi dam by addressing socio-economic issues among the inhabitants of the catchment	None
Extent: Larger setting which embeds EMP, a live document subject to revision	Extends EMP updated planning process to wider landscape and upstream catchment areas. A live document subject to review every 5 years	A specific time frame for review has been set
Coverage: (pg 7) LKEMP project area including <i>Mlimba, Ukami, Uhafiwa, Udagaji, Chisano</i> and <i>Kalengakelu</i> villages. Area is outside LKHP	(pg 4) Includes the Kihansi River basin with 10 sub-catchments. There are 14 villages in two districts <i>Kilolo</i> and <i>Mufindi</i> .	Villages of <i>Mlimba, Kalengakelu, Chisano</i> and <i>Udagaji</i> of <i>Kilombero</i> District are not included as they are on the lowland. THE LWCP adopts all villages from the CMP.
Mitigation in Catchment: (pg 63) a) Human health programme b) Natural resources (includes water resources) management programme	(pg 156) List of activities for four components of mitigation provided; a) Conservation farming practices adopted b) Improved livelihood options available c) Biodiversity and Environment Services maintained d) Improved enabling institutional and policy environment	None
Mitigation in the Gorge ecosystem: (pg 71) Mini-catchment study findings to be integrated into LWCP		No mention of mini-catchment study findings
Links to other programs: (pg 80) LKEMP and the EAMCEF	EAMCEF, World Bank and UNDP emphasised as funding sources	Additional funding sources e.g UNDP included
Monitoring in the Catchment: (pg 82) Establish a baseline with recent satellite or aerial imagery for the area. Study to include ground truthing and a socio-economic study of driving force behind changes.	(pg 26) Use of a satellite image of 2003 to determine land use and land cover changes from 1999 classification map.	None

During the process of preparation of the LWCP, Participatory Rural Appraisals (PRAs) were conducted in 7 villages¹⁰. The main aim of the PRAs was to feed into the LWCP and enable long-term conservation. The PRAs revealed that the main threats to sustainable catchment management are the lack of financial and technical resources to conduct conservation activities. In response to this LKEMP prepared a handbook of guidelines for the preparation and implementation of sub-projects. This handbook outlines the process whereby villages can apply for small grant funding (via the Districts) to LKEMP. These grants are only available for communities in the LWCP focal area, i.e. the 14 villages in both Kilolo and Mufindi Districts.

Our findings on the continuation of MUAJAKI, SEMA-Ki and CMP activities are presented in the following sections.

10.2 Public Health

The MUAJAKI project was geared towards addressing health related impacts associated with the LKHP, in particular prevalence of malaria and sexually transmitted diseases (STDs). One of the mitigation measures provided through MUAJAKI was public health education. The implementing bodies were the health departments in the responsible Districts.

In both catchment villages, *Uhafiwa* and *Ukami*, primary health attendants were trained by MUAJAKI on how to monitor malaria cases including malaria mortality. This is no longer done. Public education on how to prevent malaria is provided regularly including use of mosquito nets and prevention of the spread of vector habitat by local government clinical officers. Mosquito nets are available for a subsidized price to women for Tsh 1,500/- per net (including “ngao”, a repellent). The regular price is Tsh 3500/-.

We were told that in *Ukami* and *Uhafiwa* the District has taken over the following activities related to health:

- Maintaining the running cost of the village dispensary including quarterly supply of medicine;
- Mother and Child Healthcare (MCH) education but at a limited level due to insufficient staff and technical support;
- Maintenance and supply of equipment used for testing malaria and STDs and HIV;
- Health education conducted by clinical officers for local community and individuals on STDs and HIV. In *Ukami* an educational session is conducted for one particular disease every working day. In *Uhafiwa* village no such education has been provided since the phasing out of MUAJAKI.
- In *Ukami* condoms are distributed for free by the village government dispensary with subsidies from the District Council. In addition, condoms can

¹⁰ 2 from Kilombero district on the lowland (Chita and Mlimba), 3 villages from Kilolo district (Ng'ungula, Masisiwe, Boma la Ng'ombe) and 2 villages from Mufindi district also on the catchment (Igeleke and Mapanda).

be purchased in local shops for Tsh 100/- per packet. In Uhafiwa purchase is the only option.

- A villager in *Uhafiwa and Ukami* has to pay Tsh 5000/- per year to become a member of the dispensary eligible for treatment. This membership does not include cost for drugs. Alternatively Tsh 1000 have to be paid for every visit to the public dispensary to receive a consultation. The majority of the villagers are only able to afford the latter option.
- Data on malaria cases is being compiled weekly, monthly and quarterly by the dispensary as a routine activity. This occurred even prior to the project.

In the lowland villages health issues are not highlighted as part of the impacts associated with the operation of LKHP. However, the audit team understands from village meetings that health issues prevailing among communities in the catchment are even more pronounced in the lowland. This might not be only due to the presence of LKHP. Other major contributing factors might be the overall better developed infrastructure in the lowland villages, for example the road to Ifakara, the JKT (Jeshi la Kujenga Taifa) camp at *Chita* and the Tazara station in *Mlimba*.

During the construction phase of LKHP health services in these villages were to be improved as follows:

- In *Mlimba A* a dispensary was built and the cost of services were provided by LKHP. The local government is presently managing this dispensary.
- In *Kalengakelu* village a dispensary was constructed and funded by MUAJAKI.
- *Udagaji* has no dispensary but treatment is currently available from the TANESCO dispensary at the Lower Kihansi Hydropower plant.

In the lowland malaria is endemic particularly in the rainy season. This has always been the case, even prior to the construction of LKHP. Due to the severity of the problem monitoring of malaria cases has always been a government activity. Measures taken to reduce malaria cases with MUAJAKI support include health education, provision of mosquito nets and treatment.

The second most prevalent illness after malaria is typhoid associated with the shortage of clean water, improper sanitation and the tendency to drink water, which has not been boiled. The lack of sufficient sources of clean water has forced most people to use water from shallow wells that have been subject to contamination by the shallow latrines. The problem is worse during rainy seasons when most people leave their homes and establish temporary settlements in the agricultural areas, far from sources of clean water.

MUAJAKI conducted educational sessions on STDs and HIV in the lowland communities. Some members of the communities were trained to become counsellors and peer educators. However it has been reported that they are not using their education to help others. We were told that the problem of HIV is now becoming more serious and the village has no facilities to deal with it.

MCH is also a problem for all villages on the lowland. The dispensaries do not have adequate facilities to handle birth complications. The District Hospital at

Ifakara town is the closest medical centre far from the LKHP area to which there is no public transport from any of the other villages. Private transport is available at a price of Tsh 72,000 for fuel and has to be paid up-front before one is taken to the hospital.

On the lowland, cost sharing arrangements for health services differ slightly from that in the catchment villages. The costs are: Tshs 200/- for registration; consultation and purchase cost depend on ailment. Drugs have to be brought from the pharmacy. In *Udagaji* villagers attending the Kihansi dispensary have to incur similar costs to those of *Mlimba* and *Kalengakelu*. In contrast to the catchment villages there is no membership programme on the lowland. Likewise there are no subsidised nets for pregnant mothers as all nets are sold for Tshs 3500/-.

All down stream villages report the absence of proper sanitation facilities. We were able to verify that only few people have adequate latrines that were constructed by the MUAJAKI project. After the project no efforts were made to continue the initiative to increase access to improved latrines. As a result, shallow pit latrines are commonly used, which can potentially contaminate water used for domestic purposes.

10.3 Water Supply

The SEMA-Ki project assisted with supply of clean water and livelihoods activities.

In *Mlimba A*, one of the lowland villages, LKHP constructed five deep wells that use electric pumps to supply water to the villagers and the LKHP staff living in *Mlimba A*. A water user group was formed to manage the water supply and to collect Tsh 10/- per bucket to cover the running cost, including the electricity bills. In practice the smooth operation of wells has been hampered by lack of good governance in the water user groups. Despite the collection of fees, the money has not been used to pay the bills. As a result TANESCO had to disconnect power to some of the wells as a disciplinary action, leaving only two wells operational. However, even for those in operation no payments have been made and the current debt stands at 25 million Tshs. With only two wells operational water supply has become a problem in *Mlimba A*. This is exacerbated by the rapid increase in the population due to migration and high birth rates. The shortage of water has led to increased incidence of diseases such as Typhoid and Diarrhoea which rank second and third in the number of cases in *Mlimba A* in the village health records.

In *Kalengakelu* village water is obtained from wells using hand pumps constructed by SEMA-Ki and other wells constructed by the District Council through the Village Government. The current supply of water is insufficient to sustain the population in the village that amounts to a total population of 6449 people.

Similarly in *Udagaji*, the villagers get water from wells that use hand pumps, also constructed by SEMA-Ki and District Council through village govern-

ment. Water supplied by wells is not enough to sustain the population of 1535 people. It was reported to us that most of the villagers obtain water from streams flowing from the Udzungwa Mountains and water from wells supplements their requirements.

In the catchment villages water is obtained only from streams. No well was constructed, either by SEMA-KI nor the District Council. In *Ukami* village water is reportedly a significant problem as there are few permanent streams compared to *Uhafiwa*. The villagers depend on two permanent springs found down the valleys, which are not adequate and the level of safety for domestic use is questionable. Though water availability in *Uhafiwa* is not a problem, cleanliness and safety of the stream water is uncertain.

10.4 Livelihoods

Subsistence agriculture is the principle income generating activity for both catchment and lowland villages. Crops produced include rice, maize, cassava, peas, groundnuts, and finger millet. Part of the produce is sold to pay for other non-agricultural food products (e.g. sugar, salt, tea) and other requirements like hospital expenses. The market for these crops is limited particularly in the catchment due to the lack of infrastructure and transport. Villagers from *Uhafiwa* carry 20 - 30 kg of maize, beans or millet over 40kms down the escarpment to *Chita* to sell it at a price between Tsh 2000 to 5000.

Access to markets is less of a problem in the lowland villages as traders come to the villages to buy crops. In *Kalengakelu* village the District introduced sunflower as a cash crop. There is also an Irish Aid supported livestock project. Natural resource exploitation through charcoal burning, timber harvesting and fishing was reported to us as common.

In the catchment villages alternative sources of income are limited. Woodlots were introduced by SEMA-KI and CMP as a source of income. Reportedly, very few people can afford to buy the seeds (Tsh 500/- per seedling) and the concept of tree planting is still not well adopted as concept of preserving the environment for future generations. Thus, we were informed that exploitation of natural resources continues in the area.

10.5 Employment Generation and Community Relations

The EMP (pg. 57 onwards) advises that TANESCO and other implementing agencies should uphold a 'locals first' policy when employing new staff. This policy should give preference to members from the local community provided they have the skills required for the job.

Upstream villages report that there has been no employment generation through the LKHP. Villagers in the downstream communities acknowledge the fact that there was employment generation during the construction phase but report that it has decreased substantively post construction. We were able to confirm that occasional labourers are hired from downstream villages to maintain, for example, the re-vegetation efforts along the Kihansi road. Various sources confirm

that the post-construction employment effect is small as the majority of TANESCO staff has been brought in from other power plants elsewhere in Tanzania. This is perhaps not surprising as the operation of a hydropower plant needs specialised skills and training.

The EMP recommends the inclusion of community relations programmes in the social mitigation measures listed for the LKHP works site (p.72).

We understand that while there is a TANESCO representative responsible for environmental, health and safety issues relevant to resident staff, there is no contact person for communities. It was reported by the villagers that the contact between LKHP and villagers in the adjacent communities is minimal, in particular with regard to the two upstream villages visited as part of this audit.

All three projects suggested that a Kihansi Management Committee be established to deal with community activities during operation of LKHP. However this was not set up. Hence the communities feel that they do not have a platform of discussion with the LKHP.

10.6 Land Issues and Lack of Electrification

Villagers resettled during the LKHP construction phase in the *Udagaji* village area were compensated for crops and houses through the relevant Local Authorities. During the site visit the communities raised concern for the discriminative attitude which allows TANESCO staff to farm on land that they had to give up in the name of 'conservation'. Furthermore, the villagers feel that the population influx triggered through LKHP has decreased land availability and increased land conflicts.

A justification for the allocation of farm land to TANESCO staff on former village land is not provided in any documents reviewed by the audit team. It would rather seem rational that TANESCO staff, which has purchasing power, would contribute to the economies of the local farmers by buying their produce rather than farming themselves on former village land. This situation seems to create tensions between local population and TANESCO staff.

The lack of electrification was aired as a concern in all villages visited. Only one sub-village, *Mgugwe* of *Chisano*, close to the previous MUAJAKI camp is electrified with power from LKHP. This village which was not included in the EA, has attracted a number of LKHP staff who do not reside in the camp and thus TANESCO has electrified this village.

It is understandable that the sight of power lines going through a village to electrify a distant municipality in a scenario where power is unavailable locally leads to discontent. The complexities of rural electrification and the lack of economic viability for TANESCO to electrify individual villages are known. This problem would need to be addressed on a national scale and not only at Kihansi. For example the Rural Electrification Fund set up under the Ministry of Energy and Minerals could prioritise those villages in vicinity of hydropower

plants, as a means to decrease tension and to generate local goodwill and support.

Allegedly during campaigning for the LKHP the villagers were promised by NORPLAN and District officials that their villages would be electrified. Although this may generate goodwill in the short run, it is likely to turn into the opposite in the long run.

10.7 Findings from Mufindi District Council

The District Council had close contact with LKHP from project feasibility through to operation. The consultant, NORPLAN, on behalf of the client, TANESCO, ensured all progress reports of relevance from the feasibility and construction phases were copied to the District Council. In particular reports from the social oriented projects were sent as it was the intention that these were to be handed over to the District.

Since the closure of the community oriented projects, the District has taken over the administration of the LKHP constructed dispensary and teacher accommodation at *Uhafiwa*; and the health staff quarters at *Ukami*. However, the following difficulties were reported to us:

- Financial constraints: The funding at the District is not sufficient to continue the activities initiated under the MUAJAKI and SEMA-Ki projects. Mufindi District has 132 villages of which only 14 are within the area of concern to LKHP. The District receives approximately Tshs 3 million from the Central Government and collects approximately Tshs 4.5 million from local revenue to carry out all its activities. The budget allocations presented in the EMP for Local Authorities (US\$ 30,000) must have been notional allocations as they were not effected to the Districts.
- Technical constraints: District staffing in the two wards within the Kihansi area is inadequate.¹¹ The District has recently signed an agreement with the Tanzania Social Action Fund (TASAF) but no funding has been forthcoming to date.
- District priorities: HIV/AIDS in Mufindi is considered especially important on the tea and timber plantations where there are large numbers of migrants living in camps and thus efforts to combat the problem are focused in these areas. Another development suspected to have increased HIV/ AIDS cases is the road through the District. LKHP is not considered a main contributor to the problem.

The District brought forward the following recommendations:

- LKEMP and TANESCO to meet with the respective communities and District to draw up action plans for sustainable management of the catchment.

¹¹ Natural Resources (3); Health (8); Community Development (2) and Agriculture and Livestock Development (4). The two wards are Kibengu and Mapanda. It should be noted that there are more than 14 villages in these two wards and that the district staff are for the wards and not restricted to the 14 villages.

Since the workshop held in July 2003 nothing has been forthcoming from LKHP. District Officials would like more regular meetings with LKEMP and TANESCO.

- LKHP should provide education, incentives or alternative income generating activities to the communities in areas where farming is detrimental for the dam and reservoir. During the SEMA-ki project people were told not to fish, or to plant eucalyptus trees. However alternatives need to be provided, in order for these recommendations to be followed.

10.8 Summary

It is reiterated that the time available during the audit site visit precluded gathering sufficient information for an in-depth socio-economic appraisal. Thus, the information presented in this chapter and the conclusions made cannot be generalized for all the villages in the LKHP area or the LWCP focus area. However, the findings correspond to concerns raised by the respective communities visited and related to the MUAJAKI, SEMA-Ki and CMP programmes that justified their operations during LKHP feasibility and construction.

The following broad conclusions can be made from the socio-economic analysis:

- There is poor continuance of activities initiated by the socio-economic programmes of the construction phase as the District governments are not capacitated to do so.
- The communities were not informed sufficiently on the impacts of the various components of LKHP, i.e. feasibility, construction and operation and more specifically who is responsible for what.
- There is no platform for community concerns during the operational phase of LKHP.
- Community expectations of the LKHP have not been met due to falsely raised hopes during feasibility and construction.
- Inconsistency on the issue of land conservation by TANESCO resulted in ill feeling on the part of the community.
- There was insufficient awareness raised on how to cope with impacts of a hydropower plant development in the area.
- Health issues are still an important area to be addressed, particularly HIV/AIDS and malaria in both lowland and catchment villages.

To address these discrepancies the following corrective measures are recommended:

- A conservation plan that focuses on the lowland communities would mitigate environmental degradation in the lowland.
- Inclusion of lowland villages in the LKEMP small grants scheme.
- TANESCO needs to establish institutional responsibility to deal with community concerns related to LKHP.

Part 4 - Recommendations and Conclusions

11 Recommendations

Based on the audit findings presented in the preceding Chapters, the audit team brings forward recommendations for remedial action. The recommendations have been highlighted throughout the report and have been summarised in this chapter in bullet form.

For additional information, the reader is referred to the corresponding Chapters.

11.1 Kihansi Gorge Ecosystem

11.1.1 Artificial Spray System

- Introduction of a double tank system for all three spray wetlands;
- Measurement of pressure and installation of filters;
- Mechanism to allow rapid purchase of spare parts;
- More frequent pressure checks on each sprinkler during the rainy season;
- More frequent cleaning of sedimentation ponds;
- WD should abide with the Water Act of 1974 Section 15;
- Introduce sprinkler precipitation measurement into the monitoring regime.

11.1.2 Gorge Maintenance Infrastructure

- Improve safety conditions of the Gorge maintenance;
- Conduct EIA for all planned research related infrastructure prior to the finalization of their design plans.

11.1.3 Habitat Monitoring

- Further training of the Gorge Technicians on first aid, water quality monitoring and short courses on ecology and conservation;
- Reports of studies and consultancies should be routinely shared with the RAMPO office;
- Give RAMPO more flexibility to take decisions relating to day to day management of activities in the Gorge, e.g. control over sufficient funds to purchase spare parts;

- The water quality meter should be repaired to facilitate measurement of turbidity;
- Make provisions for periodic testing sediments, BOD, COD, and bio-monitoring and monitoring of organic substances used as pesticides or fertilisers should be made;
- Repair and replace RBWO and LKEMP data loggers;
- Conduct Chytrid studies using 'swabbing' technique on amphibians to investigate prevalence of Chytrids in the Gorge.

11.1.4 Gorge Access and Safety Protocol

- Improve enforcement of bleach foot bathing procedures;
- Take preventive measures to address theft of equipment.

11.1.5 Ex-situ Captive Breeding Programme

- Ensure wider and timely sharing of information gained from Captive Breeding programme.

11.1.6 Kihansi Scholarships

- Establish database and website to ensure accessibility of information to all parties;
- Extension of scholarship programme to include funding and activities for conservation education at primary and secondary schools in LKHP adjacent communities.

11.2 Vegetation

11.2.1 Size of Spray and Vegetation Changes

- Further study is required to monitor if there are changes in vegetation characteristics with the current flow regime.

11.2.2 Vegetation Monitoring

- The RAMPO should be trained further particularly on aspect of plant identification.

11.2.3 Related Studies

- Establishment of the baseline and scientific protocol on epiphylls monitoring.

11.3 Kihansi River Hydrology

11.3.1 By-pass Flow

- Explore possibilities of using rectangular open channel to countercheck flow from the bypass pipe;

- RBWO should download data from the loggers on monthly basis for effective monitoring water flows in the Kihansi river;
- RBWO need to improve reading and collection of data from the river gauge station by providing transport to the responsible staff;
- Staff gauges installed at river stations need to be used to calibrate the data loggers;
- Any gauging stations currently not functioning should be rehabilitated and a reliable and timely routine maintenance system established;
- TANESCO and RBWO should exchange hydrological and hydraulic data on the Kihansi river on real time basis as proposed in the EMP.

11.3.2 Hydrological Monitoring

- Specific training is required for the RAMPO to carry water quality monitoring;
- The river water need to be routinely tested against sediments, BOD, COD, and also bio-monitoring e.g levels of phytoplankton;
- Research and Consulting reports need to be routinely shared with the RAMPO office;
- Field testing of water quality need to follow closely the Tanzanian Water Utilization Regulation. This will include monitoring of organic pollution introduced artificially and organic pollution of natural origin.
- RBWO should repair any non-functioning measuring instruments and implement a timely routine maintenance practice. The reading of gauges needs to be undertaken regularly.
- Training of RBWO staff at site needs to be provided as foreseen in the EMP.
- The monitoring of diversions for the Kihansi domestic water supply and spray wetlands by RBWO needs to be done in a systematic manner.
- The financial viability of RBWO monitoring needs to be reviewed.

11.3.3 Monitoring at the Dam

- As proposed in the EMP it is important to have a standard procedure for monitoring seismic events and structural stability of the dam, standard procedures for monitoring sedimentation rate in the dam and release of sediments from dam during flushing operations.
- Repair dam monitoring tools, e.i. piezometers, presently not functioning.

11.3.4 Hydrological Modelling

- Correct inconsistencies in the reporting on the total number of gauging stations;
- A more consistent presentation of responsibilities/ownership of the various gauging stations in the reports would be desirable;

- Verify to what extent foreign technology can be replaced by simple, locally available technology so that parts and spare parts for various equipment can be obtained at more reasonable prices;
- Consider, a change in management structures, favouring those closer to the operations as it may yield efficiency gains, for example recruitment and placement of resident technicians at the site.

11.3.5 Other Issues

- Clarify (or delete if not applicable) the requirement in the EMP that TANESCO and RBWO should exchange hydrological and hydraulic data on the Kihansi River on real time basis.

11.4 Erosion, Fire Control and Waste Management

11.4.1 Erosion and Fire Control

- There should be standard procedures for monitoring erosion and re-vegetation of the excavated land;
- There is an urgent need to stringent prevention and control of fires; in this context cultivation of land surrounding LKHP area by TANESCO staff should not be allowed.

11.4.2 Waste Disposal at Lower Kihansi Hydropower Works Site

- There is need to have a resident head engineer responsible for environmental mitigation measures at the LKHP work site;
- There is a need to establish solid waste standard monitoring procedures, which will assist to improve solid waste management at the work sites;
- Liquid waste from the camp dispensary and clinic need to be tested for appropriate treatment before entering to the domestic water treatment system.

11.4.3 Solid Waste Disposal in the Gorge

- Waste disposal should be treated as a long-term issue and it is reasonable to expect that at least non-burnable, non-biodegradable waste be carried outside the Gorge. Certainly, all plastic waste should be carried out. This policy needs to be made clear to staff and visitors. Tins could be washed, collected, and another porter hired to carry down such a load.

11.5 Occupational Health and Safety

11.5.1 Compliance with TANESCO Health and Safety Policy

- Any areas of non compliance to company policy described in Chapter 7 should be rectified;
- Institutional responsibility for Health issues needs clarification;

- Reports from Field Office need swift follow-up action from Headquarters, or otherwise decision making responsibility decentralized in order not to delay important security measures.

11.5.2 Safety Management and Control System

- The managerial procedures for safety concerns need to be revised to provide for more effective and direct response to the various security concerns.
- Pest control measures should be taken on TANESCO land, in particular in the switchyard and at the solid waste dump.

11.5.3 Health and Safety Issues in the Gorge

- The suspension bridge at the bottom of the Gorge needs to be strengthened and made more stable;
- The latrines need to have a basic roof and a “squatting plate” to be made stable;
- The hole of the pit latrine needs to be kept covered;
- A first aid kit needs to be kept in the Gorge, as does a stretcher, thus facilitating evacuation. Staff needs to be given basic training in First Aid;
- The RAMPO and Gorge Technicians be made aware of the symptoms of Rickettsia and medical personnel associated with the project also receive this information, and on treatment;

11.6 Institutional Aspects

11.6.1 Monitoring, Reporting, and Training

- The EMP should be adjusted to integrated a monitoring system with quantifiable targets, verifiable indicators, clear reporting responsibilities and an annual review process;
- The EMP monitoring system is not followed in practice and may hence need to be reviewed;
- NEMC/LKEMP should prepare an annual monitoring report summarizing all monitoring data collected in the Gorge Ecosystem and disseminate widely, including to the public in LKHP locality (this requires a public version in Kiswahili for non scientists).

11.6.2 Coordination

- A review of the institutional set up of the LKEMP with a view of full inclusion of all relevant stakeholders and more complete and timely sharing of information;
- Public disclosure of environmental monitoring results and studies undertaken by LKEMP. The public includes not only the national and international research community but also village communities around Kihansi and elsewhere in Tanzania.

11.6.3 Ultimate Responsibility for Mitigation and Monitoring

- Long-term institutional responsibilities for the Kihansi area to be clarified;
- The process of granting the land title to be finalized.

11.6.4 Decommissioning

- TANESCO, involving other stakeholders, is encouraged to carefully plan and set aside funds for decommissioning incorporating lessons learned and best-practise from other projects.

11.7 Socio-Economic Aspects

- In addition to the LWCP, a conservation plan that focuses on the lowland communities would mitigate environmental degradation in the lowland;
- The employment of a community liaison officer to deal with community concerns related to LKHP.

12 Conclusions

This audit has shown that the majority of mitigation and monitoring measures specified in the EMP have been implemented within the so far elapsed 14 month implementation period.

The RAMPO and her field team are making serious efforts to maintain and monitor the Gorge Ecosystem. This is complemented by more comprehensive monitoring studies carried out by consultants or research institutions. A vast amount of information has been collected through the various consultancies and studies, which all have the potential to contribute to a greater and clearer understanding of the complex Kihansi Gorge Ecosystem. RBWO has been active in its role as the body charged with monitoring the Water Right. TANESCO has responded to some of the concerns raised by LKEMP, e.g. the correction of the amount of bypass flow. In addition TANESCO has largely followed its own corporate health and safety procedures with a few exceptions, which need to be corrected.

Despite these achievements, there is room for improvement.

The long-term success of the plans to conserve the Kihansi Gorge Ecosystem is dependent on a management plan that will involve all of the stakeholders, set clear targets and responsibilities as well as accountability. Data and information collected need to be made available for analysis and an institutional mechanism for analysis set in place.

Presently, it is not clear how the information from the various specialised reports feeds into a revision of the mitigation measures. This audit found that the current management system of the Lower Kihansi project area is not efficient due to a lack of a monitoring plan with verifiable targets; periodic reviews of monitoring information and studies to generate feedback into future decision making. There is evidence for a delay in response and decision-making as well as a lack of information sharing and limited accessibility of data and public information.

There is a tremendous range of scale involved at Kihansi, where issues range from a large scale (management of the catchment) down to micro-habitat (spray dependent habitats), and stretch over at least two regions; Morogoro and Iringa. We feel that given the complexity of the situation and the scale of impacts involved, institutional coordination, as well as commitment and ownership of the institutions needs improvement.

There are two equally important and interdependent strategies as far as the conservation of the KST is concerned. These are *ex situ* conservation efforts (captive breeding) and *in situ* efforts, mostly focussed on rehabilitating the spray dependent habitats in the Gorge. The latter also had to focus on matters relating to the Chytrid Fungus. Its appearance was noted as possibly a threat, but had not materialised at the time of the initial planning for IREM and LKEMP activities. This shows the importance of flexibility and timely response in the management system.

The LKHP is an example of the fine line between economic development and environmental conservation. Consequently there are many controversies in the LKHP. The planned expansion of the sprinkler system, although desirable from a point of view of maintaining the Ecosystem, is controversial with regard to the abstraction of water from either the bypass flow or other sources.

The KST is currently in the position of a single species totally dependent on artificial habitat management and captive breeding. The high costs involved, both financial and technical, at the national as well as international level, indicate the complexities of the tradeoffs over use of biodiversity and water resources.

Should the Spray Toad population recover, it might be dependent for its continued existence on the sprinkler system that requires constant attention and maintenance. Hence, an important long-term issue, which needs attention is the sustainable financing of the mitigation and monitoring programme in the Gorge and the Catchment by TANESCO and the decommissioning of dam. Donor dependency has presently blinded the view for the need to take responsibility.

Appendices

Appendix 1 Terms of References

A. Introduction

These Terms of Reference (ToRs) are for the selection and employment of a consultant to undertake Environmental Audit of the Lower Kihansi Hydropower Plant in Tanzania. The study is supported by the Lower Kihansi Environmental Management Project (LKEMP), funded by the World Bank/International development Association (IDA).

B. Background

The Lower Kihansi Hydropower Plant (LKHP) was constructed during the 1990s and became fully operational in 2000. The scheme incorporates a 25 m high dam which diverts water to an underground power generating station, returning water to the river about 6km downstream. As a result of this river diversion, there has been a significant impact on the aquatic, riparian and adjacent ecology of the area immediately downstream of the Kihansi Reservoir. Here, the Kihansi River runs through the Kihansi Gorge and has a number of waterfalls that sustain a unique microclimate, forest ecosystem and series of spray wetlands. These impacts have assessed to be globally significant. A variety of other more regionally or locally significant environmental impacts have resulted, arising from the construction of infrastructure, roads, communication networks and associated works at Kihansi.

In addition to environmental impacts, various health and social impacts have been caused which has been the subject of previous specific short term mitigation programs. These were the IREM (Immediate Rescue and Emergency Measures) Project, MUAJAKI and SEMAKI programs which dealt with Gorge ecological issues, public health and social issues respectively.

The Lower Kihansi Environmental Management Project (LKEMP), a medium and long-term initiative, is under the auspices of the National Environment Management Council (NEMC), in the Vice President's Office. The LKEMP main objectives are to put in place a series of medium-term measures to ensure the long-term conservation of the Kihansi Gorge ecosystem and upstream catchment areas; and at the national level, to support the development of a coordinated and consistent legal and institutional framework for environmental and water resources management, and strengthening of the ecosystem monitor-

ing and assessment functions of the environmental institutions. The project has four components:

- Habitat and species conservation and management
- Establishment of final water right
- Implementing an updated environmental management plan
- Institutional strengthening

Under component 3 the LKEMP has prepared an Updated Environmental Management Plan (EMP) with a package of mitigation steps which are now under implementation in conjunction with the ecosystem monitoring and conservation program.

C. Objectives of Consultancy

The principal objective of the Environmental Audit (EA) consultancy services is to assist LKEMP/Government of Tanzania verify whether the Environmental mitigation and monitoring measures recommended under the Updated Environmental Management Plan (EMP) are achieving their intended objective of maintaining a sustainable ecosystem in the Kihansi Gorge and its environs and recommend the best way forward.

D. Scope of Work and Activities

Specifically the consultant/s shall:

- i. Undertake Field verification and surveys to ascertain the validity of the various management reports;
- ii. Determine the nature and extent of all environmental areas of concern (including occupational health and safety) at the hydropower facility.
- iii. Undertake Field verification of socio-economic and public health aspects in three up-stream (catchment area) and two downstream villages
- iv. Identify and justify appropriate measures to mitigate the areas of concern, provide estimates for the cost of the measures, and recommend a schedule for implementing them. This work will entail a systematic, documented verification process of objectively obtaining and evaluating evidence to determine whether specified environmental activities, events, conditions, management systems, or information about these matters, conform to audit criteria.
- v. Identify any possible bottlenecks and ways in which short-comings can be resolved, including improvements to the mitigation and monitoring programs, modification of institutional arrangements, and provide advice on financial management.

Audit criteria may include but are not limited to:

- Industry Codes of Practice
- Specified organisational requirements, such as company environmental policy
- The Updated Environmental Management Plan for the Lower Kihansi Hydropower Project
- National and local laws
- Conditions of licences, works approvals and exemptions
- International treaties, protocols or other obligations

E. Desired Outputs

There will be four outputs generated by this assignment: an inception report; progress report, draft report on the EA; and the respective final report.

1. **Inception Report:** The consultant will prepare and submit an inception-report on 9 September 2005 . The LKEMP PMU will provide comments within the following two weeks.
2. **Progress report:** A summary of progress made so far including any limitations on delivery of the work
3. **Draft Final Report:** This document should be developed and submitted to LKEMP within 90 days after the submission of the inception report . LKEMP would provide written comments within two weeks.
4. **Final Reports:** This document should be submitted by the consultant to LKEMP within two weeks of receiving written comments.

In accordance with the scope of work outlined in section D above and the desired outputs described in this section, the Audit Report will include the following sections:

- (a) **Executive summary:** A concise discussion of all environmental and occupational health and safety areas of concern, recommended mitigation measures and their priority, the cost of mitigation, and a schedule for compliance.
- (b) **Project Description:** A concise description of the project, including both past and current operations. The description should focus on project components with potential environmental and occupational health and safety concerns.
- (c) **Regulatory Setting:** Details of Tanzania, local, and any other applicable environmental and occupational health and safety laws, regulations, guidelines, and policies as they may directly pertain to the hydropower facility.
- (d) **Audit Procedure:** Details of the approach used to conduct the audit, including the audit protocol. This section shall include specific information relating to historical research and records review, interviews, site inspections, and other aspects of the audit procedure. This shall include,

but not be limited to, a review of vegetation monitoring, toxicological and other studies conducted at Kihansi. Particular attention shall be paid to verifying the bypass flow being released from the Kihansi Reservoir to sustain environmental values in Kihansi Gorge.

- (e) **Areas of Concern:** Details of all environmental and occupational health and safety areas of concern. The areas of concern shall be discussed in terms of both existing facilities and operations and contamination or damages due to past activities.
- (f) **Mitigation:** Specific details of the appropriate mitigation measures and why they are necessary, and a discussion of whether the appropriate mitigation measures are readily available in Tanzania. This shall be based on an Action Plan agreed at the exit interview addressing those issues not conforming with good practice or requiring improvement.
- (g) **Costs and Schedule:** Estimates of the cost of implementing the mitigation measures and a schedule for their implementation. Cost estimates are to be based on Tanzanian conditions. Schedules should be recommended within the context of any planned capital expenditures for the facility.
- (h) **Annexes:** To include references, copies of interview forms, any details regarding the audit protocol not already included in (d), and data obtained during the audit but not included directly in (e), (f) and (g) above.

F. Reporting Requirements and Time Schedule

The consultant will report to the National Project Coordinator (NPC) who will guide the day to day implementation of the consultancy and provide relevant administrative and technical support.

The proposed tentative timetable is:

Start of work (signing of contract)	10 June, 2005
Inception Report	9 September, 2005
Progress Report	27 September, 2005
Draft Final Report	15 October, 2005
Final Report	2 week after receipt of
comments by the client	

G. Data and Support

The project will provide limited backstopping and technical support services to the consultant. The project will organize meetings with Tanzanian individuals and institutions as it may deem necessary. The project will avail relevant available background materials and reports to the consultant, or assist to obtain information from other sources if necessary.

H. Desired Outputs

The outputs of this consultancy will be an Environmental Audit report detailing the items listed under section E above.

I. Consultant's Qualifications

The consultant will have extensive and broad based experience in conducting environmental audits, preferably in East Africa. They should be familiar with relevant policies and regulations applying to environmental audit and environmental impact assessment, both nationally and internationally.

Appendix 2 List of people interviewed

Name	Position
Dr. Wilfred N. Sarunday	National Project Coordinator LKEMP
Ms. Anna Maembe	NEMC
Mr. Juma Kayera	Assistant Director, Wildlife Division
Mr. Benjamin Andulege	Game Officer, Research and Training, Wildlife Division
Mr. David Ngula	Manager Research & Development, TANESCO
Mr. Stanislaus Kizzy	Senior Hydrologist, TANESCO
Mrs. Devolent Mtui	LKEMP-RAMPO
Mr. Joseph Kerario	Head Technician, LKEMP
Isaya Luena Person Kalenga Bakari Swaki James Mtenga Amberson Kalenga Michael Mwambona Sunday Njogoro	Gorge Technicians Welding section Carpenter
Julius Chomolla	Acting Plant Manager, TANESCO
Mr. Lymo	TANESCO, Kihansi, Civil Technician, Maintenance, in charge of Water Treatment Plant, Social Club and Water Management
Makaba Rubida	Villager, River Gauge Recorder, RBWO
Mr. Luhumba	Gauge reader– Civil Technician, TANESCO
Mr. Onais Rubida	Villager, River Gauge Recorder, RBWO
Mr. Mallele	Health Officer, TANESCO dispensary
Uhafiwa Village Meeting	
Charles Mkumi	Chairman
Isaya Mhemu	Executive Officer
Amelye Chogo	Village Government Member
Edward Lubida	Village Government Member
Measomi F. Mheni	Environment Chairman
Charles Msombe	
Kwalesia Mginba	Dispensary Doctor
Ibradi Mheni	Village Chairman
Michael Kifuoga	Servant T.A.G
Nzita Mheni	Primary Health Attendant

Henry Lubida	
Frank Lyakungi	
Charles Mkumi	Chairman
Isaya Mhemu	Executive Officer
Amelye Chogo	Village Government Member
Edward Lubida	Village Government Member
Measomi F. Mheni	Environment Chairman
Henry Lubida	Catechist
Frank Lyakungi	M.A.K
Jackson Gazulo	Village Government Member
Nebioti Mhani	Village Government Member
Lukelo Chogo	Village Government Member
Mathias Kahise	Village Chairman
Tumwidinaje Mheni	Village Government Member
Legneth Gazulo	Village Government Member
Lidia Lyakungi	Catechist
Josephat Mheni	Village Government Member
Augustino Mheni	Village Government Member
Nestory Lubida	Village Government Member
Daniel Kaguo	Village Government Member
Pius Mheni	Village Government Member
Enock Peter	Village Government Member/Craftman
Elyuta Mheni	Village Government Member/Farmer
Odeni Uggi	Village Government Member
Salum Uggi	Village Chairman
Mlimba A Village Meeting	
Daniel Mkula	Village Chairman
Jackson Nkonkhela	Village Executive Officer (VEO)
Japhet Mwansasu	Member
Jovila Mfyomole	Member
Benjamini Undole	Health representative
Fikile Kibweja	Sub-village Chairman
John Mbekelembe	Member
Khassim Kitale	Member
Mage Minja	Member
Santina Songoro	Member
Halidunda	Sub-Village Chairman
Avelino Mnofuwasenga	Assistant Head Teacher
Menard Kidegelimba	Member
Osmund Ndunguru	Sub-Village Chairman
Flora Sanga	Member
Francis Chimwaga	Member
Fortinivo Tulutuhu	Member
Alberto Pilla	Sub-Village Chairman
Edgar Sweveta	Member
Rashidi L Jonewa	Sub-Village Chairman
Kalengakelu Village Meeting	

Deodatus Mgungusi	Village Chairman
Danistan Lyakwipa	VEO
Betresia Mhala	Member
Michael Makuye	Sub-Village Chairman
Faudeni Ngondo	Sub-Village Chairman
Mustafa Mwesiamo	Village elder
Peter Mkuye	Sub-Village Chairman
Fidelis Madenge	Member
Mwambene F.V	Agricultural Extension Officer
Joseph B. Mwaminga	Sub-Village Chairman
Edigri Kihongole	Chairman
Marselina Jalala	Member
Jusutusi Kahemele	Member
Priska Mikupi	Member
Maria Mkiwa	Member
Bushiri Mfawando	Member
Udagaji Village Meeting	
Kikana kilindo	Village Chariman
Rock Kambi	VEO
Adamu Omari	Member
Jackson Msokile	Member
Salumu Kayombo	Member
A. Kilindo	Member
A. Ngaseka	Member
Hasan Ngadage	Member
Ally Kaunda	Committee Member
Aljanato Chihami	Secretary Environment
Roswita Duma	Member
Musa Kihoma	Member
Victori Msofu	Sub-Village Chairman
Shahari Hangahanga	Sub-Village Chairman
Abdala Matalasa	Member
Lugus Galusi	Member
Gwivaa Nahemi	Member
A.A Makando	Member
Stefano Kiwelo	Member
Agrino Ndembo	Member
Zamoyoni Kandila	Member
Waliyobo Mtawango	Member

Appendix 3 List of Auditors and Functional Area

Functional Area of Audit	Auditor
Vegetation	Flora Ismail/George Sangu & Kerstin Pfliegner
Social Aspects	Flora Ismail/George Sangu & Kerstin Pfliegner
Gorge Ecosystem	Kim Howell & Charles Msuya
Kihansi River Hydrology	Exaudi Fatael & Kerstin Pfliegner
Erosion, Fire Control and Waste Management	Exaudi Fatael & Kerstin Pfliegner
Health & Safety/ Institutional capacity	Kerstin Pfliegner & Exaudi Fatael
Management of the audit	Kerstin Pfliegner
Local Liaison Officer	Flora Ismail

Appendix 4 Checklists

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Checklist 1 Hydrology

1. Spatial Scope	Geographical Area to be covered	Issues to be assessed
LKHP Project Area	Kihansi River and its tributaries within the area controlled by TANESCO (1-4 km wide) around and above the dam and reservoir, downstream to its confluence with the Kilombero River	Existence, quality and use of various gauging stations
	Floodplain: Water treatment plant Tailrace canal	
LKHP works site	Hydropower infrastructure: Reservoir	Existence of Sedimentation monitoring
Organisational Scope	NEMC	
	TANESCO	
	RBWO	
	Ministry of Water and Livestock Development	
	Water User Group	Exists? Communication with RWBO and TANESCO (reports, meetings)
	LKHP Field Staff	Awareness and training on various monitoring activities, emergency preparedness/risk management, procedures to handle water quality changes
	Local Government, Agric. Extension Service	

2. Mitigation measures on the Kihansi River				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication, etc.)	Comments
Bypass flow				
Is a bypass flow of 1.5-2.0 m ³ /s achieved on a constant basis?				
Is TANESCO monitoring the level of bypass flow? Are there reports? How often?				
Has RBWP installed automatic data loggers and staff gauges to monitor water flows and levels in the Kihansi River?				
Are they read twice daily?				
Is the data logger downloaded to a card once per week (once per month?)				
Are the staff gauges used as control gauges to calibrate the data logger?				
What are the cost involved?				
Are the cost covered by TANESCO?				
Are unusual or uncommon events such as unusually high or low flows immediately reported to RBWB and NEMC via UHV radio communication and recorded on paper at				

both the sending and receiving end?				
Is RBWB preparing an annual monitoring report that summarizes and brings together all data recorded during the previous year?				
Are copies of the report presented at the end of each year to RBWB, MWLD and NEMC and TANESCO upon request?				
Water rights				
Was the Final Water rights granted by 30th June 2004?				
Has a water user group been established for the Kihansi Catchment?				
If yes, have the RBWB reports been presented to the WUG?				

3. Mitigation measures in the LKHP Works Site				
Measure	Yes	No	Evidence	Comments
Has TANESCO commissioned any studies into alternative sources of water to substitute for the bypass flow at the Kihansi Reservoir?				
Monitoring of the Kihansi River				
Monitoring of river diversions and releases				
Hydrological and climatological data collection network continued to be operated in already established manner? (TANESCO and MoW)				
Does RBWO have sufficient information to determine the conditions to be associated with water rights and ensuring that conditions are being satisfied?				
Is the gauging station for RBWO installed 250 m downstream from the road bridge crossing the Kihansi River operational?				
Is being read regularly and data recorded? Is action being taken?				
Is the gauging station (1KB28) at the Chita-Mlimba bridge working? Is it accurate?				
Have TANESCO procedures and records been modified to conform with those of RWBO?				
Have the piezometers been integrated into the hydrological data collection? Is the status of their operation clarified?				
Do TANESCO and RBWO exchange all hydrological and hydraulic data on the Kihansi River on a real time basis?				
Is the monitoring of diversions for the Kihansi domestic water supply and spray wetlands irrigation done according to RBWO procedures?				
Have assessments of the River channel downstream of the tailrace been conducted to ascertain any erosion problems?				
Has a flow measurement station downstream of tailrace been established?				
Is there frequent reading and collection of the flow gauge records, with the use of a datalogger, by the field staff?				

Are personal observations carried out by the field staff? How often?				
Monitoring of Water Quality in the Gorge				
Is a system of water quality monitoring in place?				
Are the annual expenditures of water quality monitoring USD 30,000?				
Is it being implemented by TAWIRI and Universities as part of the RAMPO?				
Has training been conducted?				
Is sediment, turbidity, pH, BOD, COD, conductivity and biomonitoring, levels of phytoplankton being tested?				
Is the water quality monitoring including taking samples from the sprinkler system water sources, the dam, the Kihansi river water and sediments which collect in the reservoir?				
Is an annual program of soil and water quality testing being carried out? Conducted by a scientific authority? Testing arranged by several independent laboratories?				
Are records on maintenance being maintained by LKEMP personnel? (incidences of leakage, clearing of sedimentation ponds, replacement of parts) responsible for the sprinkler system?				
Is the field testing of water quality coordinated with the overall maintenance programme of the gorge?				
Any monitoring of presence of organic substances used as pesticides or fertilisers?				
Is the site staff competent to evaluate the monitoring data and empowered and authorized to respond?				
Have likely situations and appropriate responses been discussed with the site staff in advance?				
Have any other emergency preparedness measures been taken?				
Are the procedures of sudden changes in water quality being followed?				
This includes: Reporting to institutions as outlined in Annex 8 of EMP				
This includes: Sample taking as outlined in Annex 8				
This includes: Sample analysis as outlined in Annex 8				
This includes: Reporting results of analysis as outlined in Annex 8				
Is the site staff and are the implementing institutions (TAWIRI) aware of these procedures (Annex 8)?				
Monitoring of the LKHP works site (p.88)				
Is monitoring of Solid waste disposal, erosion and vegetation being executed?				
Are standard procedures for monitoring and reporting in place?				

Has the monitoring of seismic events and structural stability of the dam been included ?				
Are the expenditures for this monitoring USD 4,000 annually, carried by TANESCO?				
Seismograph and stress gauges in place and working?				
Warning system in the event of dam failure in place?				
Monitoring of sedimentation rate in the dam and release of sediments from dam during flushing operations undertaken?				
Are the cost of this monitoring annually 3,700 USD carried by TANESCO?				
Flushing plan agreed by TANESCO, RWBO and NEMC, incl. Aspects of timing, duration, total sedimentation quantities and sedimentation release rate?				
Long-term monitoring of the dam and associated installations (turbines) in place?				

4. Institutional Capacity and Compliance check				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication, etc.)	Comments
Is there a Head Engineer at site responsible for mitigation at the LKHP works site?				
Competence of Head Engineer at Kihansi responsible for mitigation at the LKHP works site?				
Who is responsible at site for mitigation at the LKHP project area? What is the competence and authority of this person?				
Is there a person responsible for monitoring at Kihansi assigned in the RBWO? What is the competence and authority of this person?				
Is TANESCO responsible for operating and supervising water off-take and the release of environmental flow from the dam into the River?				
Has the final water right been granted by the RBWO by 30 June 2004?				
Is monitoring of water levels being carried out by RBWO? At which locations? How often?				
Has the water right ever been breached? Has legal action been taken?				
Is the RBWO monitoring fully financed by TANESCO? And paid via the MWLD as part of the water right?				
Is RBWO submitting a 4 monthly report to the RBWB and MWLD providing flow measurement data for various gauging stations?				
Are the regular reports being evaluated by the RBWB and a brief analysis submitted to its stakeholders?				
Is TANESCO providing on a regular and timely basis its				

<p>data on river discharge rates and environmental flow release to RBWO? Are reports now directly to be provided to NEMC based on new EMA?</p>				
<p>Has RBWO at site been trained on</p> <ul style="list-style-type: none"> <input type="checkbox"/> reporting procdures (when to report emergencies, reporting formats etc.) <input type="checkbox"/> use of radio communications for reporting <input type="checkbox"/> procedures for responding to breaches in agreement 				
<p>Is the water monitoring financially viable?</p> <ul style="list-style-type: none"> <input type="checkbox"/> Are user fees collected from TANESCO? <input type="checkbox"/> Is there timely transfer of funds from MWLD to RBWO for monitoring? 				
<p>As TANESCO acquired legal tenure of the project site?</p>				
<p>Are measures outlined in Norplan Area Management Plan regarding project site management and security; protection of project infra-structure and erosion prevention being implemented?</p>				<p>Head Engineer on site should have copy of this document?</p>

Checklist 2 Occupational Health and Safety

Measure	Yes	No	Comments
1. Is there an on site health & safety representative/committee?			
2. Are there staff with 1 st Aid qualifications (at least 2)?			
3. Is emergency transportation available?			
4. Presence of first Aid equipment at key locations?			
5. Is there regular training for staff on health and safety (new staff and regular updates)?			
6. Is this training for both company and contractor staff?			
7. Is information on health and safety regularly disseminated in the form of seminars, reports and brochures?			
8. Is there a running risk assessment programme?			
9. Are the staff provided with regular medical checkups?			
10. Are working hours in compliance with labour laws?			
11. Is the safety representative appointed for a term not exceeding 12 month?			
12. How many workers are in hazardous areas? Is transport readily available near by?			
13. Do each office have a first aid box? Is it well equipped?			
14. Are employees familiar with conditions of safe conduct of their work?			
15. Is there a safety policy on site?			
16. Do employees have safety rules and regulations?			
17. Is the supervisor discussing safety rules with crew (Check contents of discussion against guidelines)?			
18. Are employees, contractors and the public informed of hazards associated with corporate facilities?			
19. Maintain health of staff regular through regular medical checks?			
20. Are confidential records of all illness kept?			
21. Risk assessment to employees?			
22. Are social facilities available: club, pool, TV, communication? Other?			
23. Are employees aware of working hours 8 h/day, 40 h/week?			
24. Is risk reduction to installations and structures carried out?			
25. Do contractors submit health and safety rules?			
26. Are employees familiar with accident prevention equipment?			
27. Are health and safety rules included in tender documents?			
28. Are health and safety meetings conducted regularly between contractor and site safety officer?			
29. Do the company's field staff attend to safety seminars at least 5 times per year?			
30. Is there evidence of Safety meetings and Investigation of accidents?			
31. Is fire fighting equipment available in installations and vehicles?			
32. Are safety inspections for monitoring conducted in a 6 months interval? Are schedules there?			

33. Is there a safety audit once per year; is action taken; with making good effects within 2 months?			
34. Are accidents, diseases etc. reported to Ministry of Labour?			
35. Is there a system of equipment maintenance?			
36. Are there operating instructions, standards, formats for testing and reporting?			
37. Emergency preparedness: dam failure, tower failure, generator failure. Are drills conducted regularly?			
38. Any disciplinary actions taken?			
39. Are accident record books kept?			

Checklist 3 Vegetation Audit

1. Spatial Scope	Geographical Area to be covered	Main issues to be assessed
LKHP Project area	Kihansi River and tributaries (Mhalala and Udagaji),	Change in flow that may cause change in vegetation patterns
	Downstream area to Kilombero confluence.	
	Wetlands created by the waterfall spray	Effectiveness of sprinklers, back up sprinklers and jet fountains sustaining vegetation
	<i>Raphia</i> palm groves in gorge	Temperature and Humidity levels that affect the presence of the community

2. Mitigation Measures				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
Is current flow (which is?) maintaining spray vegetation?				
Is there monitoring in the Kihansi Gorge and Udagaji gorge				
Is the vegetation monitoring undertaken at the same time each year				
Are there security checks in Gorge to prevent logging, fuel wood collection etc.				
Is there a responsible party assigned to conduct the mini catchment study				
Has the mini catchment study in Gorge been conducted				
Has the funding of US\$ 30,000 for a mini catchment study been disbursed				
Have the findings been incorporated into the LWCP				
Have additional studies been conducted to assess improved use of fountain jets on vegetation				
Have studies that assess alternatives to fountain jets been conducted with regards vegetation				

3. Monitoring and Supervision				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
Has there been a land cover monitoring study that indicates changes in vegetation				
<i>Spray vegetation:</i> Are the 8 plots being sampled regularly (at least once a year) following Gibbs protocol				
<i>Forest vegetation:</i> Are the various sites being sampled annually following Gibbs protocols				
-20 plots in the Kihansi gorge				
-8 plots in the Udagaji gorge				
Has the <i>Filicium</i> forest been affected by a reduction in humidity/ spray				
Are the indicator species present/ absent in plots; <i>Kupea jonii</i> , <i>Kihansi lovetii</i> and <i>Stenandrium</i>				

<i>grandiflorum</i>				
Are there epiphylls evident in riparian vegetation				
Are the woody sample plots annually monitored for change				
Are there indications of poor growth (stagnant seedlings etc?)				
Are there indications of mortality (dead stumps etc?)				
What is the cost for vegetation monitoring				
Have TAWIRI and NEMC been the responsible agencies to subcontract vegetation monitoring activities				
Has TANESCO paid the costs for recurrent activities and LKEMP a one of cost				

Record species extracted or affected.

Checklist 4 Gorge Ecosystem

1. Mitigation				
Access and control of general area (not just gorge)				
Is there control over access to the general Kihansi area, Y or N?	If Y, who is the authority? Director,	How obtained?	Any problems of people entering without permit?	Details? How is problem resolved?

2. Mitigation Measures: Sprinklers				
Working or not?	If not, how reported?			EMP
Set up correctly? Y or N				
Maintenance of sprinklers? By whom?		Names? Log book?	Where are data recorded?	
Nozzles cleaned? Y or N?	How often?	Where are data recorded?		
Nozzles replaced? Y or N?	How often	Where are data recorded? By whom?		
Pressure checked each sprinkler line? Y or N? Y	How checked?	Where are data recorded?		
Sedimentation Ponds cleaned? (dug out) Y or N?	How? Tools, shovel	How often?	Action recorded?	Manually excavated with spades at least once every 2-3 wks?
Filters in sedimentation ponds cleaned? Y or N? Y (M,J, A)	How?	How often?	Action recorded?	“even more regular basis”; if problem, what action taken?
Pipes from ponds to sprinkler systems checked for damage, etc? Y or N?	How often?	By whom?	Action recorded? booklet (M,J,A)	If problem what action taken? Maintenance (A)
Who is responsible for mitigation in Gorge and for water right?				WD
Has water right for sprinkler abstraction been obtained? Y or N?				
By whom?				WD
p.66 “for now” sprinkler to be maintained as is: what is trigger for change?				
Sprinkler support studies				
Have each of 3 sprinkler systems been tandemed with a back up? Y or N?	If Y, by whom?			
When extensive mainte-	If Y, how often is			

nance under way, are back-ups used? Y or N?	extensive maintenance taking place?			
If not, what precautions are taken?				
Pipe protection				
Any done?Y or N? Yes, patrols (M,J,A)	How extensive? Patrols over whole area; (J,M,A)			
Mini catchment study, Y or N?	If Y, by whom?	Results available?	Results used in management?	This question moved to vegetation section
Sprinklers, contd				
If Y, were results incorporated in the LWide CP components?	At time of audit, LWCP had not been finalized			
Security measures to prevent poaching, logging, fuelwood collection in Gorge, Y or N? Yes, patrols (J,M,A)	Records kept of infringements? Y or N? Yes, in waterproof booklet kept in Gorge (J,M,A)	By whom? Gorge Attendants	If security, who implementing? Regular patrols? Or in reaction to violations? Regular patrols (J,M,A)	
Continued monitoring of Kihansi and Udagaji Gorge ecosystems to evaluate effectiveness of measures? Y or N?	By whom, when , how often, reports in?			Move to Vegetation section
Water right application submitted for mitigation actions? Y or N?	By whom? Wildlife Division			“the agency ultimately responsible for mitigation”. See footnote 17 p 71, am not sure why it is repeated
p.67 implementing agencies				
Who has done these things?				WD and subcontracting local teams, company or agency, “implementation of vulnerability reduction program)
Studies for LWCP and reduce vulnerability to piping system, Y or N? (M)				

3. Mitigation Measures Fountain Jets				
				EMP
Maintenance, Y or N? Yes	What? Sometimes	By whom? Gorge	Cost?	\$5,000 for

(M,J,A)	clogged, so unclogged	Attendants(J,M,A)		spares, etc
Any further trials, varying variables, jets, aim, etc? Y or N? N (M) but we are told they are in the pipeline, to take place in September	If Y, by whom? Norplan to add tandem sprinklers and to examine issues related to fountain jets	When? Sept 2005	Report? Work not done yet	Further trials varying size of jets, change of angles, etc
Any study of alternative to f. jets? Y or N? N (M)	If Y, by whom? See above, presumably Norplan	When?	Report?	\$30,000
Expansion of f. jets? Y or N	See above, presumably Norplan			Expansion ...offers perhaps best opportunity for provision of some mitigation in adjacent wetlands
Any money spent?				5 thou for maintenance
Paid to whom?				
When?				
Who funding? Annual maintenance				TANESCO for annual recurrent costs
Study				LKEMP
Has study been done?				Given as one off to be begun in 2004

Note: Jets installed Dec 2001, some erosion problems so now aimed at river channel instead of Upper Spray Wetland where they caused erosion and removal of vegetation.

5. Mitigation Measures, Ex situ captive breeding programme			
Has it begun?Y or N?	If Y, by whom? Complex operation, WD, many other actors	When? Dec 2000 (check date)	
p.69 What are the actual costs of the captive breeding programs to the zoos?	If not known, why not?	What needs to be done to provide this info?	
Ref is made to “expensive and burdensome” costs in Captive Breeding Agreement: What are these?	M not aware		
Has govt reviewed contract? Y or N?	If Y, details: when? Findings? Any action taken		
An open question: Follow up: contract is signed by 2 parties: what do other stakeholders think?			
Has additional funding been made available to ensure continuation of pro-	If so, what are implications?	Players? IAP's?	

gramme?Y or N	When will be available? How implemented?		
TAWIRI is listed (p.69) as body which will deal with initiation of CB programme in Tz. Has this happened? Y or N?			
Annual reports of CB program available? Y or N?	If so, produced by whom?		
Has the CB program been reviewed on an annual basis? Y or N	If Yes, by whom?	Any implications, changes, financial implications?	NEMC to review annually on basis of annual reports
How much money spent in Tz on CB?			\$75,000
How long will it go on?			Continuous and indefinite, subject to annual review

6. Mitigation Measures: Upkeeping of Gorge Ecosystem			
Structures maintained? Y or N? Y (M, J,A)	If Y, by whom? Gorge attendants How frequently? Daily Any oversight, monitoring? Daily inspection	Record keeping?Yes, recorded in waterproof book	Maintenance team of the Research Station facility that will be made by LKEMP in 2004.
Costs?			
Payment?	Source? LKEMP	How?	
Off-site infrastructure, storage facilities for spares, monitoring equipment: present Y or N? Y (M, J)			
Maintenance team infrastructure, indoor work area, office, housing: present, Y or N? Yes			
UHF radio network: present, Y or N? Y (M,J,A)			
Vehicle, present, Y or N? Y (M, J,A)			
Funds expended?			\$28000 budget

Note: Bridges, walkways, ladders, small shelter, “any other facility” required/installed in future
By 6 local staff members, 1 team leader

7. Mitigation: Restriction and Access to the Kihansi Gorge Wetlands				
				EMS
Is access restricted to Gorge wetlands ? Y or N? Y (M, J,A)	If Y, how? Authority? DG LKEMP	By whom? DG LKEMP	Cost? No physical barrier but usually visitors	WD, no clear budget line, lumped with infrastructure

			are accompanied by Gorge Attendant (s)	
Safety Protocols				
Who sets up? LKEMP	Who enforces? LKEMP			WD
Any revision, changes, modifications? Y or N?	If Y, what system is in force? If No, why not?	Knowledge feedback?		
Who releases funds? LKEMP				TANESCO
For how long?	Length of project?			indefinite

8. Mitigation: KST studies				
				EMP
Have any studies been conducted? Y or N?				
Are safety protocols enforced (p.70) Y or N? Y (M,J,A)				
Other studies suggested in EMP regarding ecosystem/KSTs				
Study on maximising habitat, spraying toad rock, etc? Y or N?	If Y, by Whom?	Dates?	UDSM and foreign University	
Studies of General diurnal behaviour studies, predation, reproduction, etc, Y or N?	If Y, by whom?	Dates?		
Longevity, Y or N?	If Y, by whom? Report available?	Dates? Report used?		
Food preferences, Y or N?	If Y, by whom? Report available?	Dates, Report used?		
Pathogens of KST, chytrids, Y or N? N(M) but see caveat	If Y, by whom? Report available?	Dates, Report used?		
Funds made available for competitive research grants, Y or N?	If yes, how much?			
NEMC indicated preferences, Y or N?	If yes, which ones?			
NEMC chose proposals, etc., Y or N?	If yes, which ones and value?			
Funds used by LKEMP in 2004, Y or N?	If Y, which studies funded? How much?	If N, why not?		
Value of studies funded?				
Timing?				

9. Monitoring: Kihansi Spray Toad pg. 83				
Counts				EMP
Do Kihansi Spray Toad counts conform to Vol III IREM report? Y or N?	Generally Yes but see exceptions based on interviews			

	Daytime permanent rock plots Y or N?			
	Plots along vegetation Y or N?			
	Use of standard recording sheet Y or N?			
	Counts in spray wetland Y or N?			
		.5mx.5m quadrats along transects		
		Spray wetland vegetation, Lower, mid Gorge and main falls wetlands.		5 times if popns recover
		Upper Gorge wetlands		
		Lower Gorge wetlands		
		Mid Gorge wetlands		
		Main falls wetlands		
Temp and Humidity Y or N?		Note: KMH saw data on computer in office had been downloaded in excel		
	Has it been continued? Y or n?	According to LEMP methods ?		
	Has additional intensive monitoring of spray input in the upper wetland ecosystem been effected? Y or N	If Y, by whom?	Is report available? Y or N? Where?	
			Have data been used by decision makers? Y or N?	
p.83 Kihansi AND Udagaji forests using LEMP methods and protocol by Gibbs?Y or N	If Y, how often, by whom, etc	Documentation? Where?		This question belongs in vegetation section

p.85 Table 6.1 Habitat Monitoring Activities				
Precipitation monitored daily in mm, Y or N?	Confirm gauge(s) present	Data sheets, or logger?	Reported how? To Whom? How often?	
Air Temp deg C recorded daily, Y or N?	Confirm gauge(s) present	Data sheets, or logger?		
Wind speed in km/hr monitored at 1 site daily, Y or N?	Confirm gauge(s) present	Data sheets, or logger?	Reported how? To Whom? How often?	
Relative Humidity in % monitored daily, 1 site, Y or N?	Confirm gauge(s) present	Data sheets, or logger?	Reported how? To Whom? How often?	
Sprinkler System Flows (liters/s) continuously monitored, Y or N?	Confirm gauge (s) present	Data sheets, or logger?	Reported how? To Whom? How often?	
Sprinkler System Water Temp deg C monitored, Y or N?	Confirm gauge(s) present	Data sheets, or logger?	Reported how? To Whom? How often?	
Sprinkler System Water pH monitored, Y or N?	Confirm gauge(s) present	Data sheets, or logger? Data sheets	Reported how? To Whom? How often?	
Soil moisture in mbars (10/wetland) measured daily, Y or N?	Confirm gauges working	Data sheets?	Reported how? To Whom? How often?	
Erosion deposition around soil cracks in mm/month, 25/wetland, measured monthly, Y or N?	Confirm visually	Data sheets?	Reported how? To Whom? How often?	
Suspended solids/sediment/turbidity of applied sprinkler system water, 2 sites, monitored daily/continuous Y or N?	Confirm methods	Data sheets?	Reported how? To Whom? How often?	
Droplet density, size, recorded at 1 site, monthly, Y or N?	Confirm methods	Data sheets?	Reported how? To Whom? How often?	
Kihansi Spray Toad Surveys, using IREM and Panel of Expert Monitoring techniques, 2-5 times/year, Y or N?		Reports seen? Yes	Reported how? To Whom? How often?	
p.86 Frequency & Responsibility of Habitat Monitoring				
Is Gorge Ecosystem being managed by WD (who are also to manage mitigation measures)? Y or N?	Evidence of this in form of name of person, etc?	Documentation as regards management by WD?		
Is TAWIRI carrying out the monitoring?	If Yes, is a RAMPO* based permanently at	Documentation available?		*Research and Monitor-

	Kihansi to manage and coordinate monitoring program?			ing Programme Officer
	Has TAWIRI contracted or subcontracted chytrid specialist?	If Yes, who, timing, etc?	Report available?	
Is WD (or its contractor) continuously monitoring the sprinkler mitigation system? Y or N	If yes, records, details available? Y or N	Copies seen?		
Is annual monitoring of wetlands towards end of dry season using protocols devised by IREM and elaborated by Gibbs (2004) being conducted, Y or N?	If yes, records, details available?	Copies seen?		
Are Kihansi and Udagaji forests receiving continued monitoring using protocols devised by LEMP and described by Gibbs (2004)?Y or N?	To go to vegetation section			
Has annual re-measuring of the permanent sample plots established under LEMP taken place towards end of the dry season? Y or N?	To go to vegetation section			
Has monitoring, etc as listed in Table 6 using LEMP and IREM protocols taken place? Y or N?				
Has Bi-annual measurement in hot (Jan/Feb) and cold (Jul-Sep) seasons taken place to complement previous measurements?				

10. Vertebrates in particular amphibians					
No.	page			Comments	Related to:
1	exec summary	Land, control, institutional	Does Tanesco have title deed?	Must there be a cadastral survey to get title deed in Tz?	Land policy, village land, forests, local management of area
2	Es	Water, institutional	Has Wildlife Division the water right for sprinklers?		Does this include water for jet spray?
3	Es	Institutional control	Does NEMC have trained, dedicated staff to manage	How assess? Cvs?	
4		Institutional control	Does Tanesco have trained, etc staff?	As above	
5	?	Is there control to enter area?	Request to see log books of all visitors; tanesco workers, scientists, locals?	This is not just a security issue but may be related to chytrids	
6	24	There seems to be little	Basic fault in eia and	Check WB criteria	Also Tz water

		interest in the ecosystem integrity of below dam river	project?	and policy as regards need to maintain integrity	policy, etc.
7	26	No crocs noted, bridge?	Anecdotal reports of 2 deaths there 1994, etc.		
8	?				
9	62	Bypass flow; institutional, control, monitoring	Claimed given on a “regular basis”	Records? Discrepancies?	See Mkhandi report, Dec 2003
10		Captive breeding	No data presented	How do stakeholders, etc obtain information?	Many other issues:
11	32	Local govt implementation (general comment)	Any regular reporting? Copies of reports?	Reporting to whom? Central govt agencies?	A general comment
12	34	How will new legislation be flagged in subsequent versions of emps? 1	Covered, see annex 4		
13	36	Cross sectoral	Min. of Energy is missing, table 2.3		
14	37	Institutional	How do we assess if tawiri, wd, etc are working?	Fbd officer based in mlimba;	
15	38	Emp targets	Says wd needs support to see that these are met	Have they been met after one year?	
16	39	NEMC to be funded by tanesco			
17	40	Keeps mentioning LWCP (landscape wide cons plan)			
	69	Unusual event reporting, water	Have there been any? Do we have written reports?		

Checklist 5 Natural Resource Audit

1. Spatial Scope	Geographical Area to be covered	Main issues to be assessed
LKEMP Project Area	Kihansi River basin upstream of LKHP specifically 2 villages from Mufindi Uhafiwa and Ukami villages.	Activities promoting proper land use and environmental conservation are being implemented
LWCP	LKEMP project area i.e., the Kihansi basin upstream of LKHP	Inclusion in LWCP
	Farmland and forest between the restricted area	
	Njerera Forest reserve and Udzungwa escarpment forest Reserve areas adjacent/ traversing project	
LKHP works site	The miombo woodland along the escarpment and other areas cleared by LKHP that are to be rehabilitated	
Organisational Scope	NEMC	
	TANESCO	
	LKEMP	
	DoE	
	Ministry of Water and Livestock development	
	AgES	
	Land Office	

2. Mitigation measures from the EMP				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
Natural Resource management				
Does the LWCP include continuation of CMP activities on proper land use practises and environmental conservation				
Has LKEMP financed natural resource programmes in the catchment in 2004				
Have the EAMCEF been contacted for funding of natural resource management programmes				
Do local government have funds or sources for natural resource management programmes				
Have the ministry of Water and livestock development been contacted as funding source for natural resource programmes				
Has ministry been involved in preparation of the LWCP				
Has the estimated cost of 150,000USD been revised in the final LWCP				
Is there encroachment in the Njerera Forest Reserve				
Is there encroachment on the Udzungwa escarpment forest boundary				
Are there incentive programmes for sustainable land use				
Is there a penalty for improper practise				
Does the LWCP include a programme advocating cultivation of crops that do not require irrigation				
Does the LWCP include a community forestry programme				

Is monitoring of existing abstraction included in the LWCP				
Have the implementing agencies been involved in preparation of the LWCP i.e., Local government, AgES, RWBO and TANESCO				
Does the LWCP stipulate that the costs for water abstraction management programme to be included in the water rights payment				
Awareness and Enforcement				
Does the LWCP include awareness and extension programmes to ensure compliance to existing legislation for natural resource management				
LKHP work site				
Is the <i>Miombo woodland</i> on the escarpment adequately vegetated (road to dam site) to prevent erosion				
Are re-vegetated areas in the LKHP works site maintained?				

3. CMP objectives				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
Is land pressure significant in catchment?				
Are there water user groups?				
Are there fires in the catchment?				
Is erosion a problem in the catchment				
Are there control measures for deforestation?				
Are there public awareness programmes for compliance with national legislation?				
Has there been monitoring for changes in land cover				
Do Uhafiwa and Ukami have village PRAs which include issues of natural resource management				
Are these activities being implemented				
Is there continued regular training of farmers				
Do villages have paraprofessionals				
Are paraprofessionals regularly trained				
Do villages have access to district extension staff				
Are district extension staff regularly trained				
Are the village based environmental committees active				
Do they receive financial and or technical support				
Are the grass root voluntary groups active				
Do they receive financial and or technical support				
Are awareness campaigns continued in communities close to reservoir				
Do farmers receive access to soil conservation and afforestation material (seeds etc.)				
Do farmers receive technical support on improved tree planting				
Are there established monitoring protocols for farming methods				
Are there established monitoring protocols for live-stock movement				
Was there a smooth transfer of responsibility from CMP to local government				

Checklist 6 Socio – Economic Aspects

1. Spatial Scope	Geographical Area to be covered	Main issues to be assessed
LKHP	LKHP works site (Staff)	
	Villages on lowland, Mlimba, Udagaji and Kalengakelu. Villages in Catchment; Ukami and Uhafiwa	
LWCP	Kihansi Catchment (For this audit only Uhafiwa and Ukami areas)	
Organisational Scope	Ministry of Health	
	Local government authorities (Mufindi and Kilombero Districts)	
	NEMC	
	TANESCO	

2. Mitigation measures from EMP				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
LKHP staff				
Is there a responsible party for environmental issues at LKHP				
Is there an environmental and socio-economic mitigation plan of action for LKHP works site				
Are consequences of natural resource extraction being addressed				
Is there provision for socio-economic management in coordination with local residents on forest resource exploitation				
Has TANESCO established a cost centre to fund forest related activities				
Do the environmental mitigation activities spend 6000USD at LKHP site				
Is 4000USD spent on socio-economic mitigation				
Health				
Has the local Government taken over the activities run earlier by MUAJAKI on human health				
Has the multi-sectoral committee through LKEMP actively examined opportunities for continuance of MUAJAKI and SEMA-Ki activities				
Has there been an evaluation of the effectiveness of MUAJAKI and SEMA-Ki programmes				
Does the LWCP include programmes of; deforestation; water abstraction, encroachment into marginal lands and fire incidence.				
Has the LWCP budgeted 30,000USD a year for				

activities in Human health mitigation				
Have the local governments been included in the preparation of the LWCP of which they are to implement				
Is the source of funding for the LWCP human health programme Local government				
Employment and local communities				
Does TANESCO uphold a local's first policy when employing				

3. Monitoring measures from EMP				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication etc.)	Comment
Monitoring in the Catchment				
Does the LWCP include development of a baseline study to monitor land cover/ land use changes using satellite imagery or aerial photography?				
Does this study include ground truthing by means of a socio economic study to assess reasons for changes				
Does the LWCP stipulate 50,000USD funding for the baseline to be re-mapped every 4-5 years				
Does LKEMP have the funding for this activity				

4. MUAJAKI sustainability			
Spatial Scope	Geographical Area to be covered	Main issues to be assessed	Possible evidence to be collected
LKHP Project area	18 villages surrounding LKHP and site personnel For purposes of the audit this is limited to Mlimba, Udagaji, Kalengakelu, Ukami and Uhafiwa	What happened after the closure/ pull out of the donor funded programme	Opinions on effectiveness/ weaknesses of the programme. Information on programmes that are currently on-going emulating or continuing the activities of MUAJAKI

4. MUAJAKI mitigation during operation of LKHP				
Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication, etc)	Comment
Is there a Kihansi Management Committee				
Do the districts have financing and capacity to conduct programmes initiated by MUAJAKI				
Upland Malaria				
Is there health education available for local communities and individuals on malaria				
Are bed nets available				

Is there support to malaria case management in local clinics				
Is there monitoring of vector habit				
Is there monitoring of malaria transmission				
Is there monitoring of malaria transmission				
Is there monitoring of malaria morbidity				
Is there monitoring of malaria mortality				
STDS/HIV				
Is there health education provided for local communities and individuals on STDs/HIV				
Are condoms marketed				
Is there technical and material support to STD clinics				
Do the clinics provide Voluntary counselling and testing services for HIV				
Is there material being distributed on health/ behaviour change in the communities				
Have local and district assistants been trained after the project				
Are there any clinics (health centres and dispensaries) that have been rehabilitated post construction				
Has cost sharing been introduced in local clinics?				
Are there regular inventories of units and equipment				
Is Maternal and Child health information disseminated to TBAs and Local clinics				
Is there regular monitoring of the STD/HIV and malaria programmes at household level				

5. SEMA-Ki sustainability

Spatial Scope	Geographical Area to be covered	Main issues to be assessed	Possible evidence to be collected
LKHP Project area	8 villages closest to LKHP two in Mufindi district (Ukami and Uhafiwa) and six in Kilombero district (Udagaji, Chisano, Mgugwe, Kalengakelu, Mwembeni, Mlimba-A and B) For the audit this is limited to Mlimba, Kalengakelu, Udagaji, Ukami and Uhafiwa	What happened after the closure/ pull out of the donor funded programme	Opinions on effectiveness/ weaknesses of the programme. Information on programmes that are currently on-going emulating or continuing the activities of SEMA-Ki

6. SEMA-Ki mitigation during operation of LKHP

Measure	Yes	No	Evidence (Report, stated fact – by whom? Written communication, etc)	Comment
Is there a Kihansi Management Committee				
Do the districts have financing and capacity to conduct programmes initiated by SEMA-Ki				
What the financial resources allocated for these activities				

Are there funding agencies involved with these activities				
Are there adequate health facilities				
Are there adequate market facilities				
Is water for domestic use a problem				
Is there knowledge and skills that allow exploitation of natural resources in a sustainable manner				
Are locals being provided with know how for economic improvement				
Are communities sensitised on how to handle influx populations				
Is there continuance in village government training on sustainable development for communities				
Have initiated social amenities infrastructure been completed				
Are there additional social amenities infrastructure constructed post SEMA-Ki				
Are environmental committees functional/ active				
Are there environmental additional committees initiated				
Do the communities receive regular training for tree seed nursery care				
Are nurseries still active				
Are there active micro finance groups in communities				
Do marginalised groups have access to financing				
Are there workshops held for capacity enhancement in the community				
Do the communities have a platform to generate recommendations for mitigation to LKHP				
Is the mediation of disputes and misunderstandings between LKHP and the communities effective				
Is there small scale development related assistance provided to the communities				
Is there regular sensitisation on impacts that arise from population increments				
Is there periodic monitoring of changes in local amenities				
Are there youth and women groups involved in economic activities				

Appendix 5 Itinerary of on-site audit

Audit	Auditor	Day 1 (Thursday)	Day 2 (Friday)	Day 3 (Saturday)	Day 4 (Sunday)
Vegetation	George Sangu	- Site walk/drive - Check locations & stations - Staff meeting	Gorge	Cachments & upstream villages	Downstream villages/ Turbines/ Water treatment plant/ Debriefing
Social	George Sangu & Maj Forum				
Ecosystem	Kim Howell & Charles Msuya		Gorge Ecosystem & Sprinklers		Turbines/ Water treatment plant/ Debriefing
Hydrology	Exaudi Fatael		Dam site & top of Gorge	River	
Health & Safety/ Institutional capacity	Kerstin Pfliegner & Exaudi Fatael				Work site/ Dumpsite/ Health clinic/ Turbines/ Water treatment plant Debriefing
Management of the audit	Kerstin Pfliegner			Gorge	Cachments & upstream villages

Appendix 6 Implementation of IREM Recommendations

IREM Recommendation	Assessment
Maintain a continuous minimum bypass flow from the LKHP dam of at least 1.5 m ³ /s at all times. An independent monitoring mechanism should be established to ensure that the continuous minimum bypass flow is adhered to at all times and that no interruptions occur.	Minimum bypass not maintained as established through independent monitoring. Bypass is presently being increased, date 4. October (meeting with RAMPO).
Maintain and possibly extend the artificial spray systems and other infrastructure currently in the Kihansi Gorge. An appropriate institution (e.g an NGO with appropriate experience in biodiversity conservation) needs to be identified and funded to take responsibility for the operation and maintenance of the artificial spray systems. An independent monitoring mechanism should be established to ensure that the spray systems are successfully and continuously operated and maintained.	TAWIRI, through secondment of RAMPO, in charge of maintaining spray systems. Extension has to date not been investigated. Independent monitoring mechanism not been established. This audit possible initial step of such monitoring system.
Continue monitoring of the Kihansi Spray Toad, the spray wetland ecosystem and the Kihansi Gorge. It is not considered necessary to maintain the same intensity of monitoring inside the spray wetlands as during 2001.	Recommendation followed.
Intermittent high flows not to be studied further at this time, although this is under the assumption that the spray systems are properly operated and the continuous bypass flow is maintained	Recommendation followed. In 2005 no population of Spray Toads was found in the Gorge. Hence it is not possible to discuss the need for long-term testing of flow regimes.
Further studies to be carried out on the Upper and Lower Lufulunya Spray Wetlands (upstream of the LKHP dam) and the Udajaji Gorge Spray Wetlands as a basis for making a future decision on whether translocation should be pursued.	Studies not conducted.
Searches focusing only on the spray toad not to be continued, since the likelihood of finding the same species at another site is now very small. Instead it is recommended that expertise on biodiversity value be concentrated on areas threatened by other infrastructure development, and as mentioned below.	Searches on toad were discontinued.
Captive breeding to be continued and that study resources be put into carrying out research on this population in close co-operation with the in situ studies.	Captive breeding is being continued. Studies lack behind.
IRA recommend a complex institutional structure for conservation of 5 different units within the Kihansi Gorge Conservation Area, while NORPLAN recommend a simpler uniform conservation status be immediately established for the entire area, while lengthy legal processes are developed for establishing a Nature Reserve in the immediate Gorge zone	Simplified institutional set up does not seem to have been established. Current set up still complex.
A review to be carried out of the environmental-decision making process associated with LKHP such that the important lessons learned here will assist future projects with similar problematic issues to face.	Has not been done.

Appendix 7 Results of the Captive Breeding Programme

Report number	Date	Which of 3 annual reports for the year?	Total number of living ex situ Toads in	Notes
1				Not available
2				Not available
3	8 April 02	1/3	74 Adult, 278F1, 5 F2= 357	Report notes that it is not possible to use a studbook system to manage the populations; WCS requests a renewal and renegotiation for permission to use any and all standard management techniques to manage the toads. Fort Worth Zoo, Dallas Texas and Buffalo Zoo, Buffalo, New York have requested to participate in the programme.
4	14 July 02	2/3	58Wild, 330F1, 192F2=580	Increased misting cycles spurred heavy vocalizations and amplexus in wild and F1 toads at WCS. Visit by Dr. M. Ngoile, E. Severre, and Dr. W. Sarunday expected in Aug 2002.
5	6 Dec 02	3/3	49Wild, 192F1, 186F2=427	WCS animals continue to produce F2 progeny. Other zoos experienced some problems due to heat stress and other medical issues.
6	4 April 03	1/3	37Wild, 135F1, 97F2, 1F3=270	First F3 born in WCS; WCS ships some to Oklahoma and Baltimore Zoos
7	25 July 03	2/3	35Wild, 106F1, 94F2, 1F3=236	Oklahoma has only 2 F1 toads; Toledo Zoo shipment were delayed in flight and only 8/12 survived. Due to slow permit process, neither Fort Worth nor Buffalo zoos have received toads since official requests made in Sept 2001!
8	10 Dec 03	2/3	Total of 93*	Numbers generally dropping; none at Oklahoma. Some shipped to Buffalo, but none to Fort Worth because numbers at WCS critically low. WCS animals suffering “short tongue syndrome” and rear limb paralysis
9	16 March 03	1/3	Total of 71*	Due to drop in numbers, efforts consolidated at Toledo and Bronx (WCS) zoos. Mortality has levelled off as a whole; support sought from WB and LKEMP for captive propagation program.
10	10 July 04	2/3	Total of 82*	Toads breeding, juveniles growing;
11	22 Sept 04	3/3	102*	Permission obtained from Tanzania to establish a living cell line. WCS still awaiting news regarding establishment of a captive breeding fund for KST. Premature toads born at Toledo Zoo.
12	8 March 05	1/3	96*	No more toads have been bred. New equipment installed may change this. Tissue line establishment attempted but not successful. Zoos awaiting news on renewed MOU, captive breeding fund, and permission on disposition of biomaterials for future research.

*= because animals have mixed between generations, individual identities and generation no longer identifiable for discrete census calculations.

Appendix 8 Training and Other Support Provided

SECTOR	ACTIVITY/SUPPORT PROVIDED
1. Energy Sector	<p>MEM</p> <ul style="list-style-type: none"> • Sponsored 2 employees in MSc. (Paul Kiwele & Hamad Masauni Yusuf) • Donated various equipments: 1 Laptop, 1 PC, 1 Printer, & 1 UPS • Supported various short term staff training to strengthen the MEM Environmental Unit <p>TANESCO</p> <ul style="list-style-type: none"> • Supported Hydrological modelling activities • Supported EMP implementation & mitigation measures • Donated Various equipments (2 Laptops, Telemetry, & GIS Mike 11 Arc view) • Supported various short term staff training to strengthen the Environmental Unit • Supported the preparation of the Updated Environmental Management Plan
2. Water Sector	<p>MWLD</p> <ul style="list-style-type: none"> • Donated one Laptop <p>RBWO</p> <ul style="list-style-type: none"> • Donated one Motor Vehicle, Toyota Land cruiser Hard Top • Donated various equipments PC, Laptop, Printer, UPS & Data loggers • Donated one Motorcycle, Suzuki to facilitate hydrological monitoring in areas inaccessible by motor vehicles • Prepared and supported the implementation of the RBWO hydrological monitoring program • Sponsored attendance to international conference
3. University of Dar es Salaam (Academia)	<p>ZOOLOGY</p> <ul style="list-style-type: none"> • Donated one Motor Vehicle, Toyota Land cruiser Hard Top • Sponsored 2 UDSM staff for MSc in Environment. (Hashim Mangosongo & Catherine Masao) • Sponsored 2 UDSM staff for PhD in Conservation Biology. (Flora Magige & Radhia Ideva) • Recruited one Lecturer in Conservation Biology, October, 2004. (Francis Muthuri) • Procured and donated various IT equipments and materials to support the teaching of Conservation Biology in the University <p>WATER RESOURCES MANAGEMENT</p> <ul style="list-style-type: none"> • Sponsored 2 UDSM staff for MSc in Water Resources Management. November, 2004. (Joseph Ochieng & Bahati Joyce) • Sponsored 4 students to MSc in Water Resources Management. April, 2005. (Martha Kamuzora, Upendo Eliuze, Mwita Matiko, & Richard Wilfred) • Recruited an External Lecturer in Water Resources Management (Prof. Kachroo) • Procured and donated various IT equipments and materials to support the teaching of WRM
(Environmental Sector)	<ul style="list-style-type: none"> • Financed Drafting the Environmental Law (EMA, 2004) • Financed the drafting of EIA regulations and guidelines • Sponsored one staff for MSc in Environmental & Resources Management. December, 2004 (Onespholy Kamukuru) • Donated various equipments: 3 Laptops, 1 Printer, & 1 UPS <p>NEMC</p> <ul style="list-style-type: none"> • Donated one Motor Vehicle, Toyota Landcruiser Station Wagon • Donated various equipments: 2 Laptops, 1 PC, 1 Printer, surge arrester, & UPS • Sponsored various short courses and international conferences • Supported establishment of NEMC Website (nemctan.org) <hr/> <ul style="list-style-type: none"> • Supported the preparation of the detailed ecological monitoring protocols for the Kihansi Gorge <hr/> <ul style="list-style-type: none"> • Supported the preparation of the Landscape-Wide Conservation Plan for the Kihansi river up-stream catchment areas

5. Wildlife Sector	TAWIRI <ul style="list-style-type: none"> • Sponsored attendance to international conferences • Sponsored training of one Employee for MSc in Wildlife Management - September, 2004 (Edward Kohi)
6. Districts & Communities	<ul style="list-style-type: none"> • About 100 million Tanzanian shillings set aside to implement environmental management sub-project formulated by district councils and local communities in the catchment areas upstream the Kihansi River for FY 2005/06 • Implementation of the capacity building program for districts (Kilolo, Kilombero & Mufindi) and communities is underway. Already the Financial & Procurement procedures and sub-project preparation manual for the District and Community grant scheme are in place.

Long Term Professional Training - PhD Scholarship						
S/No.	Course Title	Venue	Dates	Duration	Institution	Individual Beneficiaries
1.	PhD in Conservation Biology (Limnology)	University of Vienna Austria	2003 – 2006	4 Years	University of Dar es Salaam	Radhia Ideva
2.	PhD in Conservation Biology (Ornithology)	Norwegian University of Science and Technology Norway	2003 – 2006	4 Years	University of Dar es Salaam	Flora Magige
Long Term Professional Training – M.Sc. Scholarships						
S/No.	Course Title	Venue	Dates	Duration	Institution	Individual Beneficiaries
1.	MSc. of Environment and Energy Management	University of Twente, Cartesius Institute at Netherlands	Feb. 2003 – Jan. 2004	1 Year	Ministry of Energy and Minerals	Mr. Paul Morris Kiwele
2.	MSc. in Conservation Biology	University of Kent at Canterbury, UK	22 nd Sept. 2003 – Sept. 2004	1 Year	University of Dar es Salaam	Mr. Hashim Mangosongo
3.	MSc. in Conservation Biology	University of Kent at Canterbury, UK	22 nd Sept. 2003 – Sept. 2004	1 Year	University of Dar es Salaam	Ms. Catherine Masao
4.	MSc. Energy Environmental Technology and Economics	City University of London	Jan. 2004	1 Year	Ministry of Energy and Minerals	Mr. Hamad Masauni Yusuph
5.	Masters Degree in Environment and Resources Management	Brandenburgische Technische Universität Cottbus Germany	Oct. 2004 – Sept. 2006	2 Years	Division of Environment, Vice President's Office	Mr. Onespholy M. Kamukuru
6.	Msc. In Wildlife Management and Conservation	Wageningen University The Netherlands	Sept. 2004 – August, 2006	2 Years	TAWIRI	Mr. Edward M. Kohi
7.	Masters Degree in Watershed Management/Modelling	University of Dar es Salaam	Oct. 2004 – Nov. 2006	2 Years	University of Dar es Salaam	Mr. Mwita Matiko
8.	Masters Degree in Watershed Management/Modelling	University of Dar es Salaam	Oct. 2004 – Nov. 2006	2 Years	University of Dar es Salaam	Ms. Martha Kamuzora
9.	Masters Degree in Integrated Water Resource Management	University of Dar es Salaam	Oct. 2004 – Nov. 2006	2 Years	University of Dar es Salaam	Mr. Richard Wilfred
10.	Masters Degree in Integrated Water Resource Management	University of Dar es Salaam	Oct. 2004 – Nov. 2006	2 Years	University of Dar es Salaam	Ms. Upendo Eliuze
Short Term skills development training courses including support to attend Workshops, professional seminars and conferences						

S/No.	Course Title	Venue	Dates	Duration	Institution	Individual Beneficiaries
1.	Procurement of Consultancy Services	Ghana Institute of Management and Public Administration	1 st – 19 th July – 22 nd – 25 th July, 2002	4 Week	LKEMP	Dr. Wilfred N. Sarunday
2.	Hydrovision 2002 Conference	Portland, Oregon in the US	July 28 – Aug. 2, 2002	1 Week	TANESCO	Mr. Kamugenyi. Luteganya
3.	Hydropower and Environment	International Centre for Hydro-power (ICH), Trondheim Norway	Aug. 24 – Sept. 13, 2002	4 Week	TANESCO	Mr. Hamdun R. Mansur
4.	Environmental Impact Assessment	Stockholm and Gothenburg, Sweden	May 5 – June 6, 2003	4 Weeks	NEMC	Mr. Kassim Sengoe
5.	IUCN World Parks Congress V(WPC)	Durban, South Africa	Sept. 8 – 18, 2003	2 Weeks	NEMC	Dr. M.A.K. Ngoile
6.	Management and Leadership Skills for Optimal Performance	Kilimanjaro International INC, USA	18 th – 29 th August, 2003	2 Weeks	LKEMP	Dr. Wilfred N. Sarunday
7.	Procurement of Consultancy Services	Ghana Institute of Management and Public Administration	27 th – 30 th October, 2003	1 Week	LKEMP	Mr. Shushuu J. Maguya
8.	System Administrator	University of Dar es Salaam Computing Centre	22 nd Sept. – 14 th Nov. 2003	3 Months	LKEMP	Ms. Lillian Somi
9.	Procurement and Stock Control	Awesome School of Information Technology	13 th Jan. – 24 th Jan. 2004	2 Weeks	VPO	Ms. Kisa Mwantobe
10.	Procurement and Stock Control	Awesome School of Information Technology	13 th Jan. – 24 th Jan. 2004	2 Weeks	NEMC	Mr. Sadik Sangawe
11.	Procurement and Stock Control	Awesome School of Information Technology	13 th Jan. – 24 th Jan. 2004	2 Weeks	LKEMP	Ms. Bahati Jasson
12.	Global Spatial Data Infrastructure (GSDI-7)	India	Jan. – Feb. 2004	1 Week	NEMC	Mr. Vedast Makota
13.	Convention on Biological Diversity	Kuala Lumpur	Feb. 9 – 27, 2004	3 Weeks	VPO	Ms. Mary Mushi
14.	Convention on Biological Diversity	Kuala Lumpur	Feb. 9 – 27, 2004	3 Weeks	VPO	Prof. Yadon Kohi
15.	Convention on Biological Diversity	Kuala Lumpur	Feb. 9 – 27, 2004	3 Weeks	VPO	Mr. Eric Mugurusi

16.	Financial Management, Disbursement and Procurement	Zanzibar Beach Resort Hotel	April 14 – 16 th , 2004	3 days	LKEMP	Dr. Wilfred N. Sarunday
17.	Financial Management, Disbursement and Procurement	Zanzibar Beach Resort Hotel	April 14 – 16 th , 2004	3 days	LKEMP	Mr. Harold Materu
18.	Financial Management, Disbursement and Procurement	Zanzibar Beach Resort Hotel	April 14 – 16 th , 2004	3 days	LKEMP	Mr. Shushuu J. Maguya
19.	Financial Management and Disbursement	Malawi Institute of Management	April 26 – May 7, 2004	2 Weeks	LKEMP	Dr. Wilfred N. Sarunday
20.	Financial Management and Disbursement	Malawi Institute of Management	April 26 – May 7, 2004	2 Weeks	LKEMP	Mr. Harold J. Materu
21.	Environmental Impact Assessment	Sweden	May 17 – June 18, 2004	4 Weeks	NEMC	Mr. Godlove Mwamsojo
22.	Water Resources Management, Data Processing and Analysis	Institute for Meteorological Training and Research, Nairobi – Kenya	6 th Sept. – 3 rd Dec. 2004	4 Months	TANESCO	Ms. Joyce Nzali
23.	Study Tour on EMS formulation and implementation procedures	ZESCO – Zambia and ESKOM – South Africa	Sept. 2004	10 days	TANESCO	Mr. David Ngula
24.	Study Tour on EMS formulation and implementation procedures	ZESCO – Zambia and ESKOM – South Africa	Sept. 2004	10 days	TANESCO	Mr. Mansur Rashid
25.	Study Tour on EMS formulation and implementation procedures	ZESCO – Zambia and ESKOM – South Africa	Sept. 2004	10 days	TANESCO	Mr. Joackim Joseph
26.	International Course on African Wetland Management (ICAWM)	Kenya Wildlife Service Training Institute (KWSTI), Naivasha – Kenya	13 th Oct. – 23 rd Nov. 2004	43 days	TANESCO	Mr. Joackim Joseph
27.	Mining and the Environment	Lulea, Sweden	Sept. 20 – Oct. 15, 2004	4 Weeks	NEMC	Mr. Danford Mwaipopo
28.	Water Resources Management, Data Processing and Analysis	IMTR, Nairobi – Kenya	Sept. – Nov. 2004	3 Months	TANESCO	Ms. Joyce Nzali
29.	International Course on African Wetlands Management	KWSTI, Naivasha, Kenya	Oct. 13 – Nov, 2004	2 Months	TANESCO	Mr. Joackim Joseph
30.	International Training Course on Mining and the Environment	Sweden	Sept. 20 – Oct. 15, 2004	1 Month	NEMC	Mr. Danford Mwaipopo
31.	IUCN The World Conservation	Bangkok, Thailand	Nov. 2004	2 Weeks	NEMC	Dr. M. A. K. Ngoile

	Union					
32.	IUCN The World Conservation Union	Bangkok, Thailand	Nov. 2004	2 Weeks	TAWIRI	Dr. Charles Mlingwa
33.	Record Management	National Institute Productivity (NIP) – Morogoro	Nov. 2004	4 Weeks	NEMC	Ms. Anna Chale
34.	Record Management	National Institute Productivity (NIP) – Morogoro	Nov. 2004	4 Weeks	LKEMP	Ms. Yolanda Turuka
35.	Record Management	National Institute Productivity (NIP) – Morogoro	Nov. 2004	4 Weeks	LKEMP	Ms. Sharifa Bakari
36.	Office Management and Administration	National Institute Productivity (NIP) – Morogoro	Nov. 2004	4 Weeks	LKEMP	Ms. Lillian Somi
37.	Environmental Management and Audit	ACP Institute for Management, Swaziland	26 th March – 24 th April, 2005	1 Month	NEMC	Mr. Alfred E. Msokwa
38.	Environmental Management and Audit	ACP Institute for Management, Swaziland	26 th March – 24 th April, 2005	1 Month	Ministry of Energy and Minerals	Mr. Theodore Silinge
39.	Environmental Impact Assessment	The Swedish International Development Cooperation Agency and Rambol Natura AB, Sweden	18 th April – 20 th May, 2005	1 Month	NEMC	Ms. Zafarani Madayi
40.	25 th Annual Conference of the International Association for Impact Assessment (IAIA)	Boston, USA	29 th May – 3 rd June, 2005	1 Week	NEMC	Mr. Ignace A. Mchallo
41.	Environmental Assessment and Information Management	Kafue Gorge Regional Training Centre (KGRTC), Kafue Gorge, Republic of Zambia	13 th – 24 th June, 2005	2 Weeks	TANESCO	Mr. Ng'anzi J. Kiboko
42.	STREAM Flow Modelling	International Water Management Institute (IMWI), Kenya	27 th June – 1 st July, 2005	2 Weeks	TANESCO	Mr. Stansilaus Kizzi
43.	STREAM Flow Modelling	International Water Management Institute (IMWI), Kenya	27 th June – 1 st July, 2005	2 Weeks	RBWO	Mr. Willie Mwaruvanda
44.	Hydropower and the Environment	International Centre for Hydropower, Trondheim, Norway	Sept. 5 th – 22 nd , 2005	18 days	Ministry of Energy and Minerals	Mr. Theodore Silinge
45.	Hydropower and the Environment	International Centre for Hydropower, Trondheim, Norway	Sept. 5 th – 22 nd , 2005	18 days	Ministry of Energy and Minerals	Mr. Leonard Masanja
46.	Hydropower and the Environment	International Centre for Hydro-	Sept. 5 th – 22 nd ,	18 days	TANESCO	Mr. Maneno Katyega

		power, Trondheim, Norway	2005			
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Appendix 9 MUAJAKI, SEMA-Ki and CMP - Objectives

MUAJAKI

Overall Project Objective: Avoid increase in health problems during construction. Areas of concern; STDS, including HIV, malaria, infectious diseases, maternal and childhood health problems, substance and alcohol abuse, and traffic- and construction-related accidents and health hazards.

Specific Objectives for transition during operation:

- Strengthen capacity and competence within District Health Departments in Mufindi and Kilombero for continued monitoring and mitigation.
- Facilitate establishment of partnerships and collaboration between districts and key national and international agencies, organisations and processes that can support the districts.
- Work towards establishing a sustainable funding mechanism for continued monitoring and mitigation of health impacts in the communities surrounding LKHP.
- Promote and contribute towards the development of a Tanzanian policy regarding assessment, monitoring and mitigation of health impacts in connection with infrastructure development projects.

Residual impacts expected during operation;

- (a) Continued transmission of malaria in upstream communities.
- (b) Continued high risk for transmission of HIV/AIDS due to long incubation times of the disease.
- (c) Lack of preventive and curative health services due to large population increase.

SEMA-Ki

Overall Project Objective: To safeguard the welfare of the people in the communities around the Lower Kihansi Hydropower Project (LKHP) in terms of promoting and/ or sustaining such aspects as health, education, housing, access to land, water and participation in decision making during and after construction.

Residual impacts expected during operation:

- (a) Migrant workers opt to remain in the area.
- (b) Opportunistic business community takes advantage of easier access
- (c) Migrant workers married to locals may bring in extended family raising population pressure.
- (d) Unsuccessful opportunistic job seekers

CMP

Based only in the Kihansi River Catchment the Catchment Management Plan had the **Overall Objective**: Achieve effective management of the Kihansi catchment, based on a well functioning catchment management system.

More specifically CMP aimed to achieve the following objectives:

- ❑ Train villages to carry out environmentally sustainable management of soil and water resources.
- ❑ Support local district institutions to monitor hydrological state of catchment.

Beneficiaries of the project were 14 villages in the Kihansi River catchment (Ukami, Uhafiwa, Ihimbo, Mapanda, Ilogombe, Igeleke, Kibengu, Kipanga, Mbawi, Ny'ngula, Masisiwe, Nyawengete, Boma la ng'ombe, Mwatasi). These villages cover two districts Mufindi and Kilolo of Iringa region.

In 2003 CMP identified a number of impacts that remain to be mitigated for a fully established management plan. Three main areas requiring mitigation were local capacity and competence building, institutional arrangement and improving services.

Appendix 10 Sustainability of MUAJAKI, SEMA-Ki and CMP

Continuation of MUAJAKI Activities by local government after project closure

Activity initiated under MUAJAKI	Effectiveness of transfer to local government (Continued or discontinued)
Upland Malaria (Uhafiwa and Ukami)	
Provision of health education on malaria or local communities and individuals	Some education is provided but with few staff (8 for district) it is not adequate
Provision/ distribution of bed nets	There is a national effort to distribute nets to pregnant mothers at a subsidized cost. For the rest population nets are commercially available at Tshs 3,500,-.
Support to malaria case management in local clinics	Malaria case management in local clinics has ceased
Monitoring of vector habit	No information
Monitoring of malaria transmission	There is no monitoring of malaria transmission
Monitoring of malaria morbidity	No information obtained during site visit
Monitoring of malaria mortality	This is done in clinics and information feeds into to district reports
STDS/HIV	
Provision of health education for local communities and individuals on STDs/HIV	Education provided but low staff numbers and lack of facilities
Condoms marketing	Condoms available in shops at reduced cost. No marketing of condoms
Technical and material support to STD clinics	Lack of technical and material support on STDs/HIV in clinics both on the lowland and in the catchment. Clinics do not conduct voluntary counselling and testing services for HIV although training was provided.
Provision of Voluntary counselling and testing services for HIV	Although trained, clinics do not conduct voluntary counselling and testing services for HIV.
Material distributed on health/ behaviour change in the communities	Distribution of materials on health / behaviour change in the communities has ceased after project closure.
Training for local and district assistants.	No local and district health assistants have been trained after the project.
Clinics (health centres and dispensaries) rehabilitated	No clinic or health centre has been rehabilitated post LKHP construction , most unfinished buildings remain unfinished to date.
Introduction of cost sharing in local clinics	Has been introduced but communities unable to meet costs
Regular inventories of units and equipment	No regular inventories of units and equipment.
Dissemination of Maternal and Child health information to TBAs and Local clinics	Facilities for maternal and child health services in all villages visited inadequate due to low numbers of staff and technical facilities.
Regular household visits to monitoring STD/HIV and malaria under MUAJAKI	Not continued due to lack of human and financial resources

Continuation of SEMA-Ki activities by local government after project closure

Activity initiated under SEMA-Ki	Effectiveness of transfer to local government (Continued or discontinued)
Market facilities	Only for lowland villages. Access to market is a problem in the catchment
Water for domestic use	Yes water remains a significant problem (See txt)
Dissemination of knowledge and skills that allow exploitation of natural resources in a sustainable manner	Established woodlots in catchment not doing so well, lack of seedlings and poor marketing facilities Training has been discontinued
Education on know how for economic improvement	This is not done effectively due to poor staffing
Sensitisation on how to handle influx populations	Has been discontinued
Training village government on sustainable development for communities	Discontinued due to lack of resources
Initiated social amenities infrastructure	No additional social amenities infrastructure has been constructed post project.
Environmental committees	There is an active environmental committee in all villages that participates in patrolling the catchment forest, and woodland, establishing and managing nurseries, checking for incidence of fire and raising awareness. No additional committees have been formed after the phasing out of the SEMA-Ki.
Training for tree seed nursery care	There is no training or technical support available
Establishment of active micro finance groups in communities	All micro finance groups ceased to exist.
Workshops for capacity enhancement in the community through District staff (e.g. charcoal stove making, how to write/run mini projects etc.)	Activity discontinued.
Act as a platform to generate recommendations for mitigation to LKHP	Post project, the communities have no platform to generate recommendations for mitigation to LKHP
Mediation of disputes and misunderstandings between LKHP and the communities	In the absence of a platform this is not possible. Disputes channelled through village governments
Promotion of small scale development related assistance provided to the communities	Not available
Periodic monitoring of changes in local amenities	Not done
Involved youth and women groups involved in economic activities	Has been discontinued

Activities of CMP continued by Local Government after project closure

Activity initiated under CMP	Effectiveness of transfer to local government (Continued or discontinued)
Awareness raising on environmental issues	This is continued
Establishment of water user groups	There are water user groups in all villages even on lowland, but they are not active
Preparation of village PRAs which include issues of natural resource management	Was completed under the CMP
Training of paraprofessionals	Has been discontinued, though district staff are sporadically given some training
Procurement of work gear	District does not have sufficient funds to meet all requirements
Establishment of village based environmental committees	These continue to function but have no technical or financial support from District or LKHP/ LKEMP
Establishment of grass root voluntary groups	
Aawareness campaigns in communities close to reservoir	This continues, the CMP vehicle was handed over to the District to facilitate such activity
Distribution of soil conservation and afforestation material (seeds etc.)	Discontinued for lack of funds
Provision of technical support for improved tree planting	Not done
Establish monitoring protocols for livestock movement	Not mentioned

Appendix 11 Consultancies funded by LKEMP

S/No.	CONSULTANT	NAME OF CONTRACT	DATE	
			START	FINISH
1)	NORPLAN A/ S OF NORWAY P. O. Box 280, N-1401 Ski, NORWAY	Contract for Consultancy service for the provision of Intermittent High Flow Manipulation and Ecological Studies at Kihansi	16 th Jan. 2003	November, 2003
2)	ARCADIS Euroconsult P. O. Box 441, 6800 AK Arnhem The Netherlands	Contract for Consultancy services to prepare an Updated Environmental Management Plan	12 th June, 03	June, 2004
3)	Mr. Vicent Shauri University of Dar es Salaam P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services drafting of Institutional and legal framework for Environmental Management Project (ILFEMP), Phase II- part one: drafting of the bill for the enactment of the environmental management act	15 th August, 03	30 th June, 04
4)	Mr. Casmir S. Kyuki University of Dar es Salaam P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services drafting of Institutional and legal framework for Environmental Management Project (ILFEMP), Phase II- part one: drafting of the bill for the enactment of the environmental management act	15 th August, 03	30 th June, 04
5)	Dr. Ibrahim H. Juma University of Dar es Salaam P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services drafting of Institutional and legal framework for Environmental Management Project (ILFEMP), Phase II- part one: drafting of the bill for the enactment of the environmental management act	15 th August, 03	30 th June, 04
6)	Dr. P. J. M. Kabudi University of Dar es Salaam P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services drafting of Institutional and legal framework for Environmental Management Project (ILFEMP), Phase II- part one: drafting of the bill for the enactment of the environmental management act	15 th August, 03	30 th June, 04
7)	Peere Legare, M. ATDR TECSULT International LTD CANADA	Contract for Consultancy to prepare communication strategy for the Lower Kihansi Environmental Management Project and program for its implementation	1 st Nov. 2003	31 st Dec. 03
8)	Che Weldon Molen Street 77 Potchefstroom, P. O. Box 19242, NOORDBRUG, RSA	Contract for Consultancy services the investigation of Chytrid Fungus infection at Kihansi Gorge	20 th Nov. 2003	20 th February, 04
9)	Dr. Ladslaus Lwambuka P. O. Box 35131,	Contract for Consultancy services conferences facilitation services for the Consultative Workshop on the EMP process	8 th December, 03	31 st Dec., 03

S/No.	CONSULTANT	NAME OF CONTRACT	DATE	
	DAR ES SALAAM			
10)	ARCADIS Euroconsult P. O. Box 441, 6800 AK Arnhem The Netherlands	Contract for Consultancy Service for Public Consultations on the final draft “EMP” Process	7 th December, 03	14 th March, 04
11)	Richard Wenu CDA Consulting Ltd Brushfield Street, London E1 6EX UK	Contract for Provisional of In-house training in Practical Environmental Management: Effective prevention, Enforcement and compliance.	12 th March, 04	20 th March, 04
12)	Dr. Charles A. Msuya University of Dar es Salaam P. O. Box 35064, DAR ES SALAAM	Contract for consultancy service to conduct Kihansi Spray Toad population count	3 rd April, 2004	10 th April, 2004
13)	Edward Msyani College of African Wildlife Management (MWEKA) P. O. Box 3031, DAR ES SALAAM	Contract for consultancy services research service on the season inventory and status of flying insects in the Kihansi Gorge	29 th July, 04	December, 05 Ongoing
14)	Prof. Felix Mtalo University of Dar es Salaam P. O. Box 35131, DAR ES SALAAM	Contract for consultancy services to undertake water resources capacity needs assessment for Tanzania	28 th Sept. 2004	December, 04
15)	Mekon Arch Consult Ltd P. O. Box 3124, DAR ES SALAAM	Contract for consultancy services for the design and supervision of construction works at Kihansi	29 th Sept. 2004	January, 2006
16)	SMEC International (PTY) Ltd P. O. Box 105866, DAR ES SALAAM	Contract for consultancy services to prepare a Landscape Wide Conservation Plan for the Kihansi Catchment	29 th Sept. 2004	Sept. 2005
17)	Barney I. S. Laseko P. O. Box 13798, DAR ES SALAAM	Contract for consultancy services to develop financial mechanism and accounting procedures for the captive breeding programme	30 th Sept. 2004	November, 04
18)	MN Informatics P. O. Box 13798,	Contract for consultancy services to develop a district and community financial management system and procurement procedures	30 th Sept. 04	December, 04

S/No.	CONSULTANT	NAME OF CONTRACT	DATE	
	DAR ES SALAAM	manual		
19)	Professor Fransis Mbiyiwe Muthuri P. O. Box 39129, Nairobi, Kenya	Contract for Consultancy services of the external Lecturer in Conservation Biology at the University of Dar es salaam	25 th October, 04	24 th October, 06 Ongoing
20)	ERC Consultants P. O. Box 4206, DAR ES SALAAM	Contract for consultancy services to undertake PRA in seven selected villages in the Kihansi Catchment Areas	13 th Dec, 04	28 th Jan, 2005
21)	MN Informatics P. O. Box 13798, DAR ES SALAAM	Contract for Consultancy services to development of guidelines for the preparation and implementation of sub-project under the :LWCP for the Kihansi Catchment Area	15 th Dec. 2004	January, 05
22)	Tropical Pesticide Research Institute (TPRI) P. O. Box 3024, DARE SALAAM	Contract for Consultancy services to undertake Toxicological survey of soil and water samples at Kihansi	5 th June, 05	Ongoing 30 th Sept. 05
23)	The Centre for Ecology, Law and Policy In association with Norconsult Tanzania Ltd P. O. Box 9620, DAR ES SALAAM	Contract for Consultancy services to conduct vegetation monitoring in the Kihansi & Udagaji Gorges	21 st Sept. 2005	February, 06 ongoing
24)	Prof. Rajendrar K. Kachroo P. O. Box 35131, DAR ES SALAAM	Contract for Teaching and Strengthening Curricula in Environmentally Sustainable Water Resources Management at the University of Dar es Salaam	1 st August, 2005	July, 2006 Ongoing
25)	MEKON	Contract for Consultancy services for Supervision of Construction Works at Kihansi	Ongoing	Ongoing
26)	Dr. Mkhandi UDSM	Contract for Consultancy services to support the conduct of an independent audit to establish the cause of violation of the Final Water Right by RBWO and TANESCO	Ongoing	Ongoing
27)	NORPLAN consultant P. O. Box DAR ES SALAAM	Contract for Consultancy to finalize the design and installation of Back up Sprinkler System	20 th June, 05	Ongoing 3 rd week of Feb.06
28)	COWI Tanzania Consulting Engineers and Planners Ltd	Contract for Consultancy services to conduct Environmental Audit of the Kihansi Hydropower Facility	June, 2005	October, 2005 On-going

S/No.	CONSULTANT	NAME OF CONTRACT	DATE	
	398 Kawawa Road P. O. Box 1007, DAR ES SALAAM			
29)	Mr. Casmir S. Kyuki P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services to Draft EIA guideline and other related Regulations.	31 st May, 05	Sept. 05 Ongoing
30)	Dr. R. R. Mato P. O. Box 35176, DAR ES SALAAM	Contract for Consultancy services to prepare technical issue papers and reports as input for drafting of environmental management Act, 2004 regulations for registration, qualifications and code of conduct of EIA experts.	31 st May, 05	August05 (Ongoing)
31)	Prof. J. H. Y. Katima P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services to prepare technical issue papers and reports as input for drafting regulations for Environmental Audit for the environmental management Act, 2004.	31 st May, 05	August 05 (Ongoing)
32)	Dr. Robert Kiunsi P. O. Box 35176, DAR ES SALAAM	Contract for Consultancy services to prepare technical issue papers and reports as input for drafting of EIA statement for the environmental management Act, 2004.	31 st May, 05	August, 05 Ongoing
33)	Prof. I. S. Kikula P. O. Box 35176, DAR ES SALAAM	Contract for Consultancy services to prepare technical issue papers and reports as input for drafting of regulations on the conduct of environmental impact assessment process for environmental management Act, 2004	31 st May, 05	Sept. 05 Ongoing
34)	Dr. Ibrahim Hamis Juma P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services to draft registration, qualifications and code of conduct of EIA experts regulations for the environmental management Act, 2004	31 st May, 05	Sept. 05 Ongoing
35)	Dr. P. J. A. M. Kabudi P. O. Box 530093, DAR ES SALAAM	Contract for Consultancy services to draft Environmental Audit regulations for environmental management Act, 2004	31 st May, 05	Sept, 05 Ongoing
36)	Mr. Vicent Daniel Shauri P. O. Box 35131, DAR ES SALAAM	Contract for Consultancy services to Draft EIA statement regulations for environmental management Act,2004	31 st May, 05	Ongoing (Sept. 05)
37)	ERC Consultants P. O. Box 4206,	Contract for Consultancy services to conduct phase II PRA for the remaining nine villages in the Kihansi Catchment areas	1 st Sept. 2005	30 th Nov. 2005 ongoing

S/No.	CONSULTANT	NAME OF CONTRACT	DATE	
	DAR ES SALAAM			
38)	ERC Consultants P. O. Box 4206, DAR ES SALAAM	Contract for Consultancy services to Acquire all the ecological monitoring data that has been gathered in the Kihansi Gorge by various consultants in the past	2 nd Week of October, 2005	1 st week of November, 2005
39)	Peter G. Hawkes 379 Bakenkloof Street, Pretoria, South Africa	Contract for Consultancy services on the study of plant and insect relationships at Kihansi Gorge wetlands	11 th March, 05	(Sept. 05) Ongoing
40)	Pierre Legare, M. ATDR TECSULT International LTD CANADA	Contract for Consultancy services to conduct an independent audit of the Lower Kihansi Hydropower Plant	12 th Oct. 2005	11 th Dec. 2005 Ongoing
41)	MN Informatics P. O. Box 34023, DAR ES SALAAM	Contract for consultancy services to provide training and facilitate the implementation of the Districts and Community Grant Scheme	October, 2005	June, 2006 ongoing

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